Freeway, Crossroads or Cul-de-sac - The Crisis of Personal Mobility

An M Phil (Critical Management) Dissertation
by Peter J C Bailey
The Management School, Lancaster University

April 1999

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Abstract

This dissertation has two main objectives, to build a social history of the car and its industry from invention to the present and to develop future scenarios, using insights gained from published views of the industry, its 'insiders' and 'outsiders', lobbies and regulators.

An underlying theme is one of economic and organisational growth with its tendency to consolidate, complicate and fragment with maturity. Also, the car's success has had other chronic side-effects - waste-creation, pollution, and traffic congestion. These factors have become progressively apparent to the car's 'enemies' and have started to leave their mark on the automotive world through increasing lobbying and regulation. The car's allies are now accepting that something must give - though the protection of personal 'automobility' is rigourously defended.

A 'time line' of the car and industry has been created, built around five automotive 'generations' from 1900 to c2020. The generational model is adopted from William Strauss and Neil Howe's 'The Fourth Turning' (op cit 1997). The character of each automotive generation is formed around pseudo-seasonal 'turning points' - from the winter 'crisis' of the horse when Ford's Model 'T' gained ascendancy over the 'craft' of the 'horseless carriage', to a spring 'high' which saw the ascendant GM of Sloan ignite mass consumption following the crisis of the Depression. Subsequently, 'summer' matured with mass customisation leading to the current 'awakening' of an entropic 'autumnal' generation where manufacturer numbers and 'real' product differentiation shrinks, whilst 'virtual' product and service diversity grows bewilderingly and the problems of large scale personal mobility assert themselves. Such *diversity* and declining *disparity* hides the underlying threat of *decimation* of the breed - akin to Stephen Jay Gould's nature of history (op cit 1989). Finally, the paper looks at what may happen in the next destructive 'winter' generation - critically examining the views of environmental lobbies, regulators, the industry and its 'gurus' and developing a personal view of an automobility future developed from two emerging themes – the unraveling of scale and the unraveling of ownership.

Peter Bailey
Swinford,
14th March 1999

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The 'Time Line' of the Motor Car and its Industry

Big Picture

City shift to bus/tram; Death of horse -drawn transport; 1914-18 WW1; 'Roaring Twenties'; 1929- The Depression; 1939-45 WW2; Developed world shift from rail to road,from bus to car; 'Swinging Sixties'; 1967 1st Arab-Israeli War; 1973/79 OilCrises; 1992 Rio - 1997 Tokyo World 'Green' Summits- UK 'Greenhouse' gases to 1990 levels by 2005?; City Traffic control?- Bus/tram re-emerge?

Regulators

1865 - UK Red Flag Law; 1896 Red Flag Law repealed; 1907 -London Traffic Royal Commission; 1921 US Federal Highway Act - freeway building programme; Hitler builds autobahnen; Motor industry turned over to war material; 1947 Marshall Aid Plan rebuilds European/ Japanese industry; 1966 US Traffic & Vehicle Safety Act; UK motorway programme; 1968 US Seat Belt Law; 1971 US Clean Air Act; 1967 - UK MOT 'Cars for Cities'; UK Bus/Rail privatisation; 1975 US Energy Policy & Conservation Act; 1981 Japan export voluntary restraint; 1996 US 50 mph restrictions scrapped; 1997 Traffic ban in Paris; 1997 Germany recycling law; 2002 Japan export restraint finishes; Road Pricing?; 1998- UK Transport White Paper-reregulation?

Lobbies

Protests against steam cars - noise pollution, safety; Horse-drawn traffic pollution/safety issue; Demands for public works- road building; 1926 Henry Ford 'Today & Tomorrow'; Deming- SPC/quality control; 1960 Vance Packard 'The Wastemakers'; 1965 Nader's 'Unsafe at any speed'; UK 'Westway' protests; Emission control/ fuel efficiency; US Rust Belt protectionism; Noise/ Used Car recycling; 1996 Global warming awakening-opposed by US industry lobby; Pressure for traffic calming/control grows

Industry

1889 1st Car; 'Horseless Carriages' - rich men's 'toys'; 1908 Model T; 1913 Ford's 'Flow Line' production; 1919 GMAC 'Buy now, pay later'; 1923 GM Annual Model change; 1921-26 - GM adopts Sloan's 'Divisional' organisation; Flowlines converted to planes & other military equipment; Rebirth of German and Japanese mass motor industry; 1957 Chevrolet 'All fins, lights & chrome trim'; 1959 Volvo 3 point seat belts; 1955 Quality & Waste- Toyota Production System; 1961 - Chevy 'Corvair' incidents; 1971 Honda's CVCC High Economy Engine; Catalyst intro; 1955 - VW leads US import invasion; 1974 Toyota beats VW in US; 1970 - 1989 ARAMiS 'Guided Personal Transportation'; 1978 VW 1st US 'transplant'; 1982 1st Honda US 'transplant'; 1988 VW closes US transplant; 1997 solar power Honda; 1996 Peugeot 106 'hybrid' car; Alternative power source-hydrogen?; Growth in leasing

'Craft' Era; 'Unraveling' Turning point

'Mass Production' Era; 'Crisis' Turning point

Mass Consumption/'High Fashion' Era; 'High' Turning Point

'Mass Customisation' Era; 'Awakening' Turning point

'Icon' Economy>'Personal Mobility' Era?; 'Unraveling' Turning point

1900 'Winter' Destruction | **1925 'Spring' Growth** | **1950 'Summer' Maturation** | **1975 'Autumn' Entropy** | **2000**

Peter J C Bailey, Cohort 3,M Phil, Critical Management,The Management School, Lancaster University - Figure 1 March 1998

At the dawn of the 5th Age of Mobility

By way of introduction

'Plus ca change....'?

As we stand at the gateway to the new millenium, we should not forget that 100 years ago, as the winter season of horse-drawn mobility drew nigh, there was little sign that within twenty years of the turn of the 20th century the whole landscape of personal transportation would have dramatically changed and left a mark well beyond its borders. F M L Thompson, in his paper 'Nineteeth Century Horse Sense'states:

" The horse-drawn world reached the apogee of its refinement and specialisation at the very moment when motor vehicles were becoming sufficiently numerous for businessmen to notice their existience."
(**Thompson, F.M.L.** *Nineteenth Century Horse Sense.* Economic History Review, Second Series, 1976, Vol 29)

The range of mobility possibilities for the 'horseless carriage', a quirky motorised phenomenon born in the workshop of inventor Karl Benz in 1886, with the first 'car' attributed to Gottlieb Daimler in 1889, had already seeded in the minds and hands of numerous other imaginative 'garden shed' engineers across Europe and the United States - with Henry Ford's first 'motorised buggy' in 1892 and first 'car' in 1896 to Herbert Austin's Wolseley 'tri-car' of 1897 and even the arrival of the Frenchman Latil's nascent unitary body, front wheel drive specimen in 1899. Indeed, rather like the race of 'modern' research teams working in parallel to find a new wonder drug, many inventors were working to one end in isolation from each other - an isolation that was more complete and unaffected by the speed of 'modern' communications - to harness the power of a horse within a more controllable, man-made, synthetic form of motorisation. These eccentric, 'crafted' vehicles provided a glimpse of what was to follow - albeit that few pundits (and certainly the public at large) would have recognised their significance. These small indicators were to inspire a new age of scale industrialisation, a fundamental shift of production process from workshop to flowline, from local to national and international. The car and its internal combustion

engine became the mark of economic growth and 'progress', a (if not *the*) truly differentiating icon of the modernist twentieth century on the back of which, in the developed world, we have seen the economics of subsistence for the many overtaken by a more universal distribution of (material) choice, if not prosperity.

It did not take long, however, for these wacky machines to capture the imagination of those sufficiently wealthy to 'commission' their bespoke production. In those very early days at the turn of the century, the horseless carriage thus became the symbol of the prestige and success of its owner (sounds familiar, does it not? - though this outcome could not, at least initially, be the product of today's brand marketing hype!). Such luxuries were not for everyday use, merely to be seen in on high days and holidays promenading on the few 'parkways' that existed that could support the sensitivity of the invention's temperamental and unsophisticated technology, unsupported as it was by the infrastructure of 'metalled' roads and service stations upon which the car would shortly depend (if not *demand*). The car purely as a rich *man's* toy, a product of a craft-driven, workshop-based industry lasted for more than twenty years after Daimler's invention hit the streets with each vehicle's component parts turned and assembled without the assistance of automation.

The spirit of this era is perhaps best captured by Kenneth Grahame's 'The Wind in the Willows', written in 1908 with Toad's 'wanderlust', the devotion to travel, the freedom of the open road, the peace of the horse-drawn caravan and his subsequent, instantaneous conversion to the motor car and all it stands for (even now?). The pre-car Toad initially waxes lyrical about the caravan:

The Car captures Toad's imagination

"There's real life for you, embodied in that little cart. The open road, the dusty highway, the heath, the common, the hedgerows, the rolling downs! Camps, villages, towns, cities! Here today, up and off to somewhere else tomorrow! Travel, change, interest, excitement! The whole world before you, and a horizon that is always changing!"

However, his loyalty to this quiet, rambling form of mobility is changed after he is subjected to the novel experience of being nearly run over by a motor car, leaving his beloved caravan wrecked and horse having bolted. Whilst his more plebian fellows, Mole and Rat were transported into a road rage of protest about the vehicular 'villains' who disturbed their tranquil journeying, far from being incensed by this event, Toad eulogises:

"Glorious, stirring sight!.....The poetry of motion! The real way to travel! The *only* way to travel! Here today - in next week tomorrow! Villages skipped, towns and cities jumped - always somebody else's horizon! O bliss! O poop-poop! O my! O my!"

He goes on,

"O what a flowery track lies spread before me henceforth! What dust clouds shall spring up behind me as I speed on my reckless way! What carts I shall fling carelessly in the ditch in the wake of my magnificent onset! Horrid little carts - common carts - canary-coloured carts!"

On being further implored by Rat to report the incident to the Police and the need to put the caravan into working order, Toad retorts:

"Police-station! Complaint! murmured Toad dreamily. Me *complain* of that beautiful, that heavenly vision that has been vouchsafed me! *Mend* the *cart!* I've done with carts forever. I never want to see the cart, or to hear of it again. O Ratty! You can't think how obliged I am to you for consenting to come on this trip! I wouldn't have gone without you, and then I might never have seen that - that swan, that sunbeam, that thunderbolt! I might never have heard that entrancing sound, or smelt that bewitching smell! I owe it all to you, my best of friends!"

Grahame, K. *The Wind in the Willows* (1908). UK:Purnell Books Edition, 1982

This idealistic love-hate relationship with the car, well represented by the sheltered elitism of those drivers and passengers within its 'comfortable' mechanical framework

contrasting with the exclusion of those more *pedestrian* by-standers whose lives are adversely affected by it, is still at the core of the car debate today. Except that it must be said that the battle-lines are less well defined, often with the proponents of each position featuring on both sides - whether it be the the new age traveller's rejection of the motor age but whose right to mobility is often enabled by the oldest, unsafe, and 'dirtiest' cars and coaches, or the privileged business user, the advocate of motorisation, nevertheless wanting to keep his or her journeys, domestic and business life, traffic congestion and pollution free. This sort of hypocrisy about mobility and the right to travel is a trade mark of our times (and, as it happens, those that went before the car was at the epicentre of the argument).

Horst Moennich, the German journalist made the following observation which clearly positions the car as a (if not the) key expression of its age:

"At the beginning of the century, where our story begins,there is one thing which ranks amongst the finest achievements of science and technology - the internal combustion engine; a thing buried beneath the carriage seat, which moved four wheels without without the previously harnessed power of horses. In a few examples, which crawled along rather than travelled at any great speed, it released a shudder of delight, not to mention displeasure, when people on public roads had to get out of its way; it was a discovery that had something unpredictable about it. Called then, as now, the automobile, we still avoid it - and the problems it creates. It has taken hold of life like an epidemic and remade cities to its own requirements. It has radically altered landscapes and transformed and redefined human habits and ways of thinking. Whether we enjoy it or curse it, we cannot deny its usefulness, and no one today can imagine life without it. Future historians, when coming to judge the twentieth century, will depict it as a monument more significant to the age than nuclear power or microprocessors.....

"A car is a thing which is to be used. Even when it inspires dreams suited to the force of epoch-making events, it is a subsidiary event, never the main one. This subsidiary event most clearly describes the upheaval we are currently experiencing: a class-based

society which no longer sees life tied to one place, but as one constantly being caught up in the process of travel."

At the end of his book, Moennich goes on:

"It is almost as if I knew what had grown out of that thing called the car. It is an object whose mobility, I suggest, has been the cause of real movement this century. This is what has torn people from classes and strata, forced them together, mixed them up and changed urban landscapes."
(**Moennich, H.** *The BMW Story: A Company in its Time* (1983, 1987). Translated, Bastow A. & Henstow W. London: Sidgewick & Jackson, 1991)

This quotation eloquently sums up this conflict between the passion of the car owner (or aspiring owner) and the effect of motorisation on the world at large. However, his view is that the underpinning technology of the internal combustion engine was the key to the rise of the automobile and its subsequent impact on society, for better or worse. But without Ford's method of mass production, its societal and environmental impact would have surely been much more limited? What is evident is that these two technologies, product and production, combined and in so doing caused ripples which have left little of Mother Earth's resources untouched. The car and its industry have surely (and perhaps, inevitably) become victims of their own success?

Its potential as a foundation for an entirely new regime of mass personal transportation based on utility not merely 'elitist joy-riding' was envisioned by Henry Ford in 1909:

"I will build a motor car for the great multitude. It will be large enough for the family but small enough for the individual to run and care for. It will be constructed of the best materials, by the best men to be hired, after the simplest designs that modern engineering can devise. But it will also be so low in price that no man making a good salary will be unable to own one - and enjoy with his family the blessing of hours of pleasure in God's great open spaces."

(**Ford, H.** *Ford on Management: Harnessing the American Spirit.* Edited by Lessem, R. Oxford:Basil Blackwell, 1991)

It was from this vision that the Model T, launched in 1908, and its radical mass production flowline method, launched at the Highland Park plant in 1913, emerged and the car broke out from an exclusively 'reserved' owner body into one which came within the reach of the public at large. Indeed, it was Ford's avowed intent to make his workers 'owners' in their own right backed by his ground-breaking $5 dollars a day pay deal which left disposable income in the pockets of his employees and their families to enjoy their leisure time - albeit that the line paradoxically enslaved his workforce during working hours. In 1908 Ford made less than a tenth of US cars, by 1914, his company's Model T accounted for half of them (Automotive News, *100 Events that made the Industry*, Vol. 2, June 26, 1996). Thus, the mass-produced product virtually as we still know it burst on to the world stage. It could be argued that, in reality, the product was an *evolution* in mobility terms, it just happened that its heart, the internal combustion engine, was one technological outcome - one which triumphed not only over the horse, but also at that time, over the steam and electric car as a result of advances made in its supporting infrastructure with the extraction and distribution of its petroleum fuel. (Even so, perhaps, the rumours of the 'death' of the steam or electric car were a little premature?). The real *revolution* was the production method.

However, even with the evolution of the car and its revolutionary production method in place, it could be further argued that since 1913 the progress of both of these elements has been incrementalist - continuously improved. Even with the inclusion, for example, of the most modern electronic wizardry in both car, its production system and the incorporation of different raw and processed materials such as plastics or micro chips into the product, the underlying mechanical principle and basic componentry have remained the same. The Fordist production method backed by his highly refined product costing process (its principle of component costing to three decimal points to avoid waste is still used today) and his 'wage motive' of paying his employees a wage above subsistence creating both disposable income and leisure

time, the gem of modernism, brought the car in particular and material goods consumption in general within the reach of the ordinary 'line' employee. The widespread distribution of this economic reward has fired the enormous growth in the demand for motorised mobility and it was from this growth that the problems of mass personal transportation, especially but not exclusively, in the cities, surfaced (or should I say, *re*-surfaced?). The spreading popularity of the car and the demand for it as a basic 'right of passage' have in their wake (re?)created far more fundamental environmental problems which are thought by some to threaten the very 'carrying capacity' of the planet - the sustainability of life itself. This open conflict between the Ford's exploitative 'abundance mentality'seeing opportunities enough for all and his counter-balancing conservatism where he saw the avoidance of waste being a crucial part of his mission is reflective of an on-going argument and increasing current focus on 'managing scarcity' for the sake of future generations.

As Ford put it:

"If one used nothing then one would waste nothing.That seems plain enough. But look at it from another angle. If we use nothing atall, is not then the waste total?"
(**Ford, H.** *Today & Tomorrow* (1926). Portland, Oregon: Productivity Press, Reprint 1988)

But on the other hand:

"Industry owes it to society to conserve material in every possible way. Not only for the element of cost in the manufactured article, although this is important, but mostly for the conservation of those materials whose production and transportation are laying an increasing burden on society."
(op cit 1926)

Car - cause or effect of the desire to travel?

Though the internal-combustion-engined car is often blamed as a primary cause of many urban (if not global) environmental problems, it is also seen as an effect of the

rapid rise in the demand for more practical 'A to B' personal mobility from the turn of the nineteenth century. The desire to live beyond the overcrowded inner city led to the establishment of improved, extended road networks from city centre to outskirts plied by horse-drawn 'car' and subsequently tram, trolley bus and subway services. This heralded the rise of the suburban 'commuting' classes. This view is well represented by Clay McShane, the American historian in his 1994 book would discount Moennich's propulsion technology-based view as being an example of 'the standard literature' on the evolution of the automobile, a survey of which 'showed the standard form of determinism':

"To authors such as John B Rae and James L Flink (in McShane's view, 'stereotypical' of automobile historians - Moennich would be in the same category), the automobile progressed logically and almost inevitably from the invention of the internal combustion engine."
(McShane, C. *Down the Asphalt Path:The Automobile and the American City*. New York: Columbia Press, 1994)

He goes on:

"These historians seem to have adopted the simplistic approach from their sources , largely automotive trade journals, which were anxious to claim priority and sagacity for the founders of their industry.....But, of course, the mere invention of one type of engine did not guarantee the automobile's inevitable acceptance as a private carrier. Many other social factors had to coalesce to create a demand for such a vehicle."

McShane's argument is that the car needed the late nineteenth century city as a context for its development and it was the interaction of certain key social, economic and environmental characteristics of city life which ultimately put the petrol-engined, rather than steam or electric-powered car in pole position in the race to meet the explosion in demand for personal transportation. In purely propulsion technology terms, the notorious unreliability of the steam car, its lack of practicality for the driver, its dirty soot emissions and the ever-present risk of boiler-explosion coupled

with the excessive weight of both steam and electric cars and the lack of range of the latter effectively saw off these transportation modes (at that time!) in favour of the internal combustion engine.

As McShane sees it, with the initial popularity of the car as a luxury fashion item, it was inevitable that it succeeded first in the city since that was where the wealthy businessmen of the time lived and worked. The car gave them the ability not just to show off their new-fangled mode of transport on the few 'parkways' that existed, but also - more importantly - it gave them the opportunity to extend its use beyond just 'Sunday afternoon promenading', enabling their move out of the inner cities, first to live and latterly to work in more attractive, less crowded outer districts. However, with the increasing scale of industries, the demand for increasing numbers of administrative 'white-collar' staff who did not live on top of the factory sites at which they were employed led to the establishment of arterial routes and tram services which reinforced this shift to 'suburbanisation'. It was this mass movement of people that changed the role of the city street from one of access and social use for the 'frontager' house-owner to one of a city-owned amenity - a managed network of 'thoroughfares' supporting the commuting traveller and other commercial transportation. This process of suburbanisation in the American (and European) city was already well underway before the motor car hit the streets in any numbers. The car is thus seen by McShane as an enabling technology 'waiting to happen' once rapid mass personal transportation became a key municipal development matter. He states that:

"The culture for suburbanisation produced the technology not vice versa."
(op cit 1994)

McShane's modern interpretation of cause and effect also stands in conflict with that of Henry Ford (op cit, 1926), who saw the car as the 'vehicle' which lies at the roots of modern industrialisation and economic prosperity. Ford told representatives of Russia who came to buy tractors to improve the productivity of their state farms:

"...you first ought to buy automobiles and get your people used to machinery and power and to moving about with some freedom. The motor cars will bring roads, and then it will be possible to get the products of your farms to the cities."

This view would have been supported by the engineer Louis Haupt in 1877, quoted by McShane as saying:

"It may be safely assumed that facility of communication is one of the most potent elements of human progession and development, hence any obstacle to mobility, however small, becomes a bar to progress and ought to be removed."

Notwithstanding this argument over cause or effect, few people would deny the outstanding success of the motor car as a utilitarian aid to mobility or the impact of Ford's low-cost, mass production method in putting car ownership within reach of the people at large for both business or pleasure puposes. It is the very scale of this desire, if not need, for individual 'freedom' to travel 'door to door' that has paradoxically 'fed-back' into the current motorised traffic chaos faced by the traveller and has reversed the initial advantages of a better quality of urban environment as the car replaced the horse.

Whilst the motor advertising moguls represent the car in surroundings which emphasise the freedom of the open road - travelling at speed in an environment free from the intrusion of other cars, or as a haven of peace protecting the incumbents from the chaotic city outside, the reality we all know is very much different from this fantastic virtuality. John Whitelegg sees this as a sort of 'Faustian Bargain':

"The car can liberate the self-imprisoned soul from its perceived boredom in a limited geographical area. It can confer strong feelings of power, external signs of material wealth, sexual mastery and status. These benefits are severely constrained by the extent to which the rest of the world shares the same degree of motorised affluence but, more importantly, are purchased at considerable expense. Consequences range from the destruction of health and community in local neighbourhoods to the

destruction of planetary life support systems as a consequence of global warming. The ability to crave and enjoy the benefits and the ability to recognise the severity of the price that has to be paid is Faustian in character."
(**Whitelegg, J.** *Critical Mass: Transport, Environment and Society in the Twenty First Century*. London: Pluto Press, 1997)

What cannot be ignored is that the disdavantages of the car rain down on the driver and passenger as well as the pedestrian or innocent by-stander. Henry Ford's laudable pre-occupation with the elimination of waste of matter, labour and time to create more time for the pleasures of life belies the current reality:

"Certainly we are moving faster than before. Or, more correctly, we are being moved faster. But is twenty minutes in a motor car easier or harder than four hours solid trudging down a dirt road? Which mode of travel leaves him more time and more mental energy?.....

"You must get the most out of power, out of material, and out of time....The progress of the world has been in direct ratio to the convenience of communication. We have made this country with automobiles. But we do not have these automobiles because we are prosperous. We are prosperous because we have them. Before the motor car many a man lived and died without ever being more than fifty miles from home. That is the past in this country."
(op cit 1926)

It is interesting to note that Ford's vision is very much bound up with the 'big country', the freedom to travel to and from the farm of his early life and not necessarily within and around the city in which the car has subsequently had its most negative impact. Whitelegg argues that, in fact:

"The car is extremely efficient at creating ever deepening dependencies on itself and exterminating alternatives.

".....Henry Ford was obsessive about waste of time and waste of money. In 'My Philosophy of Industry' published in 1929 he frequently returned to these ideas. The car has ensured that we all spend more time in transit, making more trips to increasingly distant things. The consequence of these longer trips and the greater amounts of time allocated to car travel is that more money must be spent on roads, car parking and all the associated infrastructure of dependency on motorised transport including the police and courts. Henry Ford would not have been impressed by the monster he was creating."
(op cit 1997)

Maybe, Ford had some insight into this matter:

"There is too much transportation anyway - too much useless carting of goods to central points from there to be distributed to the points of consumption."
(op cit 1926)

Though Ford's concerns were related to commercial operations (he certainly balanced the need for production economies of scale with the need to specialise, make and assemble locally to avoid unnecessary transportation), the same concerns can very easily be extended to fit the habits of the motorist as commuter or consumer.

Whilst the economist would not disagree with the 'motorised accelerator effect' - generating, if not re-generating, jobs and prosperity in areas by facilitating their access by car, Whitelegg would add that this economic advantage was illusory. Improving access and egress in one place merely shifts jobs and prosperity from one place to another, and indeed, unnaturally clusters economic activity in one area at the direct expense of more local production elsewhere. At the same time, increasing dependence on car travel and the time wasted in completing journeys deprive urban communities of life and diversity around the clock. This act of mass entrance and exit from the cities during 'rush' hours, in turn, leaves commercial districts empty and unused after hours and makes the city less safe to those travelling on foot or who live there and

reinforces their 'self-preservationist' need to use the car unnecessarily for even local journeys.

Whitelegg argues that while the technological solutions to remove the adverse side effects of the car in terms of pollution will remain an important agenda item for the industry, the adverse environmental by-product of continued expansion of vehicle ownership and use in terms of support space and infrastructure adds other less palatable restrictive solutions for the industry, its car users or aspirant owners. Thus, the incremental improvement of the internal combustion engine in terms of increased fuel economy, reduction in pollutant emissions or the adoption of more radical alternative, environmentally friendly power sources attacks only the 'tail' side of the coin.

The economic ratchet effect of traffic extends from a local and purely personal to a global societal level. In industrial terms, Whitelegg goes on to demonstrate the extreme environmental and economic 'feedback' difficulties created by the implementation of industrial 'just-in-time' waste avoidance techniques and globalisation. The former uses the local road system as an extended ('gratis' to the firm) conveyor belt and no inconsiderable cost to those communities which 'JIT' is designed to serve. On the other hand, the latter, in some ways contradictory, move to 'globalise' buying operations carries a similar negative effect. Establishing and developing low cost finished good or component sourcing, and its transportation to its receiving destination again does not take account of the true (re)distribution cost to or from either directly or indirectly-affected, current or future communities. It is they who may stand to win or lose longer term economic or environmental (dis)benefits as a result of the expansion of unsustainable production activity which supports more than purely local requirements.

Aggregating these different strands, Whitelegg states:

"A return to more sustainable modes of transport, such as walking and cycling, is necessary, together with investment in public transport. But neither will this be

enough on its own. The physical amount of travel and transport is itself a problem, as is the globalisation and large-scale regionalisation that goes with it. If we are to succeed in solving environmental problems then we have to find ways of sourcing goods and services more locally, satisfying travel needs more locally and regenerating communities and economies from within."
(op cit 1997)

However, this opening statement does not go far enough in terms of how these 'sacrifices' should be made and who should make them. Is it the urban traveller whose motoring will be curtailed whilst the rural dweller's mobility needs are respected? Is it not the car, as a personal transporter which aided and abetted suburban sprawl and further enabled the migration of the commuting city dweller to even more distant rural habitats? Will this urban retreat and flight to the countryside not further reinforce the entropic effects of a fragmented approach to personal transportation? Does the city not stand or fall anyway by the effectiveness of its mass transportation systems even now? What will make any of us give up our 'right' to some form of motorised personally-controlled mobility - enlightened extended self interest or mutual reciprocity in a world of 'tragedies of the Commons' or self interest triggered by price rationing or other forms of draconic regulation?

In 1969, a key feature of the plot of the comedy film 'The Italian Job' centred around the deliberate 'hacking' into Turin's (then) sophisticated computerised traffic management system to bring the city to a halt. This traffic chaos enabled the Michael Caine and his Mini Cooper-mobile friends to make a cinematically-creative, very much 'off road', post-bullion robbery escape. The armageddon unleashed in the film and its literal use of the 'rat run' to avoid traffic chaos is no longer a fantasy but a reality. In many urban areas the 'art' of traffic avoidance has destroyed the peace of back streets and in its wake is leading to the imposition of traffic calming measures to recreate a safe environment for frontagers. In addition, on arterial routes, the management of 'bottle-necks' and traffic flow has developed into a whole new science of 'telematics' geared to ensure that the daily societal and economic 'show' is to be 'kept on the road' at all costs.

Who, at the close of the nineteenth century, would have foreseen the outcome of unbridled car-derived personal mobility driven to its present, barely sustainable level? Who would have dreamt that a single motorway accident in Belgium in 1992 or a bomb scare on the M6/M5 Spaghetti junction complex in 1997 would almost gridlock a whole country, or relatively minor interruptions to traffic flow make great cities almost impassable on a regular daily basis?

Full Circle - Lobbies and Regulators

'.....plus c'est la meme chose'?

But have we not been this way before? Though the context and the technology may have changed, are we not witnessing many of the same problems of and arguments about urban life (if not the latest 'rural sprawl' equivalent) at the turn of the twentieth century as our forebears did at the turn of the nineteeth (or even earlier)? After all, we are constantly reminded that crowded trains ran faster and more reliably in Victorian times than they do now despite our more 'developed' technologies and that the speed of traffic on London's streets is no faster now than it was when the horse provided the backbone of personal transportation.

The fact is that many of the problems epitomised by the car as a mobility provider and their potential solutions are not new. They may have specific characteristics, the roots of which are in the car's technology, but at a higher, aggregated level, they have been faced before. Cities and their burgeoning populations faced transport-related traffic jams, accidents, parking problems, pollution, arguments over the street rights of frontagers and passing travellers, between public and private transport solutions at the end of the nineteenth and early twentieth century. While it is now entirely possible to have cleaner, quieter, safer, recyclable cars if we so desire, as then, is it not the inherent global scale of the human transportation problem in gestation that makes the difference? Or does it?

Both F M L Thompson's work (op cit, 1976) and Clay McShane's book (op cit 1994) give some interesting insights into the pre-motor car world of the city.

Thompson reviews the problems created by horse-drawn transport of Victorian England in London, the struggle between pro and anti transport pressure groups, and the myopia and inertia of some politicians and regulators who steadfastly refused to accept that a new approach may have been needed. Highly articulate but often 'lone' voices initially made little headway in effecting change - albeit that their ideas would not look out of place now. Thompson provides the following telling example:

"Even in 1906, when motor vehicles were a good deal more familiar and more reliable, the notion that motor traction should or could be substituted for horse traction was greeted with some astonishment by the Royal Commission on London Traffic. Many expert witnesses then put this view, but its strongest and clearest advocate was an elder statesman of the City, Sir Henry Edmund Knight, who had been an alderman since 1874 and Lord Mayor in 1882. His argument was simple and compelling: that motors would save at least 25% of the space occupied by horse-drawn vehicles, and thus solve the problem of unsupportable congestion and approaching traffic paralysis. His ideas were extremely radical, and included the invention of one-way street systems, bus lanes and smokeless zones.....His supreme self-confidence and willingness to use statutes to interfere with people's private lives provoked the baronets of the Royal Commission to pepper him with hostile and mocking questions..... 'You mean to say that you would prohibit the use of horses in London ?'. 'Do you think Parliament would ever pass a law saying that a man should be prohibited dragging his van by a horse?'. Sir Henry answered the last question by claiming 'that parliament would have no diffiiculty in doing that if it were shown that the streets would be very greatly relieved and the public convenience very much facilitated. Many private persons have adopted the system of their own accord; you see many motor vehicles and motor vans about.' A great traffic-improver and motor enthusiast, therefore, as late as 1906, did not have sufficient confidence to rest his case on superior technology and performance and on cost advantages, which would have led users to adopt motors out of self-interest, but felt obliged to invoke compulsion in order to drive the horse off the streets as a public nuisance."
(op cit 1976)

The problems related to (horse-drawn) transport were not new then (or now with their motorised equivalent - witness the increasing difficulties the present Labour Government has reportedly faced with its much heralded, then delayed and 'watered down' Integrated Transport White Paper in 1998), even in 1906. Thompson makes the point:

"In the largest town of all, London, private horse-keeping was becoming a growing headache at least from the late 1860's because of the unpleasantness of driving in the congested streets, and because of the difficulty and expense of finding stabling, factors which were to rear their heads again in relation to cars from the 1950's with the telling difference that horses could not be left permanently parked in the streets."
(op cit 1976)

He further comments:

"Each one (horse) produced three to four tons of droppings a year, which if properly made up with straw litter was the basis of twelve tons of good manure; but which if left in the streets was just four tons of nuisance....The enormous improvements in the urban environment - in health, in smell, and in traffic flows - stemming from the achievement of the motor in cutting down the town horses to 243,051 in 1924 and to 131,812 by 1934 are thus abundantly clear."
(op cit 1976).

In the same area, Clay McShane states that:

" Some companies attempted to train their animals to defecate only in their stables since manure could be sold as fertiliser (an interesting commercial by-product!), but most droppings fell in the street where they posed a continual public health problem."
(op cit 1994)

He estimates that in New York, the horse stock passed between 800,000 and 1,300,000 pounds of manure a day which required removal. He goes on:

"Dust in the air from ground-up manure provided a likely vector for the bacilli which caused respiratory infections, the major killer in big cities." (op cit 1994)

This unwanted by-product of horse-power was supplemented by disease and death of the horse stock itself. The untimely expiration of horses not only caused traffic disruption but also problems with disposal of the carcass itself.

Despite these problems of urban horse traffic, the then UK Government found it immensely difficult to use tax as a regulator even to pay for the physical damage that was being inflicted on city streets. In the late nineteenth century, any suggestion that transportation should be burdened by taxation was shunned as an inhibitor to economic life (op cit 1976). A strong anti-taxation lobby, the 'Cart, Van, and Wheel Tax League', was formed which, backed by the upper middle, professional classes which needed horses to propel their personal cabs and carriages, secured the withdrawal of the proposed measures in 1888. It took until 1909 for the Lloyd George Government to introduce his road fund - then aimed at the motor car itself to bring about change - a change which was to focus the UK car industry on the production of small cars of 7 horse power or less rather than bigger 'gas-guzzling' models which depended on expensive oil imports.

Clay McShane (op cit 1994) has also looked closely at these early horse-drawn and 'motorised' traffic problems in American (and European) cities - problems which were exacerbated with the introduction of the motor car into a horse-drawn environment - the problems of mixing transportation modes - public and private, human, animal or motor-propelled still faced by many cities, especially (Bombay or Jakarta with rickshaws, ox-carts, buses, trucks, cars, bikes and pedestrians), but not by any means exclusively (Birmingham or Manchester with trams, buses, cars, bikes and pedestrians), in the developing world. McShane also illustrates that resistance to the changing use of the street from social 'back yard' in the crowded inner cities post

industrialisation to the transportation thoroughfares started early - in the 1880's 'luddite' Milwaukeeans resisted the onset of steam-propelled transport for fear of their safety in the street, not only fearing the instability of steam technology but also the pollution from smoke and the risk to playing children and pedestrians from such transport's 'runaway' speed. This sounds familiar, does it not?

But the city populations have always had this somewhat ambivalent attitude to the threat posed by traffic. On March 12, 1840, riots broke out in a district of Philadelphia to resist attempts to build a railroad on urban streets, McShane relates that police were driven away from the scene while rails were torn up and the holes which they left were filled in with the paving blocks which had been removed to lay the track (op cit 1994). The loss of the street's amenity value was too much for the residents to bear -

"Railroad rights of way could never be playgrounds or meeting places, so the construction could only make life miserable for Kensington (Phil) residents and lower the value of their homes. Soot from bituminious coal would make homes and clothing perpetually filthy."
(op cit 1994)

So, 'NIMBYISM' is nothing new. But even this fight for the control of the streets was not an entirely new phenomenon in the late nineteenth century or was the presence of other self-interested, lobbying groups. McShane reminds us that in the mid-eighteenth century, London tried to ban (horse-drawn) carriages -the personal transportation of the rich - in favour of the more environmentally-friendly sedan chair "since carriages presented serious safety problems on the old style streets." He goes on to point out that, " the carriage was resented by the carters" (in today's terms, read 'Road Haulage Association'?) and that regulations "imposed a stiff annual carriage tax and limited the number of vehicles allowed within the city" (memo: such schemes are still an agenda item in the Greater London Area and many other European cities). However, as we know only too well, the inexorable rise of (horse-drawn and otherwise) vehicle ownership fired by the consuming passion to travel went (and continues to go) on unabated despite the initial hostility of its opposition and the use of 'draconian'

regulatory devices. Perhaps, the car's utility value has softened opposition to it with many becoming captivated by the prospect of ownership?

McShane demonstrates that, even at this early stage, America was not immune from this transport regulation conflict:

"Many municipal ordinances in the late seventeenth and early eighteenth century prohibited the galloping of horses (speed limits?), a sign that the number of animals (traffic) was increasing. These laws required carters and teamsters to walk alongside their horses rather than drive them in the congested areas of cities (a 'low tech' approach to traffic control adapted to the motor car in the UK with the 'man with a red flag', followed by a host of formal traffic rules and regulations, with the future looking to the automated traffic management through telematics)."
(op cit 1994 - items in parentheses have been added)

Regulation in these early days did not stop at traffic control measures, however. At the same time cities imposed rules on vehicle specifications also with bans on narrow wheels and heavy loads (to protect the surface of the throroughfare). Even charging for the use of highways to pay for their upkeep goes back to the British 'turnpikes' of the eighteenth century with their tollgates (with their modern day equivalent 'telepeages' and automated street charging). Also, with city traffic already perceived to be a problem at that time, McShane suggests that the development in Europe of the raised pavement came about as a direct, albeit rear-guard, result to protect the pedestrian from the its dangers. The 'sidewalk' came much later in the USA, where:

"abutters might also seek very light, flawed pavements to keep heavy traffic off their streets, so that they could have the neighbourly enjoyment of streets." (op cit 1994)

He continues:

"Such physical impediments were necessary since effective regulation of carriages was non-existent (the forerunner of modern 'traffic calming'?)."

(op cit, 1994, items in parentheses have been added)

Another personal travel-related factor which is becoming increasingly troublesome because of its impact on individual 'freedom' is that of 'independence' of control and the resultant chaos that can ensue. The moves to suburbanisation (and latterly the shift to 'ruralisation') and the role of the commuter - whose domestic habitat is increasingly distant from his or her work place (and indeed, shopping, leisure or school place) has given rise to many more individual journeys in its wake, which are unsupportable by any means other than personally-guided transportation. The roots of this shift of emphasis, however, still lie in the late nineteenth, early twentieth century and are not purely a product of the modern age. With the role of the post-industrialisation city street moving to one of transportation, the opportunity arose to allow the urban dweller to live away from work and away from the inner city and thus the era of the 'commuter' was launched from circa 1850. However, notwithstanding the lack, at that stage, of an effective mass individual transportation mode such as the motor car, the problems of mass (public) transportation were already evident. Horse-drawn omnibuses weaving dangerously and often, unpredictably, through city traffic, stopping irregularly - even in their 'deregulated' way, racing to pick up passengers and snatch them from competitors gave rise to much anxiety in other street users and frontagers. As McShane puts it:

"....(horse-drawn) omnibuses always posed a danger. Horses often panicked in traffic, then bit and kicked people (road rage?). Omnibuses followed a wandering course in the street. Their drivers could not control their horses easily or rapidly brake the top-heavy vehicles on a rough surface, especially when competitors raced each other to pick up a passenger."
(op cit, 1994, items in parentheses added)

This unpredictability and lack of control ultimately led to the introduction of the horse-drawn (and eventually electrically-propelled) tram, where the traffic system was literally 'kept on the rails' with no room to deviate from the prescribed path. Whilst it is intriguing to watch in the last throes of the twentieth century the renaissance of the

tram - with its 'imposition' on other more independently-controlled forms of transport such as the motor car or truck often causing problems, it is also the same lack of 'lane discipline' that is giving impetus to the development of 'virtual' tramtracks on to which a car (or alterior form of personal or commercial transport such as the doomed 'Aramis' - hailed in Bruno Latour's book 'Aramis, or the love of technology' (1996)) may be forced to hitch when travelling within or between cities on major routes. The recent shift in the remit of UK Highways Agency away from road-building towards traffic management through 'radical plans to ease congestion on the roads through an extension of variable speed limits and computerised traffic monitoring' (The Times, *Less Haste, More Speed.* London, 5th August, 1998) in order to keep four times the levels of traffic moving on the same transportation conduits is another attempt to solve the same problem of flow and mix of traffic faced by the Victorian age.

However, the introduction of the horse-drawn tramcar increased the speed and predictability of urban travel to an extent where more commuters could live even further away from the inner city - the unforeseen (but inevitable) negative feedback which, in turn created more journeys and traffic and thence more traffic jams - with most major American cities reaching their horse-drawn capacity well before the turn of the nineteenth century . This aspect of rapid infill of released capacity having apparently alleviated a particular problem associated with transportation does not stop there. In relation to this controversial subject of 'land use', whilst horse-drawn traffic took up far more space per vehicle than motorised transport, and posed significant garaging, maintenance and parking problems, the release of that space with the demise of the horse was rapidly absorbed and exceeded by even higher levels of motorised transport which further increased the call on transportation space. This previously learned lesson is now being played back to the regulators of today by post-modern environmentalists who are keen to avoid the creation of such a 'more for less' personal transportation 'illusion.'

Even the subject of transportation sustainability is not new. It is not widely realised that another social overhead of sustaining the horse as mobility provider was that of its nourishment. F M L Thompson estimated that it took five acres of land to provide

feed for one horse. Clay McShane has taken this estimate and calculated that as a result, at the turn of the nineteenth century, one third of the arable land in the USA would have been given over to the the nourishment of the nation's horse stock and that this may have in turn placed an upper limit on the levels of horse-drawn transportation that could be sustained within the system. This is not unlike the effect of oil supply or alternative fuel ceiling on the automobile - albeit that it could be argued that at least horses are a renewable resource. However, increasing the output of nourishment to sustain an ever increasing horse stock could only have been achieved by either diverting food production away from people, bringing ever more marginal land into food production, or more intensive farming - all of which have negative environmental feedbacks as we now know only too well.

So we are back where we started - the effects of unabated personal transportation, especially in the city, are different but the same. Different types of pollution, but pollution nevertheless. The 'clean' motor car replaced the filth of millions of tons of decaying animal waste with millions of tons of noxious gases. The horse-drawn traffic jams in big cities at the turn of the nineteenth century have been successfully transformed in turn, into the motorised traffic jams at the turn of the twentieth. The 'breathing space' created by the car has been almost exhausted - the advantages of its convenience (within reach of most upwardly mobile folk to use to get exactly where they want to go), its compactness (more can use our streets for transit or parking), its speed (better flow), its safety and protection (for those inside it rather than those without), its inner cleanliness (outweighed at least currently by its emitted toxic waste), and its reliability (over its less well-supported and therefore less predictable mass transit substitutes) have all succumbed to the inevitability of its popularity - the realisation that its continued exponential growth as a personal mobility form is not sustainable overall and something must give or change.

Just as with the horse, more almost inevitably led to less, so with the car. However, the car is not dead yet, as is the desire for personally-guided mobility. It is no longer the rationed preserve of the Western elite - it has captured the imagination of the developing world as an icon of 'progress' and 'prosperity' at the time when its use as

a utility in the car-saturated developed economies is becoming increasingly limited through the scale of its success. The paradox now exists that the growth of personally-guided mobility enabled by the motor car is arguably capable of being supported in low car density societies - albeit underpinned by improved, yet to be developed, technologies from which a clean, environmentally-friendly, if not sustainable, product would emerge. At the same time, at a certain level (almost, if not already reached by the developed world) the car, regardless of its technology, will reach the limit of its utility if not sustainability as a prime source of personal travel. The introduction of new 'clean' car technologies and clever traffic management systems in the saturated markets, whilst making an important environmental contribution, will not solve the negative feedback problems of vehicular success - the very scale of traffic flows will impose a limit on local usage - artificially rationed by price (or other means) or more naturally through self-imposed 'desertion' through inconvenience or ever more selective use - in favour of a different, less car dependent, life style. However, as this introduction shows, it is not as if 'limits' of this sort have not been faced before.

In the body of the paper to come, the developing world of the car as the personal mobility provider of the twentieth century will be explored - taking into account the views of its industry, lobbies (for and against), regulators as well as the 'big picture' into which the world of the car fits. A high level of focus will be given to the car's current position at the threshold of the twenty-first century, out of which scenarios will be developed for its next 'generation' towards the year 2020-2025. As a first step, the role of this introduction has been to review the questions which the car raises about the 'cycle' of personal transportation in the context of the past.

The Generational Model used in this dissertation

This dissertation follows the time line of the motor car and its industry. Its 'generational' model has been adopted and adapted from one developed by William Strauss and Neil Howe in their book, 'The Fourth Turning' (**Strauss, W. & Howe, N.** *The Fourth Turning: An American Prophecy*. New York: Broadway, 1997). In essence, they view (American) history as a progression of centennial cycles, each split into four 'generations' which, rather like the annual calendar seasons, are repetitive to

the extent that the influence of individual generations waxes and wanes in relation to the social and political effects of a single crisis point, the effect of which diminishes over time as power shifts to successive generations. Having established a generational pattern from the crisis turning point - often related to a major political or social conflict or discontinuity, they see the take-over of power by subsequent generations triggering a turning point in its own right. With the influence of each generation lasting approximately a quarter of a century, Strauss and Howe consider that the tenor of each turning point is almost a natural by-product of the distance in time away from the all-important crisis turning point. As the effect and memories of the effect of the last crisis point and those directly involved in it diminish, they see the development of another crisis point as inevitable. Their model is not based on the twentieth century alone - it is constructed from an interpretation of history from Tudor times to the present day.

The logic of their turning points is as follows. The crisis point is the product of a previous point of 'unraveling', akin to 'winter', a period of accelerating destruction where the previous social order is fragmenting and under increasing pressure to change - the two world wars and great depression are examples of this. Following the crisis point where the old order is over-turned, a second generational period of 'growth', like 'spring' is established by those with the new ideals over which the crisis was fought - the returning servicemen post World War II generation represent the power base of this period. This leads to a social 'high' turning point, after which a generation of 'maturation' sets in, where the elders of the crisis period hand over to their successors - the 'baby boomers'. The seeds of the next crisis point are set in this period, leading to an 'awakening' point where a new social order starts to establish itself - the growth of the protest movements in such a period - 'Ban the Bomb', Westway and others spring to mind. The following generation, that of an autumnal 'entropy' witnesses a progressive undoing of the previous regime, where the memories of the last crisis and the 'security' of the order that followed it are increasingly questioned and individualism rather than collectivism take over bringing society around to the 'unraveling' point once again. As we stand at the beginning of the next century, Straus and Howe suggest a period of increasing unrest as

generational winter moves towards its next 'crisis' turning point in the next twenty years or so.

If applied to the motor car, very much a product of the twentieth century which celebrated its centenary in 1996, a degree of 'fit' can be established between Strauss & Howe's generational model of history and the time line of the product and its industry. The growing scale of the industry through the period has not only been affected by the background 'big picture' foundation but to a significant degree has shaped the political, social, economic and environmental landscape of which it is a part. The structure of the dissertation is thus 'generational' with some reference to automotive turning points. It records the development of the car and its industry into four generations, 1900-1925, 1925-1950, 1950-1975 and 1975 to date, drawing out key points from within the industry and external factors - social and political - impacting on it and upon which it has impacted. In the final part of the paper, the implications for the next generation of various strands and patterns identified and discussed within are constructed into several views (including my own) of Generation 5, as well as the realisation that in terms of personal mobility at least we may have been in a similar position before.

Destruction to Growth - From Horse's Winter to a Horseless Spring

The TIme Line of the Motor Car and its Industry - 1st Generation

Big Picture — By 1901,US'Oil Rush'begins

Role of street changes from social amenity to transportation artery - Suburbanisation takes off- Failure of steam road transport

Cities shift to motor bus and tram/trolley from horse-drawn transport, trade horse pop. at zenith(GB)

1914-18 WW1

Trade horses live onfor commercial haulage and war work (GB)

Roaring Twenties - US Prohibition

Trade horse pop. halved (GB)

1929- Wall St Crash

1926 UK General Strike

Private Carriage Horse Pop. (GB)

1901 40,000 (Cars - c5000)

1910 - 'Traffic Jam' 1st coined

1911 537,000 (Cars -c150,000)

Traffic/parking problems abound

1924 52,000 (Cars - c700,000)

Regulators

1865 UK 'Red Flag' Law

1896 UK 'Red Flag' Law repeal

1907 - UK Royal Commission on London traffic

From 1911- Wide adoption of road use regulations - traffic police, lanes, parking, increased speed limits enforcement etc (US)

1921 US Federal Freeway Act - 200000 miles of public road building

1890-- 'Suburbanisation' takes off -control of streets shifts from abutters to cities

1908 Asquith TaxonAuto Horse Power- leads to smallcar development in GB

Jitneys regulated out of existence

1920 - traffic lights introduced

Lobbies — Car as 'rich man's toy'

Protests by householders v. Steam Cars- noise, pollution safety

1905- UK AA formed

1895 - Chicago -Milwaukee Race

1894 - Paris -RouenMotor Race

Progrssive 'socialisation' of car brought about by spread of industry-backed auto clubs

Car as commodity- utility transport for all

Informal Car sharing (jitneys) in US starts, opposed by taxis, trams,property owners

1917 - US dealer lobby stops 5% luxury car tax

1916 - Auto press complain about parking shortages

Car as symbol of progress

City redevelopment for the car a key focus - boulevards, ring roads, and car parks - even in NY's Central Park

Industry

1889 Daimler's 1st Motor Car

1892 - Ford's 1st motorised 'buggy'

1899 -Latil's unitary body/ front wheel drive

1902 - Cars take editorial in press

1904-7 Daimler runs Mercedes factory in USA -1st 'transplant'

1908 Ford Model T

1908 - 1910 Wm Durant forms GM,from Buick 25 motor co.s inc Olds, Cadillac, Oakland and related 'suppliers'

1910- Banks take control of GM, write-offs rationalisation

1911 - Chevrolet formed with Durant- reinvests in GM. Dupont invests also.

1911 Delco self starter

1913 Ford's Flow Line Production- Utility of Model T

1914 -Budd's all steel body Ford's $5 /day wages-worker as customer

1916 - Durant reasserts control of GM

1919 GMAC 'Buy Now, Pay Later'

By 1917, cars taking 25% of US adspace in magazines

1921>>>>>>>>>>>>1926 Sloan's GM Divisional management organisation

!922 - Austin 7 intro

1923 GM Annual Model Change

1924 Dupont/ GM intro 'Duco' colour laquer

1926 Ford 5 day week

1927 Model T demise

1928 Ford launch of Model A

1928 Ford finally offers credit sales

1890	1900	1905	1910	1915	1920	1925	1929
Craft Era - carriage makers' workshops go 'horseless' 'Unraveling'		1st Consolidation- Acquisitive opportunism		Mass Production- Ford's service objective/wage motive 'Turning' Points		Mass Consumption- Sloan's In business to make money 'Crisis'	

Freeway, Crossroads or Cul de sac - The Crisis of Personal Mobility - Peter Bailey 1998 - Figure 2

1. The Time Line of the Motor Car and its Industry - 1st Generation - Destruction to Growth - From Horse's Winter to a Horseless Spring

From 'Unraveling' to 'Crisis' turning point. Putting the early years in context, 1890 - 1908 'Craft Era', 1908-1913 '1st Consolidation - Acquisitive Opportunism', 1913-1923 'Mass Production - total process control', 1923 The start of the era of 'Mass Consumption and planned obsolescence'.

Evolution in the early days

Whilst the idea of motorised personal mobility could be argued to be a product of the late nineteenth century - replacing the unpredictable horse as a method of propulsion was already well underway with the invention of the 'iron horse' using steam as a propellent from the 1850's. What is less known is that it was the railway that overtook the road running steam 'carriage' invented by Trevithick in the early 19th century. Subsequently, it was the influence of the powerful British railway lobby that had secured dominance over such horseless transport through the 1865 'Red Flag Act' which limited road locomotives to a speed of 4 mph and decreed that a man with a red flag should proceed on foot before such forms of transport. The railway as the main organised form of mass public and goods transit had developed well into its heyday by the turn of the twentieth century. The horse, however, still continued to provide basic personally-controlled transportation. Despite the efforts of nineteenth century experimenters working with steam, gas and electricity, it was in Germany in the 1880's, that inventors, including Karl Benz and Gottlieb Daimler evolved the 'internal combustion engine' and applied this new propulsion technology first to that of the bicycle. It was only a matter of time before this cross fertilisation of ideas led to the 'horseless carriage' and with it a less temperamental form of mobility whose driver was in rather more absolute control of movement.

Exactly who led the automotive way is still open to some debate since such inventors, based in workshops (if not livery stables!) had worked in relative isolation from each other to try and find a reliable replacement for 'horse-power' on country lanes and city streets. Gottlieb Daimler, trained as an engineer in Stuttgart, designed an

'advanced internal combustion engine' whilst working at a factory in Strasbourg (it is interesting to note that the Frenchman, Jean Joseph Lenoir had built the first internal combustion engine in 1860). Nicholas Otto and Daimler refined Lenoir's machine over the following twenty years, with Otto's version being introduced into the USA from 1876. In 1881, in the summerhouse of his home, Daimler produced his first single cylinder engine. Benz is credited with the building of an internally combustion-engined, 3-wheeled 'car' with electric ignition and differential gears in 1886. This was followed with Daimler building two 'cars' in 1889. Given the lack of 'modern' 20th century communications technology, and the argument over whether a motorised bicycle or tricycle, or a steam or gas-powered carriage was a car, it is difficult to say who made the first 'car'. It is, however, undoubted that the mix of technologies centred around a petrol-fuelled internal combustion engine embodied in the body of a 'carriage' was around in these last few years of the nineteenth century and it is recognised that it was Daimler who incorporated the first company to *produce* cars in 1896 - so the motor *manufacturing* industry was born of one of its engineering inventors.

As illustrated in the introduction, the car has inspired a whole genre of industrial commentating which sees the product itself as a major stimulant of progress and change in the twentieth century. Horst Moennich, the German journalist and motor historian provides a good example of this style in his book 'The BMW Story - A Company in its Time' - the quotation included in my introduction hailed the invention of the petrol engine (a 'life-form' around which the 'petrol-headed' BMW Company has centred) as *the* driving force behind the modern era:

"It is almost as if I knew what had grown out of that thing called the car. It is an object whose mobility, I suggest, has been the cause of real movement this century. This is what has torn people from classes and strata, forced them together, mixed them up and changed urban landscapes."
(op cit 1983-1987)

However, whilst the invention of the internal combustion engine was indeed a significant event, I would argue that it was more *evolutionary* than revolutionary - it was the almost inevitable product of a desire to displace the horse - the winner of a race in which various alternative fuels - steam, gas and electricity - and their supporting technologies competed against the more difficult to harness 'horse-power.' Moreover, whilst the power of gas has similar attributes to petroleum (and is still a current competitor in its LPG/LNG forms), the testing problems of generating the correct amount of automotive power from steam or electricity within the small, lightweight structure of an automobile are still concentrating the minds of engineers today with the ever more pressing need to stem air pollution.

So, if it was not the motive power solution that was the revolution, what was it that put the car in pole position as personal mobility provider of the twentieth century? What was it that put pay to real 'horse power'? I believe the real revolution was in the *method* of the car's *(re)*production which put the car within reach of the 'masses'. The fact that, in 1896, Gottlieb Daimler may have set up a syndicate to produce cars was still not revolutionary, an inventor and experimenter he may have been, but prophetic visionary he was not. His goals were still at that stage commercially modest, engineering and building individual cars, most customer-'commissioned'. In this relatively undeveloped, 'craft'-based state, the fledgling industry, founded and run by its engineers, grew rapidly with literally hundreds of motor carriage makers establishing themselves across Europe and the USA furnishing motor conveyances for the rich and powerful. As Daimler unveiled his 'motor syndicate' in 1896, coincidentally, two other significant events occurred. In Detroit, Henry Ford produced his first car after making his own engine on a table in the kitchen of his home in 1893 and in the UK, the British Government repealed the 'Red Flag' Law.

Henry Ford's revolutionary vision

It was Ford, not Daimler, who brought about the *revolution* in twentieth century personal mobility. It was he who foresaw the car as a utilitarian commodity - an independent transport solution for all. It was he who not only engineered the product, but, from that knowledge, conceived and engineered the delivery of the product for

reproduction on a massive scale. Such was his genius that even as early as 1909, with his Model T just off the drawing board and making the now (in)famous statement that is now associated with the Model T's demise ('Any customer can have a car painted any colour that he wants so long as it is black'), Ford pronounced his captivating vision:

"I will build a motor car for the great multitude. It will be large enough for the family but small enough for the individual to run and care for. It will be constructed of the best materials, by the best men to be hired, after the simplest designs that modern engineering can devise. But it will also be so low in price that no man making a good salary will be unable to own one - and enjoy with his family the blessing of hours of pleasure in God's great open spaces."
(**Ford, H.** *Ford on Management: Harnessing the American Spirit*. Edited by Lessem, R. Oxford:Basil Blackwell, 1991)

Ford's statement reveals the foresight of his design, engineering, manufacturing and sales intent - to make a car affordable for the many not the few, of simple design, easily maintained, built to a high level of quality from the best materials at the lowest possible cost, delivering a product which gives its owners the freedom to explore the great outside at their leisure. It captures, even today when the road is anything but 'open' and the industry and its product is anything but simple, the aspirations of many a motorist or motor industry insider. It was from this vision that his radical mass production flowline method, launched at the Highland Park plant in 1913, emerged and the car broke out from its exclusively 'reserved' owner body into one which came within the reach of the public at large. The principles of what Ford did in terms of total process organisation are still the basic benchmark for scale production to this day. I will return to Ford's classic organisation of his continuous manufacturing process later.

Chicken or egg - car or road?
However, in terms of creating a supporting infrastructure for the car, Ford was adamant that cars *created* the demand for better roads - road systems did not per se

provide an environment in which development of the motor car was an inevitable outcome. As illustrated in my introduction, Ford's exhortations to Russian trade representatives to buy automobiles as a spur for mechanisation and movement demonstrates his conviction (albeit it could be labelled as a 'sales pitch') that automotive modernisation would stimulate road building, which would enable the efficient distribution of goods from farm producer to city customer and (**Ford, H.** *Today & Tomorrow* (1926). Portland, Oregon: Productivity Press, Reprint 1988).

Whether the Soviet Union ever saw this important role of car (or, indeed, any) consumption is debatable - however, the lack of an effective distribution infrastructure in Russia is still widely considered to be a significant inhibitor to their economic development!

At the end of his book, Ford reinforced the point:

"Road building goes on everywhere. The automobile is the greatest modern source of roads. The formula for getting good roads is, first get your automobiles. It is not good roads that have brought good automobiles, but automobiles that have forced good roads."
(op cit, 1926)

Ford's argument, where he saw the car as a positive driver of economic prosperity and redistribution (if not *physical* distribution) of wealth now uncannily and paradoxically resounds to the clamour of current anti-car lobbies and governments who would no doubt agree that more cars create the demand for the supply of more roads with any extra roadspace being rapidly filled with traffic and, therefore, they seek to deliberately control road development to discourage traffic (and thus limit car demand?)!

Clay McShane describes the developments in the US and Europe which gradually provided the car with its infrastructure at the expense of the horse (and the railway - see also **Goddard, S.** *The Road to Now*. In The Annals of the American Academy of

Political & Social Science, Ed. Long, S.G. London: Sage, Sep1997, Vol. 553, 30-41). McShane argues that the provision of urban road systems was more a product of suburbanisation than the advent of the motor car. As we have seen in my introduction, he sees the car naturally filling a personal transportation gap created by municipal development. As he put it:

"The culture for suburbanisation produced the technology not vice versa."
(op cit 1994)

(Ford's view nevertheless fits with the need for longer distance travel and was probably more the product of his rural upbringing where necessary or leisure visits to cities or neighbouring friends and relatives involved much longer distances and journey times).

However, by the end of the nineteenth century, both in Europe and the USA, the process of suburbanisation was well under way without the car whose arrival *en masse* was yet to come. It was in this period that the role of the urban street started to change from a social amenity for frontagers to a public thoroughfare designed to speed commuter and commercial traffic to, from and about the city. Despite the objections of 'abutters' who sought to protect their ownership of their street frontage, the maintenance of the thoroughfares were progressively taken into the public domain. In the USA, the introduction of rapid transit routes connecting more pleasant suburbs to the working hub of the city, came hand in hand with the first horse-drawn omnibuses - street railways were seen as a dangerous and inappropriate phenomenon and many municipal regulations were passed to keep railways away off urban streets, and to contain them either above or below the ground, and if on it, in their own separate conduits. In 1896, the second event coincidental to Daimler's establishment of a motor company and Ford's first car, the repeal of the UK's 1865 'Red Flag' law, underlined the declining power of the mass transit railway lobby and moreover, the increasing *appeal* of the car as an alternative form of personal mobility and the influence of its then limited body of exclusive owners. However, this adventurous

move by the regulators did not see off horse-drawn transport so easily with the car being made for and run by the privileged few.

Suburbanisation and the rise of commuting

The arrangement of early public road transport services at specially-reduced or 'commuted' fares enabled the richer, management and 'white collar' staffs to migrate from the crowded, dirty city centres to create a new suburban quality of life whilst still being able to conduct their working lives at commercial sites and plants based in the centre. Indeed, McShane (op cit 1994) makes the point that many suburban property speculators and developers had a direct interest in the provision of fast, safe road transport into the cities at subsidised cost to add value to their out of town development sites (sounds familiar, does it not?).

However, it was not long before it was realised that the horse was not the ideal propulsion method to meet this increasing need for public or private transportation. Their drivers' ultimately lacked of control of their equine charges; the mess they created was a constant danger to health; chaos frequently resulted from horses bolting or dying; there was a need for constant supervision - horse-drawn vehicles could not be parked unattended and their 'engines' needed 24 hour stabling care and attention and, horse-drawn transport was perceived to be slow. These factors meant that the days of mass horse-drawn mobility were numbered, but belied the fact that such transport still grew exponentially during the first decade of the twentieth century (whether there will be a similar, 'end-of-era' automotive growth pattern in the early years of the twenty-first century remains to be seen).

F M L Thompson (**Thompson, F.M.L.** *Nineteenth Century Horse Sense.* Economic History Review, Second Series, 1976, Vol 29) demonstrates the significant lag between realisation of the problems of horse-drawn transport and its decline with just a handful of cars on the roads of London in 1901 (c5000) against 40,000 private carriage horses, a growth followed to 537,000 horses in 1911 (with cars at c150,000), thereafter followed by a decline to 52,000 horses in 1924 (with cars at c700,000). Whilst the physical lack of Ford's flowline production technology was undoubtedly a

key factor in holding back the rise of the car (it was not fully developed until after 1913) nevertheless as cited in the introduction, Thompson makes the point that there was nevertheless a high level of resistance to overtures from eloquent and well-connected members of the car lobby such as Sir Henry Edmund Knight from pro-horse-drawn transportation pressure groups as early as 1906. Knight's articulate argument that the motor traction was infinitely preferable to horse-drawn transportation on the grounds that its more efficient use of space would alleviate London's chronic traffic congestion problems seemed incredible to the cynical supporters of the horse.

So, urban sprawl served by a mushrooming network of roads and spiralling traffic movements was a reality for (horse-drawn) public transport even before the car (with its potential for meeting the door to door travel needs of its individualistic driver) hit the streets in any sort of volume. Rush hour traffic jams (a term which illustrates the essential conflict between *'rush'* and *'jam'* first coined in the US in 1910) were as common place in the days of horse-drawn traffic as they are now - speed of movement was then (as now) never the issue but weight of traffic flow always was.

However, it could be argued that this ever burgeoning demand for first domestic, then commercial suburbanisation led to cities being ever more criss-crossed by the *indirect* journeys of individuals, who often went many an extra mile out of their way using congested arterial routes in and thence out of connecting nodes to complete their journey. This is where the motor car, up to then used by the few more often than not for leisure rather than essential business use, came into its own since it gave its users the 'freedom' to travel to their exact destination by the shortest and therefore potentially the quickest route. Not only that, but its technology, once it became the preserve of the driver rather than the engineer or chauffeur, meant that it could be 'parked' at its temporary destination awaiting use on the return journey. This 'user friendliness' has long secured the success of the motor car over its less convenient public mass transit counterparts in all but the world's largest, most crowded cities. It was this mass potential that Ford saw and set about bringing into reality. So how did Henry Ford deliver his revolutionary formula for personal mobility and in doing so,

leave his indelible mark on the the motor car and its industry, a formula which has so many positive and negative modernist resonances today?

I shall now look at Ford's legacy to the industry in more depth.

Fordism - from craft to mass production - his 'idea'

Ford's 'big' idea was not just a well-worked out production method but a philosophy for the 'modern' age. A definition of philosophy which appears in the Longman Dictionary of the English Language is:

'The pursuit of *wisdom*; the *rational* study of the nature and meaning of *existence*, *reality*, *knowledge*, *human perception*, *moral values* etc.'
(the italics are mine)

Ford had something to say about all these things. He took the opportunity to make his philosophy a reality through practical application. His language was born of opportunity and his belief that there were few (if not no) bounds to man's (economic) progress. He had an 'abundance' rather than 'scarcity' mentality - albeit that it could be argued that he exploited man and material, it was not (at least at first) without respect for either. The opening lines of his work, Today and Tomorrow (op cit 1926) make the point:

"For hundreds of years man have been talking about the lack of opportunity and the pressing need of dividing up things already in existence. Yet each year has seen some new idea brought forth and developed, and with it a whole series of opportunities, until today we already have enough tested ideas which, put into practice, would take the world out of its sloughs and banish poverty by providing livings for all who will work. Only the old, outworn notions stand in the way of these new ideas. The world shackles itself, blinds its eyes, and then wonders why it cannot run."

He goes on:

"Take just one idea - a little idea in itself - an idea that anyone might have had, but which fell to me to develop - that of making a small, strong, simple automobile, to make it cheaply, and pay high wages in its making. On October 1, 1908, we made the first of our present type of small cars. On June 4, 1924, we made the ten millionth. Now, in 1926, we are in our thirteenth million.

"That is interesting but, perhaps, not important. What is important is that, from a mere handful of men employed in a shop, we have grown into a large industry directly employing more than two hundred thousand men, not one of whom receives less than six dollars a day. Our dealers and service stations employ another two hundred thousand men. But by no means do we manufacture all that we use. Roughly, we buy twice as much as we manufacture, and it is safe to say that two hundred thousand men are employed on our work in outside factories. This gives a rough total of six hundred thousand employees, direct and indirect, which means that about three million men, women and children get their livings out of a single idea put into effect only eighteen years ago. And this does not take into account the great number of people who in some way or other assist in the distribution and maintenance of these cars. And this idea is only in its infancy!

".....What nonsense it is to think or speak of lack of opportunity! We do not know what opportunity is.....

"Now the fact is that a generation ago there were a thousand men to every opportunity while today there are a thousand opportunities for every man. Affairs in this country have changed just that much."

The underlying message is that Ford believed that ideas spawned opportunity - opportunities for men to employ men and through doing so to distribute wealth for the good of all willing to do an honest day's work for an honest day's pay. He put his idea into practice and created a whole new industrial world, which impacted not only on its immediate product - the motor car - but operations of *scale* in general. His mark is left on any mass production function to this day.

Ford's application of scientific management principles to the organisation of work and continuous production technology

Ford's legacy to the (motor) industry was founded in the genius of his 'Tin Lizzie' product design and in the organisation of the work, power (machinery) and material to produce it in an end to end manufacturing process in which the maximum output was achieved without piece work or overtime. His organising method was 'division of labour'-based with every piece of work reduced into the smallest cycles and placed alongside the automated production power it required in the correct order to achieve the highest level of efficiency (and therefore cost effectiveness) in the total process. Mechanisation was at the core of Ford's production process. Ford makes the point:

"An interesting side development of putting the work on machines instead of on the man is the increased necessity for skilled workmen to repair machinery and tools and now to construct new machinery. Many people thought that machine production would destroy craftsmanship. Exactly the reverse has come about; we now have more expert machinists than we ever needed - we can always use more tool makers. Making and repairing machinery is now a large industry with us, employing several thousand men.

"As we increase our fund of mechanical knowledge, productive machinery will steadily require less attention from its operators, and the shift will be to the making of this machinery." (op cit 1926)

Whilst automation did have the above effect for 'several thousand' of Ford's workers, much of the balance of direct labour was a semi- or un-skilled mainly devoted to machine-minding, intensely specialised to a particular job, performing its often mundane, repetitive tasks at the correct station to keep a continuous flow of production running. It is ironic that Ford would have argued that the use of machinery was to avoid hard manual labour and therefore make the machine the servant of man whilst, in fact, the reverse became true with man 'enslaved' to Ford's production line. Ford's concept of the 'flowline' or assembly line was applied not only to assembly

but also to the manufacture of individual components, engines, wheels, axles, chassis, upholstery or whatever with the time and distance between each line, whether up- or down-stream (on or off site) carefully measured to achieve the best overall method of working. Each operation was stationed at exactly the correct point on the line where its output was required. As Ford puts it:

"The thing is to keep everything in motion and take the work to the man and not the man to the work. That is the real principle of our production..."
(op cit 1926)

At outset, the regularity and simplicity of work undertaken, its organisation together with good pay appealed to employees, many of which came from unskilled rural backgrounds (not unlike some of the labour employed at the current wave of 'transplants' in the US and Europe) positively contributed to the success of Ford's product (the Model T), company and the increasing importance of the motor industry as an economic driver. However, over time the dehumanising effect of working on the line saw employees either becoming dissatisfied or mindless automatons or both - this ultimately played a part in the rise of union power and poor quality in the 'generations' to come. At the time, however, Ford's production process was seen as revolutionary progress for the organisation and delivery of work. The nature of his employment policy was seen to bring benefits to his workforce. However, his mass production method was built on a notion of scale that was underwritten by customer demand and it is to this foundation I turn before examining other equally important supporting aspects of his method.

Ford on scale

Ford had no fear of scale; he believed it to be a natural function of demand for a good product or service as well as an employer for the masses and as such a contributor to the distribution of wealth and further growth and economic and social prosperity. His economics in this context were laissez faire, however; he saw the only limit to growth being that of customer demand - he believed that the ultimate growth of a firm into a monopoly was still limited by the market for its product. If the product and the service

it gave fell short of customer expectation, the demand would fall and so would the fortunes of the producing firm:

"Big or little business grows in response to a demand, and the demand is created by the service rendered. Stop the service and the demand ceases. Stop the demand and where is big business? .....

Business grows big by public demand. But it never gets bigger than demand. I cannot control or force the demand. There is no super-control save that of the people reacting to the service they get. The only monopoly possible is based upon rendering the highest service. That sort of a monopoly is a benefit. Any attempt artificially to monopolise is only a method of throwing away one's money."

(Ford, Today & Tomorrow, 1926)

Ford and Service

With Ford's mass production method relying on long runs of singular products, it has subsequently come to be associated with production rather than market-led business - in current language, 'supply push' rather than 'customer pull'. However, it should not be forgotten that he developed and delivered his idea at a time of insatiable demand for his product - the Model T only failed after an uninterrupted mass production run from 1913 to 1927. This was not to say that the product did not develop over that period, but enhancements were delivered as running changes rather than as new models (it was A P Sloan's regularly updated, multi-model policy at GM that upset Ford's single product approach in the next generation of the car and its industry). Equally, to represent Ford's legacy as being customer-unfriendly is misrepresentation. Ford's manufacturing ethos was rooted in customer service:

"In the end it is the way a product is made, and not the way it is sold, that governs, and if a product requires an unusual degree of salesmanship it is always a question whether the product is right. The question behind manufacturing is not: 'How can I best serve the salesmen?' It is: 'How can I best serve the customer.'

"If you find the answer to the second question, then it is quite inevitable you will also find the answer to the first, for there is a conflict between the two ideas only when the approach is through the salesman instead of through the consumer."
(op cit 1926)

Ford's commercial 'idea' was that it was the consumer who would set demand for the product not the producer (or even the seller). The producer's role was to make the product as *cheaply* as possible and pass the benefit on to the customer; subsequently the satisfied customer repays this benefit to the producer by buying again (or by recommending the product to others). As a result, he saw profit flow as a result of such good customer service. At the same time, his financial rectitude meant that he had little time for bankers and the service they provided to the (business) community. High levels of borrowed capital would inflate the return required from a product or service to service loans - regardless of its real customer value .

"A foreign manufacturer, visiting our plants, said: 'We have to fix our profits in advance, or we should not be able to pay our charges. Unless we can calculate on the basis of a certain output and certain profit, we should have to go out of business. How do you manage that?'

The question was perfectly sincere. But he was trying to drive with the cart before the horse. He had been setting out to gain, whether or no, a certain profit instead of starting out to render a certain amount of service - and let the profit take care of itself.

We regard a profit as the inevitable conclusion of work well done."
(op cit 1926)

So much was Ford concerned to maintain his service principles that in one year, he declared that his company had made too much profit; he returned $50 to each customer in good faith. In his book, 'My Life and Work' in 1922 (cited in **Ford, H.**

Ford on Management: Harnessing the American Spirit. Edited by Lessem, R. Oxford:Basil Blackwell, 1991), Ford comments:

"In the first place, I hold that it is better to sell a large number of cars at a reasonably small margin than to sell fewer cars at a large margin of profit.

"I hold this because it enables a large number of people to buy and enjoy the use of a car and because it gives a larger number of men employment at good wages. Those are the aims I have in life. But I would not be counted a success; I would be counted, in fact, a flat failure if I could not accomplish that and at the same time make a fair amount of profit for myself and the men associated with me in business.....

"And let me say right here, that I do not believe that we should make such an awful profit on our cars. A reasonable profit is right, but not too much. So it has been my policy to force the price of the car down as fast as production would permit, and give the benefits to users and labourers - with surprisingly enormous benefits to ourselves."

From these statements, many others in his texts, it is easy to see that Ford is positioning his company and his product very much in the domain of commodities - putting the history of the car as a luxury item for the elite behind him and setting his business sights on delivering a car which would offer utilitarian benefits to as wide a customer audience as possible.

Ford and the 'wage motive' - employees as customers

It is of note that another of Ford's prime objectives was to provide work for as many hands as possible at a fair wage. Ford would argue his minimum wage in 1914 of five dollars a day was deliberately set a level that gave his employees enough disposable income to become Ford customers in their own right. His obsession with cleanliness in the workplace and working conditions in general and his later move in 1926 to a five day working week, illustrates his concern for his workforce and their time in and out of the workplace and it is to his theory of 'the wage motive' that I now turn.

Ford's 'generous' approach to his employee working conditions and pay seems in conflict with his views on total cost reduction. Ford separated labour cost from capital and material cost as a result of his insight to look at the role of men in the process of production - it was men's time that should not be wasted, this was tantamount to a sin. He had the foresight to pay more since he believed that a satisfied workforce would be motivated to work productively to protect the privilege of their position. Paying the wages of subsistence alone was no guarantee of loyalty and quality of output. In his words:

"For many years we have heard the phrase 'profit motive', which meant that someone called a capitalist provided tools and machinery, employed men - that is, labour - at the least possible wage, and then manufactured goods and sold them to some strange collection of people known as 'the public'. The capitalist sold to this public at the highest price he could get and pocketed his profits. Apparently, the public came out of the air and also got its money out of the air, and it had to be protected from the profiteering capitalist. The workman also had to be protected, and someone invented the 'living wage' notion. All of which grows out of a complete misconception of the entire industrial process.

"It is true that petty business can work on the capital-labour-public mistake, but big business cannot, nor can little business grow big on the theory that it can grind down its employees. The plain fact is that the public which buys from you does not come from nowhere. The owner, the employees, and the buying public are all one and the same, and unless industry can so manage itself as to keep wages high and prices low, it destroys itself, for otherwise it limits its number of customers.

"Our own employees ought to be one's own best customers.

"The real progress of our company dates from 1914, when we raised the minimum wage from somewhat more than two dollars to a flat five dollars a day, for then we increased the buying power of other people, and so on and on. It is this thought of

enlarging buying power by paying high wages and selling at low prices which is behind the prosperity of this country.

"It is the fundamental motive of our company. We call it the 'wage motive.'"
(**Ford, H.** *Today & Tomorrow* (1926). Portland, Oregon: Productivity Press, Reprint 1988)

However, this appoach was not charity - Ford did not believe in giving something for nothing - he then turns to productivity:

"But, of course, high wages cannot be paid to anyone just for the asking. If wages are raised without lowering costs, then buying power is not enlarged. There is no 'living wage', for unless an equivalent in work is returned, no wages can be high enough for a man to live on them. And also, there can be no 'standard wage'. No one on this earth knows enough to fix a standard wage. The very idea of a standard wage presupposes that invention and management have reached their limit.

"No greater injury can be done to a man than to pay him a high wage for a small amount of work, for then his high wages increases the prices of commodities and puts them beyond his reach."
(op cit 1926)

Ford's critical balancing factor which allowed him to pay a good wage for a good output was time - this is the starting point from which Ford's focus on waste reduction as a way of minimising cost developed. He designed his product, and organised its method and place of production to minimise the loss of time (as well as power and material); Ford's definition of efficiency is:

"Efficiency is merely the doing of the work in the best way you know rather than the worst way."
(op cit 1926)

Ford, standardisation and cost reduction

As has been demonstrated above, a cornerstone of Ford's idea of successful scale production was that growth was achieved through passing the benefit of ever-reducing prices to the consumer. More and more consumers could be attracted to a good product as its price fell. Through increasing the 'scale' of production, a more sophisticated level of specialisation was possible, and as a result efficiency increased, and costs fell - therefore prices to customers could be reduced also, which in turn further increased demand for the product.

To achieve this 'virtuous circle', Ford not only needed growing demand for his product (which he had from 1908 through to the mid twenties) but that needed to be supported by a fixation with cost reduction. He achieved this through standardisation, including the vertical integration of his production process from raw material to finished product. However, his process was geared throughout to one product - variety of production in a single plant made standardisation difficult to achieve, therefore efficiency was impaired, cost increased. As he puts it:

"The strongest objection to large number of styles and designs is that they are incompatible with economical production by any one concern. But when concerns specialise, each on its own design, economy and variety are both attainable."
(op cit 1926)

Thus, he kept dissimilar products, such as those of the Lincoln Motor Company apart from those of his mainstream Model T.

Ford's approach to standardisation meant that every component was designed for ease of reproduction and every short cycle job definition which related to the manufacture and assembly of the component or finished product was tightly defined and could therefore be directly 'transplanted' to other plants around the world if required. Such job descriptions and their outputs were backed by standard costing routines which analysed the direct and indirect labour and material cost of every manufacturing and assembly operation in the build process to three decimal places (a benchmark for the

industry to this day). Unit costs fell as production runs increased since the fixed and semi-fixed costs of the business including product development and capital investment could be spread over a larger number of units produced.

Ford and Waste

Ford's policy on cost reduction did not stop at the detailed method of job evaluation and costing described above. He focused also on waste reduction. Whilst he had no problem in the efficient use of resources (material or labour), he abhored waste. He makes the point:

"If one used nothing then one would waste nothing. That seems plain enough. But look at it from another angle. If we use nothing atall, is not then the waste total? Is it conservation or waste to withdraw a *public* resource wholly from use? If a man skimps himself through all the best years of his life in order to provide for old age, has he conserved his resources or wasted them? Has he been constructively or destructively thrifty?.....

"Conserving our natural resources by withdrawing them from use is not a service to the community. That is holding that the thing is more important than the man. Our natural resources are ample for all our present needs (memo - abundance mentality!). What we have to bother about is the waste of human labour."
(op cit 1926)

The word 'public' highlghted (by me) in italics seems to imply that certain resources are there to use 'freely' and might be construed to work for exploitation and against conservation. Indeed, his parable of the saver is not unlike the parable of the talents with its suggestion that lying land or talent fallow does not necessarily provide the 'best return' for a man or mankind. Thus, Ford was happy to use resources for utilitarian purpose but never more than was strictly necessary to build his product, any more than that would create the excess cost of waste, which would in turn have to be accounted for in the total cost of the product. Such waste would work against the reduction of price to the possible lowest level, would limit the growth of demand and

therefore the healthy growth of the business. Ford, however, does not focus on the waste of 'natural' resources *per se* - whilst he recognises he pays for steel rolls or trees not just the those steel or wooden parts of used in the production process - he again homes in on the waste of labour (represented by the cost of wasted time) in unnecessary processing. As he puts it:

"A man cannot be paid much for producing something which is to be wasted.

"My theory of waste goes back to the thing itself into the labour of producing it. We want to get full value out of labour so that we may pay it full value. It is use - not conservation - that interests us. We want to use material to its utmost in order that the time of men may not be lost. Materials cost nothing. It is of no account until it comes into the hands of management.

"Saving material because it is material, and saving material because it represents labour might seem to amount to the same thing. But the approach makes a deal of difference. We will use material more carefully if we think of it as labour. For instance, we will not so lightly waste material simply because we can reclaim it - for salvage involves labour. The idea is to have nothing to salvage."
(op cit 1926)

Ford's approach would set the standard for the resource to be used (for instance, the guage and quality of steel), buy it as cheaply as possible and use that which he had bought *exhaustively*. Whilst his policy is hardly conservationist in the current context - it is attuned to his economic cost paradigm - he nevertheless recognises that avoidance of depletion through waste is a key cost objective. Though his motives are to support meaningful work, he does understand that there is a corporate responsibility to the public which has just a hint of care for the greater environment:

"Industry owes it to society to conserve material in every possible way. Not only for the cost in the manufactured article, although that is important, *but mostly for the*

conservation of those materials whose production and transportation are laying an increasing burden on society."
(op cit 1926, *italics* are mine)

However, his motive is still born of his abundance mentality and his faith that man (through science) will find a way of sustaining growth. Ford was no green - he was just a careful businessman:

".....As it is, our task is rather a large one, for we must look well ahead to the possible depletion of resources, to the saving of material and to the finding of substitute materials and fuels."
(op cit 1926)

His philosophy on waste has subsequently formed an integral part of the quality and cost reduction programmes such as 'just in time' evolved by the Japanese in generation 3 and re-applied to the industry in the West in generation 4. Ford's advantage, at least until the mid twenties, was that there seemed no limit to the growth in demand for his product so it was possible for him to run his production capacity at full stretch. He did not face the problems of market saturation that are prevalent today.

Fordism - the foundation of the modern automotive industry
In summary, Ford used his principles of standardisation, simplicity of design to support the assembler, standard costing and waste elimination alongside his continuous flow production methods to progressively reduce cost to the consumer. These basic scientific management-inspired methods were almost universally adopted by the motor industry on a world scale thereafter. The lack of working quality of life imposed by the assembly line, once the aspirations of the workforce moved beyond the fulfilment of their basic needs, has been a recurrent problem but 'the line' has nevertheless remained in tact as an integral part of motor industry life. Efforts led by the Japanese and companies such as Volvo in Sweden to restore employee interest, learning, flexibility and responsibility into the mass production process through lengthening job cycles, providing variety in jobs at the expense of specialisation,

increasing shop-floor control and accountability have had a positive effect but the basic components of Ford's mass production practice remain.

As Taiichi Ohno, the father of the Toyota production system puts it:

"Henry Ford (1863-1947) without dispute, created the automobile production system.

"Strictly speaking, there may be as many ways of making automobiles as there are automobile companies or individual plants. This is because production methods reflect the philosophy of business management and the individuality of the person in charge of the plant. However, the basis of automobile production as a modern industry is the mass-production system that Ford himself practiced."
(**Ohno, T.** *The Toyota Production System: Beyond Large Scale Production* (1978). Translation: Cambridge, Mass: Productivity Press, 1988)

Mass production enabled the demand for the motor car to be met - first as a commodity under Ford's personal management, and then as a supply machine for the era of mass consumption that followed. Its perceived benefits brought the car as Ford had envisaged to a much wider customer audience who then experienced the 'freedom to roam' it granted. Ford's method moved the car from the hands of the few and put it in the hands of the many. It took its production from the many 'back street garages' and started the process of industrial capitalisation and consolidation which has continued and is still continuing today. However, the initial success of mass continuous production went virtually unopposed once the perceived benefits of its product, the car, were available to the man in the street rather than just the motoring elite. It is perhaps significant to note that the first opposition was to come from within - it was the workforce who reacted against the machine of mass production in the next generation of the car and its industry. The externally-motivated opposition to the industry and the car itself would not arrive until generation 3 - for now, the consumer and the public at large (Ford would see them as one and the same thing), were greatly satisfied with their new material comfort.

Ford himself, shocked by the near failure of his venture with the demise of the Model T in 1927, learnt to adapt his mass production model beyond his one commodity product approach as a direct result of the chill wind of variety-driven competition from General Motors in the late twenties, though as his text reveals in 'Today and Tomorrow', in 1926, he had little fear for the future of his industry or the limitations that would start to be imposed on it by the universality of appeal of its product:

"But what of the future? Shall we not have over-production? Shall we not some day reach a point where machine becomes all powerful and the man of no consequence?

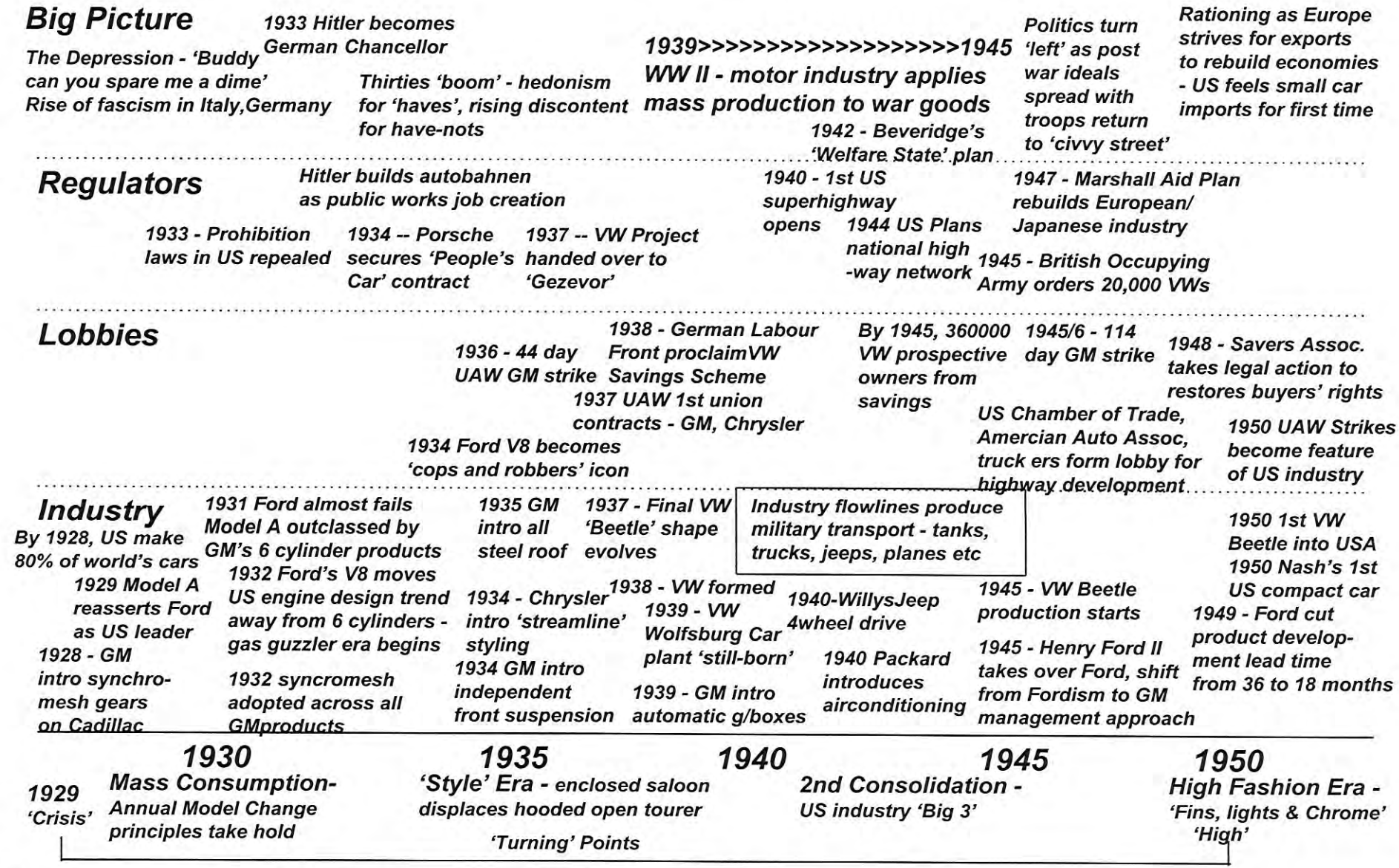
"No man can say anything of the future. We need not bother about it. The future has always cared for itself in spite of our well-meant efforts to hamper it. If today we do the task we can best do, then we are doing all that we can do.

"Perhaps, we may over produce, but that is impossible until the whole world has all it desires. And if this should happen, then surely we ought to be content."

The problem of over-production, and the global mass production capacity that underpins it, has developed into a (perhaps *the*) major problem for the motor industry and its product, the car (and the national economies and societies it 'supports' in turn) at the end of the twentieth century. Whether the flower of the automotive spring will wither after a long hot summer is the question we face at the 'unraveling' turning point at the dawn of the twenty-first century.

Growth to Maturation - The Motor Car Era takes hold

The time line of the motor car and its industry - 2nd Generation



Freeway, Crossroads or Cul de sac - The Crisis of Personal Mobility - Peter Bailey 1998 - Figure 3

2) The Time Line of the Motor Car & Its Industry - 2nd Generation
Growth to Maturation - The Motor Car Era takes hold

From the 'crisis' to 'high' turning point - after the 1929 crash, the economics of growth take hold; variety and style overtake the utility of mass production; mass consumption on the 'never never' is fuelled by the annual model year change; internationally, GM consolidation through acquisition complements the 'transplant' strategy of Ford; the consolidated industry process successfully underwrites war work

- Sloanism - a complement or substitute for Fordism?

Towards the end of the first generation of the car, signs began to emerge that Ford's dream of utilitarian mobility for all were not enough to sustain the genius of his mass production methods - supported by the ever lower prices achieved through the economies of scale production of a long run of a single product. Behind the scenes even as early as 1908, with Ford's 'end to end' scientific management doctrine built around the Model T still just a vision, the large population of small motor manufacturers in the USA provided the 'seedcorn' for an alternative approach of growth through industrial consolidation. This potential route, was prematurely adopted by William C Durant of the Buick Motor Company who formed the General Motors Company with a vision which stood quite distinct from that of Henry Ford. Alfred P Sloan, whose seminal text, 'My Years with General Motors' encapsulates the underlying business philosophy of the second generation of the car, makes the point:

"Both Mr Durant and Mr Ford had unusual vision, courage, daring, imagination and foresight. Both gambled everything on the future of the automobile at a time when fewer were made in a year than are now made in a couple of days....Their organisational methods, however, were at opposite poles, Mr Ford being an extreme centralizer and Mr Durant an extreme decentralizer. And they differed as to products and approach to the market.

"Mr Ford's assembly-line automobile production, high minimum wage, and low priced car were revolutionary and stand among the greatest contributions to our industrial culture. His basic conception of one car in one utility model at an ever lower price was what the market, especially the farm market, mainly needed at the time. Yet Mr Durant's feeling for variety in automobiles, however undefined it was then, came closer to the trend of the industry as it evolved in later years. Today each major American producer makes a variety of cars."

(**Sloan, A. P. Jnr.** *My Years with General Motors* (1963). London: Pan Piper, 1967)

It would be wrong, of course, to misrepresent Henry Ford - centralist, vertical integrator though he was, he did see the need to support variety and differing customer needs. Sloan's point that Ford's utilitarian Model T philosophy was especially supported by rural customers is valid - however, Ford himself did see a very different role for his Lincoln motor cars:

"Several years ago, we bought the plant of the Lincoln Motor Car Company, more for personal reasons than because we wanted it. Our Model T - the "Ford" - is our principal business, and we have made it a commodity. We have no desire to make a commodity out of a Lincoln. Its standards are no higher than a Model T, but they are different.....

"But the point is that, though the one company makes these two types of cars, they are not made under one roof, and they are made from different motives. The Model T is low-priced and serviceable - the man who makes it can buy it. The Lincoln effort is not in the direction of prices at all - and the man who makes it cannot buy it. It is not a luxury car in the sense that it performs no service; it gives supreme service, but it is not a commodity. There must be grades of service, just as there are grades of human beings; one man's effort will bring him a return sufficient to buy one kind of article, while another man's effort will bring him a return sufficient to buy something higher in price. This is not violating the principle of the wage motive; it is extending the principle through all grades of service. We must level upward not downward. And keeping that principle will prevent standardisation from ever becoming a menace."

(**Ford, H.** *Today & Tomorrow* (1926). Portland, Oregon: Productivity Press, Reprint 1988)

Sloan, the ultimate architect of GM's brand of management, goes on to explain Durant's failure to maintain control of the original General Motors Company, which combined the forces of Buick with Olds (now Oldsmobile), Oakland (now Pontiac), and Cadillac by 1909, as follows, clearly making the distinction between Durant's approach and his own:

"Mr Durant was a great man with a great weakness - he could create but not *administer* - and he had, first in carriages and then in automobiles, more than a quarter of a century of the glory of creation before he fell. That he should have conceived a General Motors and been unable himself in the long run to bring it off or sustain his personal, once dominating position in it is a tragedy of American industry."
(op cit 1963, italics are mine)

Albeit that Durant lost the management control of his General Motors Company in 1910 to the banks, his approach was of collecting not only different manufacturers (and their marque names) but also key component suppliers to his manufacturing plants. Sloan explains that this policy was not entirely opportunistic, however:

"But Mr Durant was interested in consolidation, through the extension of his product lines and through integration. He was advanced for his time in his general methods of production. Unlike most early motor-car producers, who merely assembled components made by parts manufacturers, Mr Durant already had Buick making many of its own parts, and he expected to bring about increasing economies in this direction."
(op cit 1963)

Sloan sees Durant's legacy to motor-car related manufacture (and hence his programme of acquisition) driven by three major objectives; first to be able to provide a variety of cars to meet a variety of customer preferences; second, to diversify into

related mobility product fields such as bicycles and trucks and companies whose engineering technologies were such that they may offer developmental possiblities for the future; third, to integrate his GM business through its wholly-owned network of manufacturing plants and generic parts and accessory 'suppliers'.

In these early years, however, it was Ford that made the running. General Motors in its 'pre-corporate', bank-controlled form, though its volume increased from 40,000 to 100,000 units between 1910 and 1915, its market share was halved with Ford's mass production capability of the Model T well able to meet the exponential growth of the bottom end of the motor market in which GM did not then compete (the Durant association with Chevrolet, GM's mass market contender, came later when he engineered a 'reverse take over' of the General Motors Company in 1916 from which the GM Corporation subsequently emerged with the direct investment and involvement of the chemical conglomerate Du Pont Company). It is this evolution of GM's financial structure and struggle for corporate ownership through the stock market that gave Durant a reputation as a 'stock market plunger' (Sloan, op cit, 1963) rather than as a father of the motor industry as we know it. However, this motor 'conglomerate' provided Sloan with the opportunity to use his expertise as an organiser and manager to take Ford head on from the early twenties - almost to the point of Ford's demise in 1928. Sloan took the industrial vision of Durant, applied the flowline production techniques of Ford and with his flair for organisation and administration helped create the most powerful industrial corporation on earth. In his own words, he states in the introduction to his book:

".....I have centred my thoughts on certain elements which seem to me to have influenced most importantly the evolution of the enterprise (though the *enterprise* to which he refers is most likely GM, it could be substituted for the development of the motor industry in particular or large enterprises in general) - broadly speaking, the origin and development of General Motors scheme of decentralised organisation (a feature directly attributable to Sloan himself), its financial controls (which probably relate in some measure to the history of bank control following Durant's period of almost unfettered acquisition together with Sloan's affinity with the shareholder's

interest in the bottom line, capital growth and dividend pay-outs), and its concept of the business as expressed in its approach to the intensely competitive automobile market (perhaps most directly related to Durant's views on variety and diversification)."
(Op cit 1963; comments in parentheses are mine)

- *Sloan's Organisation Study*

It is in the context of organisational structure - the balance struck between central policy-making and decentralised divisional operational control - market representation and product policy that secures Sloan's approach as an evolutionary complement to the rigid overall control of operational efficiency of Fordism. GM, under Sloan's guidance allowed the mass production principles of Ford to become the domain of his operating divisions which either represented GM in the market place - Chevrolet, Pontiac, Oldsmobile, Buick and Cadillac, or its internal supporting 'suppliers' such as AC-Delco in electrical components or GMAC, the wholesale and retail finance wing. He overlayed onto this divisional structure a central staff which focused on the corporate policy matters of finance, research and engineering (central 'R & D') manufacturing (covering real estate, production engineering and production control and purchasing), styling, distribution and personnel.

The key to Sloan's contribution came with his 'Organisation Study' which was drafted in 1920. At outset, the study established two founding principles:

"The object of this study is to suggest an organisation for the General Motors Corporation which will definitely place the line of authority throughout its extensive operations as well as to co-ordinate each branch of its service, at the same time destroying none of the effectiveness with which its work has heretofore been conducted.

"The basis upon which this study has been made is founded upon two basic principles, which are stated as follows:

"1. The responsibility attached to the chief executive of each operation shall in no way be limited. Each such organisation headed by its chief executive shall be complete in every necessary function and enable(d) to exercise its full initiative and logical development.

"2. Certain central organisation functions are absolutely essential to the logical development and proper control of the Corporation's activities."

A P Sloan's Organisation Study, 1920, quoted from My Years with General Motors, op cit 1963)

The essential conflict between these two principles - which are at the core of the debate about the deployment of power in any institution -was subsequently recognised on reflection by Sloan:

"But looking back at these two basic principles, after all these years, I am amused to see that the language is contradictory and that its very contradiction is the crux of the matter. In point 1, I maximise decentralisation of divisional operations in the the words 'shall in no way be limited'. In point 2, I proceed to limit the responsibility of the divisional chief executives in the expression 'proper control'. The language of organisation has always suffered some want of words to express the true facts and circumstances of human interaction. One usually asserts one aspect or another of it at different times, such as the absolute independence of the part, and again the need of co-ordination, and again the concept of the whole with a guiding centre. Interaction, however, is the thing, and with some reservation about the language and details I still stand on the fundamentals of what I wrote in the study. Its basic principles are in touch with the central problem of management as I have known it to this day."
(op cit 1963)

Sloan realises that wherever the balance of power comes to rest in an organisation, it is not through the absolution of written definition but through human interaction - the spirit can be very different from the letter of the law. What must be said, however, is

that what Sloan proposed was fundamentally at odds with the centralised seat of power in the hegemony at Ford, with its rigid vertical process control, rules and regulations. It does not mean, however, that there was no control or responsibility in GM, merely that the need to operate the operating divisions as almost independent businesses in their own right was recognised as a key factor in the sustenance of such a diverse corporation represented in many if not all of the automotive sectors (and other motorised transportation markets in which GM was to become involved - trucks, locomotives, aerospace etc) which were developing or capable of development for the good of the shareholder.

However, Sloan goes to great pains to point out his role as a 'corporate man', who believed in power not being wielded absolutely by the individual chief executive officer but through a more consensual approach with important decisions being taken with the agreement of responsible management teams is epitomised by his textual preference for 'we' rather than 'I' - again he underlines the point:

"Decentralisation or not, an industrial corporation is not the mildest form of organisation in society. I never minimised the administrative power of the chief executive officer in principle when I occupied that position. I simply exercised that power with discretion; I got better results by selling my ideas than by telling people what to do. Yet the power to act must be located in the chief executive officer."
(op cit 1963)

The practical operation of this balance of power between the need for the President of the corporation and his small staff to develop broad guidelines and policies without being troubled by the day to day heat of operations delegated to 'lesser executives' (op cit, 1963) is not easy to achieve. However, the impact of Sloan's management philosophy of professional administration and devolved operational control (which became the rational expression of industrial modernism), was immensely successful from the twenties to the fifties under his personal guidance. Its evolution in the third and fourth automotive generations into the ivory tower isolationism, petrifying central bureaucracy, and inter-functional power struggles has severely limited the success of

GM putting it at the mercy of lobbies, regulators and perhaps most important, more nimble competitive players - first the Germans and then the Japanese - in their own backyard. GM's corporate decline and the role in it played by its organisational model has become a much-reported management (and motor industry) case study (vis a vis, **Peters, T.J. & Waterman, R.H.** *In Search of Excellence:Lessons from America's best run companies.* New York: Harper Collins, 1982; **Pascale, R.** *Managing on the Edge: How successful companies use conflict to stay ahead.* New York: Simon & Shuster, 1990; **Womack, J. Jones, D. & Roos, D.** *The Machine that changed the World.* New York: Rawson Associates, 1990 and many more). But more of this later (see Generations 3 & 4), we must return to the unfolding story of the second generation of the car and the part played in it by Sloanism.

- Sloan & Variety - rationalisation and logical product positioning

Sloan's organisational construct of a clutch of powerful operational divisions overseen by a small central administration team formed an essential adjunct to Durant's legacy of a loose collection of well-known marques which potentially met the diverse motoring aspirations of a burgeoning clientele. Durant's focus on variety and integration was now reinforced with an appropriate management philosophy which eventually took the meaning of 'variety' through 'product line extension' to dizzy heights of extravagance which again, like the management structure itself, ultimately weakened GM through the dilution of variety into ever higher levels of product complexity, many permutations of which were never taken up by the customer. At the end of Sloan's book, he proudly boasts from his standpoint in 1963:

"The events of the past few years in the car market, I believe, have validated the General Motors product policy that we formulated in 1921. John Gordon, president of General Motors, recently observed that our slogan of 'a car for every purse and purpose' is as appropriate as ever; indeed, we have never offered our customers greater variety and choice than we do today. In the 1963 model year the industry offered 429 models of domestically produced cars, compared with 272 in 1955; General Motors alone had 138 models in 1963, compared with 85 in 1955. Of this Mr Gordon said: 'Taking into account all of the colours available and all of the optional

equipment and accessories we now offer - power assists, air conditioning, tilt steering wheels, autronic eyes and so on - we could, in theory at least, go through a whole year's production without making any two cars alike (a theme adopted by Toyota in generation 4). Our objective is not only a car for every purse and purpose but, you might say, 'a car for every purse, purpose and person'."
(op cit 1963, item in parenthesis is mine)

But at least in the second generation, this GM objective of product differentiation paid off in a market dominated for over a decade by Ford's standardised Model T. In 1921, out of the Durant collection of brands - Chevrolet, Oakland, Olds, Scripps-Booth, Sheridan, Buick and Cadillac - Sloan states that more by accident than design, only two, Buick and Cadillac had 'clear divisional concepts' (op cit, 1963) with Buick quality and medium volume at the top end of the middle price bracket and Cadillac's high quality, high price and low volume market positioning. The full line of GM products was impressive but a look at its pricing revealed that there was little overall structure and much overlap between the marques - which meant that, in reality, the brands were competing with themselves - given that Ford had established for himself total dominance of the low price sector. As a result, apart from Buick and Cadillac, the other companies were all making losses and losing market share as a result of Ford's relentless exploitation of the rapidly increasing market. As a first (and in Sloan's view 'most significant') step in the implementation of Sloan's organisation study, a special committee of senior GM executives with an operational motor industry background was set up to establish a rational product and market policy for the Group. As Sloan puts it:

"It was clear that we needed an idea for penetrating the low price field, and for the deployment of the cars through the line as a whole; and we needed a research and development policy, a sales policy, and the like, to support whatever we did."
(op cit 1963)

Whilst vociferous elements of his executive committee were attracted to investing in 'risky' new single product technologies to beat Ford, Sloan and his advisory

committee resisted this to complete an assessment of their overall position which put bottom line profit and shareholder value (rather than Ford's philosophy which saw profit coming about as a result of good public service) as an essential part of the corporate mix - in his words:

"The primary object of the corporation, therefore, we declared was to make money, not just to make motor cars.....General Motors had collected a number of profitless motor cars since 1908, and a few were still being produced.....one of our first conclusions was that the number of models and the duplication that then existed within the corporation should be limited." (op cit 1963)

This resulted in a 'rationalisation' of overlapping and unprofitable product lines and established in Sloan's view a sustainable product policy which minimised overlap (though he admits to some), and gave wide market coverage but did not attempt to compete at any price. The approach stands in contrast with Ford's philosophy:

"Business must be run at a profit, else it will die. But when any one attempts to run a business solely for profit and thinks not at all of service to the community, then also the business must die, for it no longer has a reason for existence." (op cit 1926)

In his account of the product policy's development, Sloan adopts a terminology invented by GM, which has become an ingrained feature of the motor (and other) industry(ries), the analytical, statistically-based language of market volume and price positioning, market sectors and the like and reflects an entirely different way of looking at the motor world - quite different from Ford's commodity-driven language of scale production. Sloan admits that at the beginning, the industry felt no need for statistical information, given that most cars were sold before they were built but in order to build a *logical* strategy such data and its analysis became an essential prerequisite of policy-making.

From this application of Sloan's management philosophy in general and GM's resulting approach to the market, other elements which subsequently became standard features of the motor industry landscape emerged.

- *Progressive adoption of new product technologies and features across the divisions*

The separation of the market position of the car divisions envisaged by the product policy did not prevent the spread of product development-led efficiencies across the Group. The progressive management of integrating new technical features into GM became another model for the industry at large. Relatively important technological developments such as syncromesh gears (a Cadillac 'first' in 1928), automatic transmission, power assistance on various items (steering, brakes, windows etc), and other 'gismos' such as air-conditioning could be 'trailed' first as options sold at a high profit margin on expensive cars such as Cadillac recognising that at some point in the not too distant future they would become a 'standard entry' feature on such a product. Thereafter, the feature would then be offered first as option then as standard further and further down the GM product ranges in similar fashion. As the volumes of such features grew, their production cost fell as a result of scale, whilst a high unit price and high rate of return against the initial investment was secured in the early days by 'creaming' the richer, more discriminating market at the top end at outset. This step by step formula of both creating initial demand and its management as a marketing differential to secure the highest profit contribution had two other succesful outcomes for GM (and subsequently other industry players).

- *'Trading up' and the 'never never'*

Another feature which marks the evolution of the car from first to second generation is that of the availability of both wholesale and especially *retail* finance to support the sale of cars. Whilst Sloan tells us that banks had been making loans available to prospective car buyers since 1910, the creation by GM of its wholly owned subsidiary, the General Motors Acceptance Corporation (GMAC) in 1919 marked yet another industry milestone - a facility stalwartly resisted by Henry Ford until a decade later when his empire was close to insolvency as a consequence of failing Model T sales. Ford's attitude to debt is best expressed in his own words - though the reference

was related to business rather than personal borrowing (I doubt very much whether he would have discriminated at that time between the two!):

"Debt is nowadays an industry. Luring people into debt is an industry. The advantages of debt have become almost a philosophy. Possibly it is true that many people, if not most, would bestir themselves very little were it not for the pressure of debt obligations. If so, they are not free men and will not work from free motives. The debt motive is, basically, a slave motive." (op cit 1926)

Ford had relied from outset on the pent up demand for his commodity product to ensure payment in cash by the dealer up front. This meant that his costs, and therefore price could be kept even lower as a result of low or no finished vehicle inventory. Other manufacturers, GM included, were not in such a favoured market position. Their reliance on the banks to provide an independent credit service to customers (and dealers to cover stocking costs) was a key obstruction in the way of developing the motor market. Sloan takes up the point:

"We got into this business over forty years ago when the need for financing the distribution of automobiles first arose. Mass production brought with it the *need* for a broad approach to consumer financing, which the banks did not take kindly to. They neglected - I might say they declined - *to meet the need; and some other means had to be found if the auto industry was to sell cars in large numbers."* (op cit 1963)

The move into consumer (and trade) finance by GM marked a shift from mass production to mass consumption philosophy. Even Sloan's words, highlighted by me in italics above, suggest that the move was not necessarily customer-led - there was a *commercial* need to '*sell* cars in large numbers' - as opposed to a *customer* need to *buy* cars in large numbers. The formation of GMAC was an excellent example of horizontal rather than vertical integration - GM were unwilling to let the conservatism of the risk-averse banks hold their corporate development back. On the other hand, GM saw GMAC as a profit centre in its own right - albeit within the overall context of supporting its automobile business with a finance subsidiary which offered

competitive rates to its borrowers. As a result of GM's (especially Durant's) foresight, a method was provided which deprived the banks of profitably financing car purchase and at the same time deprived them of providing dealer business funding requirements. Though the dealers were not obliged to take their funding from GMAC, it was made commercially sensible for them to do so with wholesale inventory and capital funding discounted in proportion to the 'writing of retail paper' - securing profitable retail credit transactions and the chance to sell vehicle insurance through GM's other subsidiary, the General Exchange Insurance Corporation - for which they were paid a commission. As with the concepts of product policy already discussed, the formation of wholly or partly-owned finance subsidiaries has become an entry feature of the motor (and other) business which has tried, through its retailer networks, to become a 'one stop shop' for the consumer to facilitate the sale. The provision of such a strategic 'service' to customers offered GM the possibility of tactically creating and managing demand, enabling it to fuel mass consumption of its products - the age of the 'never never' had truly arrived.

The offer of competitive retail instalment credit schemes, hire purchase and the like opened up other potential sales policies for new (and used) cars. The translation of transaction cost from absolute sums into a weekly or monthly cost to the consumer over a 2 or 3 year period not only facilitated a repeat sale (the date of the final or early credit completion was always known to the lender) but also the incremental sale of high profit optional features ostensibly for 'a few pence per week' and provided GM (and subsequently the industry) with a system of sales incentives to encourage the customer to 'trade up' from last to this year's product or from a low to a high specification vehicle. As the market matured, the higher incidence of used car 'trade-ins' meant that, in addition, the focus of the customer on the 'retail' price of the product shifted to the net replacement cost (i.e. the difference between the new price to be paid and the 'trade-in allowance' on the used car), for which finance had to be found. This, in turn, has ultimately meant that the vehicle transaction could be represented in different ways to suit 'customer preferences' - for instance, high new vehicle discounts could be offset by low trade-in allowances or inflated credit interest rates. The exploitation of the customer in this complex way has led to 'trust' and 'car

salesman' becoming mutually exclusive terms on the one hand, matched by the tendency for customers to become far more circumspect and demanding about the 'deal' and looked on with suspicion by the salesman. It took until the sixties and the car's third generation for the abuse of this process by the industry to become recognised as an issue by increasingly influential lobbyists such as Vance Packard and thereafter by critical industry insiders such as John De Lorean, the ex GM executive who revealed the triviality to which product differentiation had then descended as developing into an ethical rather than commercial issue.

In this context, to be fair to Sloan, he did see the danger of such consumer credit-related excesses:

"GMAC helped to bring consumer financing into being in the early days. It has had an influence on keeping the terms of down payments and time span on a reasonably conservative basis. Its disciplinary influence in the direction of reasonable rates to the customer is gradually being taken over by legislation; more than half of the states now set maximum rates by state law. I believe the time is not far off when all the states will have rate legislation." (op cit 1963)

Whilst he foresaw the need for regulation, he believed that the industry should be capable of regulating itself - an endorsement of rate regulation was followed with a rebuttal of the need to control the deposit and repayment period - he saw this as being in the domain of the dealer and the purchaser. However, he did agree with the need for these other transactional dimensions to be managed carefully by the industry - though arguably from the standpoint of protecting the industry and its objectives rather than the customer.

"This does not mean that I have not been aware, along with others, of the dangers of over-expansion of consumer credit. The record is clear that GMAC has been continuously interested in keeping the length of the term within reasonable limits. I think I might add that conservative financing is essential to the health of the

automobile industry. The man who pays too little down and takes too long to pay will have no equity with which to come back soon for a new car." (op cit 1963)

Whatever Sloan's view, in the third and fourth generation of the car, the need 'to keep the lines moving' has seen such retail credit prudence go out of the window - with low or no rate, low or no deposit, extended repayment periods, repayment 'holidays' and swollen, 'balloon' final payments - all of which became day to day features of mass consumption credit financing. This will be explored further in the review of the third generation of the car.

- *The annual 'Model Year' Change*

The culminating piece of the Sloanist product jig-saw, which embodies the thrust of the policies on product development and the supporting role of GMAC to financially underwrite sales, is the annual 'model year' change - again adopted as custom and practice by the industry at large. Originating in GM's approach to variety and the product development process, Sloan believed that Ford's Model T single product-based long production run with 'running changes' adopted as improvements became available (akin to the 'kaizen' or continuous improvement of the fourth generation) was not the best philosopohy for a corporation which had to regularly update its wide variety of products, manufacturing and selling them in much shorter production runs. With total product development timescales being long - often a minimum of three to five years to bring an entirely new offering to market - and recognising the speed with which new features attractive to the customer were being launched on to the market - though not necessarily embodied into an entirely new product, Sloan's product policy committee at GM thought that deliberately encapsulating such new features in visibly different products made good commercial sense. Whilst new products were not entirely new - a significant level of 'carry over' parts formed the foundation of most 'new' products - external, visible to customer, 'sheet metal' styling changes could be bundled up with more significant under the bonnet feature changes - new engines, transmissions, suspension and other systems and adopted as appropriate to the life cycle of individual products across their model ranges. This approach carried powerful consumer marketing opportunities for the Group.

In 1935, Sloan masterminded the development of an administrative procedure governing the production of a new models to avoid the mistakes of the early twenties with individual GM companies working in an uncoordinated way on overlapping new product programmes. In his words it was:

"a manual designed to 'provide a definite and orderly method for submitting the essential data required, in order that the economic, financial, engineering, and commercial position of proposed new products may be evaluated; and second, that their progress,from the time of approval to production, may be established for the information of all concerned." (op cit 1963)

In essence, the process developed, working on a two-year development timescale (albeit that Sloan recognises that this period does not represent a complete vehicle cycle from concept to production and launch, it rather reflects a period of culmination of bringing diverse, on-going, product engineering developments and complementary carry over parts under the auspices of a particular new product project), fits into an orderly overall product policy of replacing individual products within GM product ranges at regular intervals in line with an overall corporate product plan. It does not prevent research and development working independently on new engineering technologies which may be fitted into individual product developments at a time when it is appropriate to do so. The new models to which Sloan refers are thus rather more a product of the exterior and interior styling studio - the shell into which the on-going developments of key components such as engines and other engineering related features are absorbed when it is deemed that they are ready or even *necessary*.

Thus, the annual model year change became an important feature of the motor industry at large. However, whilst in the early days, it made some sense to manage the process of product change on a timed annual basis across a wide variety of models with the incorporation of quite significant product features built into a single change point, the policy became increasingly devalued as it degenerated into the 'planned obsolescence' label identified by Vance Packard in Generation 3 - a device which

deliberately shortened the life of products (either through depreciating their 'image' through 'enhanced' styling or making replacement 'cheaper' than repair) to reinforce consumption as markets moved to replacement rather than first time buy.

- A different approach to internationalisation

The other key feature of Sloan's administrative term at GM was that of the policy established for overseas expansion. It took the early opportunistic consolidation undertaken by William Durant in the US pre-1920 to a different level based on Sloan's principles of strategic policy-making and the application of his 'staff and line' decentralised organisational structures well beyond US borders.

Sloan and Ford established two contrasting routes to the construction of their global operations - both of which have stood the test of time and have been adopted by others in their wake. Ford's cost-down, vertically integrated process-driven approach centred around his universal Model T commodity (the 'world car' is still very much a part of Ford language today). Ford's reasoning was that whilst the product would be the same globally, it should at least be capable of assembly if not full production close to its market. In reality, his expansion into Europe and elsewhere established wholly-owned 'transplants' - a terminology perhaps incorrectly attributed in the eighties and nineties to the Japanese approach to their establishment in America and subsequent globalisation.

Sloan's policy was fundamentally different (and probably influenced more than a little by William C Durant's affinity with marques). GM's international expansion was three-pronged. Fully built-up vehicles were exported to 'open' markets where the American car was an attractive consumer proposition. Where markets were either protected or inappropriate for American automobiles, GM either acquired a local car manufacturer in its entirety or granted an assembly contract to a local, independent 'distributor' which then managed car assembly from CKD ('completely knocked down') vehicle kits. This approach was driven by a belief that products should be a reflection of their market, recognising that its big American cars and its home marques were not suited to every market. Since GM was not a 'marque' in its own

right as was Chevrolet, Cadillac etc - it was entirely acceptable that further divisions could be established overseas with GM represented by different, locally well-known names. Sloan, demonstrating his bias for careful opportunity appraisal and analysis carried out by various high-powered policy-making committees, the hallmarks of his central staff function, relates the key factors which influenced the development of GM's overseas policy as follows:

"We had to decide whether, and to what extent, there was a market abroad for the American car - and, if so, which American car offered the best growth prospects. We had to determine whether we wanted to be exporters or overseas producers. When it became clear that we had to engage in some production abroad, the next question was whether to build up our own companies or to buy and develop existing ones. We had to devise some means of living with restrictive regulations and duties. We had to work out a special form of organisation that would be suitable overseas. All of these problems were considered fully within the corporation for a period of several years in the 1920's when the basic policies were established." (op cit 1963)

Europe was the first focus of GM's attention. The first overseas acquisition was that of Vauxhall Motors in Britain in 1925 (it is interesting that an earlier take-over approach to the Fordist-structured empire of Herbert Austin failed and that a link-up with the emergent GM-look-alike of William Morris from which the Nuffield consolidation of Morris, MG, Riley and Wolseley marques came about in 1938, was apparently not considered). Vauxhall was followed by Adam Opel in Germany in 1931 (supplemented later by Holden in Australia, a division whose products more closely relate to those of the US GM divisions). These local marques still exist as divisions today, albeit that the underlying products (and increasingly their model names) are the same. The operation of these overseas divisions with their US stablemates provided strong representation in the US and Europe and when complemented with the overseas CKD assembly policy has given the benefits of a best 'mix and match' of product coverage in many other markets across the globe. It allowed GM to balance the local with the central, built-up vehicle exportation with

local assembly or entirely self-sufficient overseas production and distribution organised on GM divisional lines to meet the peculiar needs of individual markets.

As with the 'transplant' approach of Ford, Sloan's acquisitive approach to international expansion has also become a feature of the industry today. Where, the the Japanese - Honda, Toyota - established transplants wholly in their own image to build their modern commodity Model T equivalents - Accords, Civics, Camrys and Corollas - first in the US then in Europe (albeit that Honda followed the lead taken by VW and latterly specialist marques such as Mercedes Benz and BMW have entered the transplant race), consolidation motivated through GM-like marque acquisition rather than competitor elimination has re-established itself in the nineties. It could be argued, however, that the breed of marque acquisition currently underway is driven by a recognition of the power of a potential global rather than purely local marque. Ford's purchase of Jaguar, BMW's acquisition of Rover (which secured most of the BL badges for future exploitation) and most recently, the competition between BMW and VW to acquire Rolls Royce and Bentley bear witness to this. Perhaps, this is a subtle innovation of Sloan's philosophy - when he acquired marques such as Vauxhall or Opel, it was the popularity of their products in their etablished markets that was the attraction. In the fragmented, hedonistic era of entropy in which the motor industry is presently embroiled, it is the existing or potential developmental value of the marque and its pedigree which is the objective. But more of this later in generation 4.

The heyday of the car and its industry - untrammelled growth, unfettered by regulation, helped by crisis

Given the contribution to economic growth made by the car and its industry, its rise and rise came virtually unopposed. Ford's view, not unaffected by the relative isolation of his rural upbringing, was that the car was the root from which the trunk and branches of prosperity would grow - cars bring roads, not the other way around; roads make distribution easy and connect suppliers with customers; cars bring pleasure with employees as buyers weekend-released from their daily toil to explore and enjoy the great outside, visit their relatives and friends;cars bring worthwhile employment and through it personal development. The adoption of the car and with it

the 'freedom' of personally-directed mobility by the population at large not just the well-heeled elite meant that, at least in the second generation, that opposition to its advance was non-existent. The motor industry's role, with its mass production methods, as a mass employer paying above the going rate (symbolised by Ford's 'wage motive') at a time of mass unemployment gave hope during the crisis of the Depression (in the US and Europe) and provided the manufacturing infrastructure which underpinned the 1939-1945 Second World War effort. Such was an industry that was unlikely to face opposition from without - indeed, prosperous cities such as Detroit became magnets to large numbers of displaced farm labourers looking for work to support their very subsistence.

The almost total dominance of the US car industry - it still manufactured 80% of the world's supply in 1928 - belied the fact that more radical internal industry change was afoot. The demise of the Model T in 1927, followed by the short-lived success of the Model A which first restored Ford's prime position in the US in 1929, and then almost brought about corporate failure yet again in 1931 with the introduction of GM products powered by a superior 6 cylinder engine demonstrated to Ford that the days of his one product policy were over. Competition had arrived which meant that the commodity-based long runs upon which Ford had based his strategy were no longer viable in the face of stiff, responsive competition from Sloan's GM. Ford's reluctant acceptance of this competitive product development drive from GM which caught the imagination of the consumer on a mass scale led to a race developing between the two corporations to deliver a rash of significant enhancements on a regular basis - V8 engines (Ford, 1932), synchromesh gears (GM, 1932), 'streamlined styling' (Chrysler, 1934), independent front suspension (GM, 1934) and the all steel roof which marked the birth of the fully enclosed saloon (GM, 1935). These developments kept the motor industry at the forefront of the mass consumption revolution and were seen as visible proof of economic progress supported by a compliant customer who was increasingly the face of the population at large. Opposition to such advancement with the memory of the Depression and the First World War that went before it still very much in the mind of 'Joe Public' would not easily take root. Such hopes were not a monopoly of the USA, the motor industry and that of its service infrastructure fuelled economic

recovery across the Atlantic too - in Germany specifically, Hitler's vision of the people's car (which became the VW Beetle) backed by the creation of the supportive autobahn system through public works ensured the pre-eminence of the car and its industry in the regeneration of the German economy.

Motor industry as supportive lobby

Thus the car and its related industry became the very icon of modernity - a foundation for growth and material wealth creation on a massive scale. At the same time, the car's supremacy over other transportation 'life forms' was sealed through supportive lobbying and regulation - in this context, the lobbies and regulatory authorities which had worked against the 'monopolies' of the rail industry during the first generation of the car, were faced with increasing pro-car pressure directly supported by the increasingly powerful motor industry itself. As Stephen B Goddard puts it in his paper:

"Not only did the policies of government and business aid and abet one another, but their personnel moved between government and industry in a seamless continuum. Auto executives holding stock in their companies moved into government, openly helped legislate profits for themselves, then returned to their industry to harvest their rewards, in a day before Congress outlawed such dealings.

"In 1922 for example, Michigan voters sent James Couzens, Henry Ford's former right hand man, to the US Senate. Within a decade, Ford's former finance chief would chair the Senate Interstate Commerce Committee, where he would effectively block legislation to regulate the motor industry.

"Francis du Pont did not merely switch hats; he wore two at once: while his family's stock controlled the General Motors Corporation, the wealthy du Pont served on the Delaware Highway Commission from 1922 to 1949. In 1953, he would succeed (Thomas Harris) MacDonald as the director of the Bureau of Public Roads, and a couple of years later he would become one of the key players in convincing President Eisenhower to propose the Interstate Defense Highway System.

"By 1921, railroads were petitioning the ICC (the Interstate Commerce Committee) to let them discontinue lines because of auto competition (*witness Beeching much later in the UK*). The trend had mushroomed by 1932, by which time the country had fallen into the worst depression in its history. In the previous six years, lucrative less-than-car-load rail freight had fallen 60 percent, while the number of motor vehicle registrations had risen to 26.5 million in 1929.

"A century old, the nation's railroads had still not learned to get along, and decades of regulation by hostile forces had frozen them into a defensive posture, as creative young minds, with names such as Walter Chrysler, fled to industries with a future. Rather than focusing on how to attract the customers to the rails, railroads had responded to the motor onslaught by fighting highway appropriations, demanding that Washington regulate truckers, and diversifying into trucking themselves."
(**Goddard, S.** *The Road to Now*. In The Annals of the American Academy of Political & Social Science, Ed. Long, S.G. London: Sage, Sep1997, Vol. 553, 30-41. *Note*: statements in parentheses have been added)

So, whilst the motor industry effectively lobbied from within government (moving to a multi-national level with the investments made by Ford and GM in Europe) for its sustenance, the rail industry was seen as a leviathan whose rights needed cutting back (a fate which now awaits the motor industry itself?). At the same time, the motor industry began to ensure that much of the hidden cost of its successful expansion (road construction and maintenance, for example) was subsidised by government with the full support of the consumer who did not see the full cost of his automotive pride and joy -

"Perhaps, most important to the decline of the railroads, Americans were madly in love with motor travel and their new found freedom of movement. When railroads hiked their rates, riders could focus on the fare and compare it unfavourably to the cost of gas at the pump. Yet the true costs of motor travel were increasingly diffuse. To the per-mile cost of gasoline, an informed consumer should have added the costs

for purchase and financing, insurance, and maintenance; car and road taxes, including road damage by trucks; air pollution; dependence on foreign oil; and added police patrols, traffic courts, and land that government bought for highways - costs that would add $2.25 a gallon to gas prices, in today's dollars."

(Stephen B Goddard, op cit, 1997)

Motor industry opposition starts from within

It is perhaps only now in the 4th generation that such a complete revelation of costs, stifled for many years - 'aided and abetted' by the motor industry and its lobbies - are being considered in open debate, though still the motoring consumer is still somewhat resistant to taking the full cost implications of his or her personal mobility into account, demanding the rights of passage whilst avoiding the full responsibility for their provision.

In the car's second generation, with the motor industry consolidating at a rate which put that of the rail industry into the shade - the emergence of the 'Big Three' (GM, Ford and Chrysler) in the USA and the subsequent third generation consolidation in Europe - there was little to stand in the way of 'the wheels of progress'. However, in the thirties, despite the material wealth the motor industry created for absorbtion by the consumer, there were signs that the system could develop resistance from within and it is perhaps the nascent discontent of the industry's own workforce capitalised by the growth in organised trade unionism which, in the end, exemplified much of what was wrong with modernity and the excesses which it promoted. Whilst the Second World War provided a collective cause which subsumed the working and consumption rights of the individual towards the end of the 2nd generation, it was not before the issue of enhancing motor industry worker's rights had become a feature for which the industry attained developing notoriety in its third and fourth generations.

It was, however, in 1936 that the growing power of motor industry unionisation was first shown in the US. The UAW (Union of Auto Workers) brought about a 44 day strike at GM. Sloan and the board directors of GM were resistant to union recognition

but were outflanked by the strike tactics of the UAW who carefully picked their target plants, not hitting assembly plants but key component supply divisions such as Fisher bodies and Chevrolet engines. The strike method adopted was new - the 'sit-in' - which illegally secured control of the plants occupied and was surely an antidote to the 'lock-out' approach ruthlessly used against strikers by Ford's 'Service Department'. Despite a legal battle, successfully fought by Sloan's GM, which resulted in an injunction ordering the strikers out of the engine plant by a deadline, the workers appealed to the Governor of Michigan stating that there would be bloodshed if the eviction were carried out. Governor Murphy intervened and attended further negotiations between the union and GM which resulted in the first union-negotiated annual contracts with GM in 1937. This campaign was immediately followed up with a similar onslaught at Chrysler in the spring of the same year (Automotive News, *100 Events that made the Industry*, Vol. 2, June 26, 1996).

Sloan's view of this incident was somewhat different, seeing the union's action to subvert GM's workforce as a direct attempt to seize power both over the workforce and more importantly over the management's right to manage not exclusive but inclusive of the workforce at large. (Note: The path of this struggle for power was closely followed in the seventies at British Leyland between management, union officials who vied between themselves for an exclusive right to represent the workforce, and the employees themselves, who by no means were agreed that a, or any, union had the right to demand either exclusive right of representation over, or complete fealty, from them.)

In typical Sloan style, the direction of personnel policy was the domain of a GM central staff steering function, the 'collegiate' approach of which was fundamentally different from Henry Ford's tightly controlled patriarchy, driven as it was by his 'wage motive' - albeit that it had provided industry-standard setting daily pay rates and other worker benefits such as clean working environments, hospitals and training schools. GM's personnel policy approach, in Sloan's opinion, has incorrectly become wholly associated with that of 'collective bargaining' and the (at first annual)

contracts negotiated with the trade unions which became the pattern for the US industry. Sloan, in his book, draws the reader's attention to the fact that:

"....our approximately 350,000 union members receive a large number of benefits which are not mentioned in the contract and which, in some cases, were being provided by the corporation before modern industrial labour organisations come on the scene. Our plant recreation facilities, our payments for employees' suggestions, our arrangements for employee training, our provisions for employing handicapped workers - all of these fall outside of the contract. As far back as the 1920's, General Motors was providing many benefits to its employees. Some of these were in the form of facilities - for example, our first rate medical services, fine cafeterias, locker rooms, showers, and parking lots for our employees."
(op cit 1963)

However, the worm of para-absolute power of the industry had started to turn from within. The 'command and control' management style adopted at Ford - which had started as a 'model' employer with its wage motive-driven $5 dollars a day, 5 day week policies of the first generation - attempted at first to protect its plants from unionised labour with the violent private army and secret police methods of its 'Service Department'. This policy finally gave way to a union agreement in 1941 following the censure of government through the denial of a $10 million dollar defense contract in 1940 followed by censure by the US Supreme Court when it upheld the National Labor Relations Board's case, ordering Ford to re-employ workers it has fired illegally for supporting unionisation. In April 1941, Ford agreed to a union election which completed the unionisation of the US Big Three. Strikes thus became a regular feature of motor industry life, with a record 119 day affair at GM in 1945/6. Sloan saw this as not only a bid to gain power over management and worker alike but also influence Government:

"In the early post war period, our prospects for workable labour relations seemed to be remote. At the end of the 1945-6 strike, the United Automobile Workers was one of the two or three largest unions in the country, with a membership of almost a million.

The UAW was beseiged by factional conflicts, both internally and with respect to other unions. The principal result of these conflicts, as it appeared to us, was a tendency for every side to compete with the others in a show of militance against the corporation.

"To make matters worse, it appeared that the UAW was able to enlist the support of the Government in any great crisis. The Government's attitude went back as far as the 1937 sit-down strikes, when we took the view that we would not negotiate with the union while its agents forcibly held possession or our properties. Sit-down strikes were plainly illegal - a judgement later confirmed by the Supreme Court. Yet President Franklin D. Roosevelt, Secretary of Labour Frances Perkins, and Governor Frank Murphy of Michigan exerted steady pressure on the corporation, and upon me personally to negotiate with the strikers who had seized our property, until finally we felt obliged to do so. Again in the 1945-6, during the 119-day strike, President Truman formally backed up the union's controversial insistence that our 'ability to pay' should affect the size of the wage increase. We successfully resisted this unsound proposition, but there is no doubt in my mind that the President's statement served to strengthen the union's public position and thus prolong the strike." (op cit 1963)

Further difficulties occurred in 1947, when GM workers faced a call by their unions to 'walk out' and support an anti-legislative demonstration in downtown Detroit in direct contravention of their contractual conditions. Even as the 1947 contract was signed, the walk out began supported by 13,000 hourly-paid employees (albeit that 19,000 stayed at their posts). Disciplinary action was taken by GM against those seen as ringleaders. Though the union could have appealed to an 'umpire', it chose not to do, preferring to negotiate with the company. As a result, an explicit agreement by the union that such stoppages were violations was achieved and GM agreed to commute the sentences of those disciplined. Sloan goes on to make the point:

"During the year that followed, our labor relations were dramatically changed for the better. That year saw the defeat of the Communist element in the United Automobile

Workers (shades of Red Robbo in the seventies at BL?) and the beginning of somewhat greater stability in the union's internal affairs."
(op cit 1963, parenthesis added)

With the labour difficulties set aside, Sloan's GM delivered a contractual employment mechanism in 1948, envisaged much earlier in the thirties, which encompassed two key innovations. First, it sought to move away from annual to longer term contracts which supported the corporation's need to plan and invest on a longer term, more stable, basis - to two years at first (as a result of union concerns about a move away from an annual pay round which sought to extract the best pay rate and conditions on the company's 'ability to pay') with a move to a five year contract in 1950, followed by three successive three year contracts - (it took until the late seventies for the British industry to break away from the annual pay round - with a two year contractual norm being established which has endured to today).

The second innovation was the implementation of GM's 'wage formula' which had two features, the first being an 'escalator clause' which sought to provide wage allowances to protect employees against changes in the cost of living and the second an 'annual improvement factor', which "assured the employees of a regular share in the benefits of increased efficiency resulting from advancing technology."(op cit, 1963). It is interesting to note that both of these features would not have sat well with Henry Ford, who would have seen the first as potentially inflationary with workers being paid for work not done - his opposition to such safety nets, including a 'standard' living wage are well documented - such instruments led to higher costs, higher prices, less customer value and therefore lower sales. The second would have gone against Ford's grain since he would have seen any benefits gained as a result of efficiency being passed first and foremost to the customer in terms of a reduced price - with the benefits to the employee, whose pay was fairly related to effort anyway, coming through the greater work security gained as a result of good service and higher sales.

The argument over how productivity is measured and subsequently rewarded still haunt the industry at the end of the twentieth century, with the comparison of different companies performance in this respect widely debated within and without of the motor (and other) industry. Sloan, however, seeks to cover this controversial point:

"But contrary to widespread assumption, the improvement factor is not linked to a definitely known increase in productivity in General Motors. There is, to my knowledge, no satisfactory technique with which to measure productivity at General Motors, or, in fact, at an corporation which manufactures constantly changing products. And even if an industrial productivity measurement could somehow be provided, it would still not be desirable to relate it in direct proportion to wage increases. Such a policy applied to the economy as a whole would bring about intolerable discrepancies between wages paid in industries where technological progress is rapidly increasing, and the wages paid where technological progress must be limited - as it is in the so-called service industries. It is my belief that the improvement factor should reflect the long-term productivity increase of the US economy as a whole.

".... In the end, increased efficiency flows not so much from the increased effectiveness of the workers, but primarily from more efficient management and from the investment of additional capital in labour-saving devices. Some union spokesmen talk as though the entire benefits of increased productivity should go to labour. I do not believe that this is sound. New machinery costs money and additional investment must be justified by a return on that investment. An argument could be made that the consumer, and the economy as a whole, would benefit most if productivity increases were applied entirely to the lowering of prices. Ideally, that might be a good thing. But since it is in the nature of people to work better with the incentive of an individual or group gain and to want to bargain over it, it is a good thing to have something to bargain over. And so I conclude that the benefits of productivity increases should be apportioned among the consumer (lower prices or better product), labour (higher wages), and the shareholders (return on investment)." (op cit 1963)

So, in these latter words, Sloan rejects the simplicity of Henry Ford's 'big idea' approach to business success with employees becoming more prosperous indirectly as a result of working for the greater good through better service and lower prices. Sloan adopts the pragmatic view that all 'stakeholders' should benefit from better productivity and specifically that employees being able to directly bargain over it and share in it was an entirely natural human phenomenon.

Thus, the negotiated agreement of contracts with the UAW led to the gradual establishment of 'pattern bargaining' which ultimately put all of the Big Three on similar agreement structures and periods. Once this was achieved in 1955, it became an accepted feature of the negotiation that one manufacturer would be in line for 'industrial action', i.e. a strike, as each contractual term expired and once a new contract was negotiated with the manufacturer involved it would be adopted by the industry at large.

It is interesting to note that Ford's 'wage motive' concept (and his controversial views on 'charity') was (were) finally set aside with a 'provision for supplementary unemployment benefits' being included in the contract. Sloan states that such a measure was envisaged but not implemented by GM in the thirties following the move towards state protection. However, in the mid fifties, the unions were determined to win a supplementary concession from the manufacturers. It is somewhat ironic that it was the Ford Company which negotiated the initial agreement on such a benefit which topped up state unemployment compensation. GM and the other manufacturers fell in line with the Ford contractual terms in 1955.

So it came to pass that the first successful attempt to put an external brake on the power of the motor industry was brought about with the support of its own workforce (albeit through the power-seeking role of the trade unions) - the first effective *anti-motor industry* (but not *anti-car*, this was to be a seedling development of the third generation which has blossomed from an 'irritant' to a major 'threat' in the fourth) lobby. It is an interesting point to note that this newly established anti-industry power of the unions (first in the US and then in Europe, especially in the UK) was ultimately

to contribute to its own undoing in the third and fourth generations as the inflexibility of its custom and practice-riddled agreements, underpinned by piece rate payment systems constrained the industry's external responsiveness and image, in doing so losing the support of the consumer (and ultimately their governments) and helping to fuel the Japanese invasion of cheap reliable cars. In the thirties, Sloan saw the potential problems associated with this struggle for power and influence between unions and management:

"Before 1933 General Motors had no dealings with labour unions except for a few craft organisations in the construction field. For this and perhaps other reasons we were largely unprepared for the change in political climate and the growth of unionism that began in 1933.....The significance of large-scale unionisation was not yet clear to us. We knew that some political radicals regarded unions as instruments for the attainment of power. But even orthodox 'business unionism' seemed to us a threat to the prerogatives of management.

".....What made the prospect seem especially grim in those early years was the persistent union attempt to invade basic management prerogatives. Our rights to determine production schedules, to set work standards, and to discipline workers were all suddenly called into question. Add to this the recurrent tendency of the union into pricing policy, and it is easy to understand why it seemed, to some corporate officials, as though the union might one day be virtually in control of our operations."
(op cit 1963)

Sloan believed in 1963 that GM had put such a threat behind it, in his words:

"The issue of unionism at General Motors is long since settled. We have achieved workable relations with all of the unions representing our employees." (op cit 1963)

However, for the industry at large (and for GM in particular), his optimism was largely unfounded. In the UK, the British Leyland story of the seventies is well known in this context and in the summer of 1998, GM has suffered yet another crippling 54

day strike, losing over two billion dollars in 'lost profit', lost production of over a half a million vehicles, a drop in market share of 21% and achieving a fall in US industrial output of 0.6 percent in June 1998 - the steepest fall in five years. At the root of the dispute is GM's attempt to regain its 'right to manage' and make changes to 'inflexible' working practices. Yet again, Federal Government became involved with the appointment of a US federal judge as 'arbitrator' - perhaps revealing some political anxiety about the effect of GM's problems on the US economy and society (Wall Street Journal Europe, 22 July 1998, 'US Judge orders GM and Union into arbitration'). An article in the Times (**Brodie, I.** *GM strikers defend their high life.* In The Times, London, 22 July 1998) states:

"GM accuses the union of trickery in sidestepping its agreement to end national strikes. True, the UAW called out only 9200 workers in Flint, but they supply parts to the whole system. Shortages quickly forced GM to close 26 out of 29 assembly plants and lay off 185,000 workers. An arbitrator is to hold a hearing on the GM claim that the strike is illegal."

Plus ca change?

The rise of the unions as a politically-influential force in Generation 2 saw off Henry Ford's policy of exclusion after a bitter lock-out campaign fought between union members and his private security force in the thirties. GM, under Sloan, saw in a more rational, pragmatic approach to labour relations and union recognition - however, this did not stop the movement of power from management to the trade unions. GM's management position was not given up without a fight, but despite having the law on the management's side, the key shift in support came from Government which placed extreme pressure on GM to negotiate and so set in motion a process which in Sloan's opinion put management at a disadvantage when dealing with labour. This process of realignment of power from management to unionised labour created problems in the US which still exist today - parallels in the UK were put to rest in the Thatcher era with the Government-sponsored Michael Edwardes re-establishing the management's right to manage by going over the unions heads and appealing direct to the workforce,

thus bringing a halt to the unionised 'anarchy' which had all but destroyed the British motor industry.

The lessons of the second generation

In summary, it was in the second generation of the car that the key elements of the 'modern' motor industry mould were put in place and those key elements are still very much in evidence today - albeit that they may have become increasingly refined as the third and fourth generations have come along. It was in Generation 2 that the miracle of Ford's mass production system, with its intense focus on a single product commodity, total process-driven manufacture built at an ever lower cost on the strict scientific management principles of specialisation, came unstuck with its long production runs and corresponding lack of responsiveness to market potential and competition. However, the Fordist principles of *service* and *quality* mass production at low cost provided the foundation upon which to build for the future - albeit that these underlying features were subsequently progressively ignored by the industry as its scale and the benchmark of GM's corporate style ultimately brought about its growing detachment from the world around it.

Having said that, the second generation of the car saw the advent of Sloanism, a management method which enabled the motor industry in particular (and scale industry in general) to grow beyond a single product, to deliberately manage through time a variety of products to suit different markets with operating controls delegated to a network of 'line' divisions, the activity of which was 'steered' by a small staff of strategic corporate policy makers. Whilst Ford had applied 'transplant' philosophy to expansion at home and abroad, GM under Sloan applied the principles of his 'organisation study' to corporate expansion, evaluating possible changes through careful analysis of alternatives and adopting a range policies which best-fitted the market potential and gave the shareholder the best return on his investment - a formula which became the text-book 'case study' for the emergent business schools. This saw an entirely different form of industrial venture from the entrepreneurial marque-acquisitive approach of Sloan's predecessor, William C Durant; whilst Sloan saw that the exploitation of different market sectors was possible through a range of

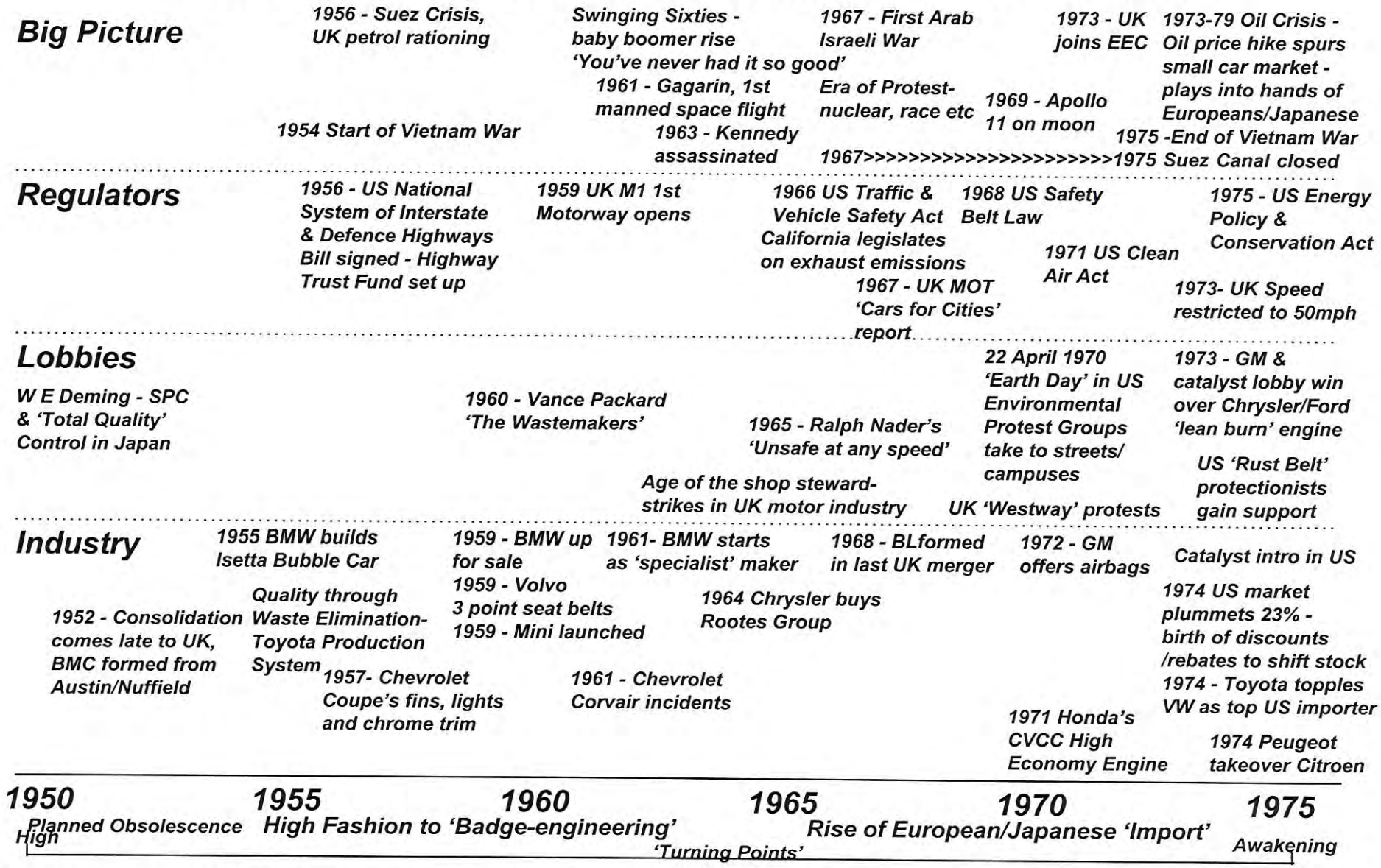
different marques, it was essential that these acquired marques (both at home and abroad) did not compete with each other but were profitable in their own right providing a comprehensive range of products from which the consumer could choose. He chose not to compete head-on with the cost-driven scale approach of Ford, but to sell to if not generate a much wider spectrum of 'needs' for which the customer would pay a little more.

The GM corporate management style from which its product and market policy, including its horizontal integration into retail and wholesale credit financing, evolved, marked the sea-change from mass production to mass consumption which subsequently spread outward into the Western world from the USA. The initial strength of this policy-making and its economic success following a time of great crisis - the Depression - left the second generation industry, its methods and products virtually unopposed as a provider of employment and prosperity from the thirties to the fifties, despite the interruption of the Second World War, when the industry's state of development underwrote the massive martial consumption needs.

However, perhaps the seeds of the car's and its industry's current state of 'unraveling' were set in this time of great growth. First, its opposition was led by its own union-organised employees from within who sought to improve their lot at the expense of the shareholder (if not customer). Second, the focus of shareholder value shifted to the short term and to the exclusion of the customer service ethic of Henry Ford. Third, mass consumption saw the evolution over-time of 'hard sell' methods to support the production needs of the industry rather than the real needs of the customer. The germs of these three elements sets the scene for the rising clamour of the anti-industry and anti-car lobbies and a shift of emphasis into car and motor industry regulation from the third generation despite the rear-guard action of the 'car lobby.'

Maturation to Entropy - from high fashion to mass customisation

The Time Line of the Motor Car and its Industry - 3rd Generation



Freeway, Crossroads or Cul de sac - The Crisis of Personal Mobility - Peter Bailey 1998 - Figure 4

3)The Time Line of the Motor Car and Its Industry - 3rd Generation Maturation to Entropy - from high fashion to mass customisation

From the 'high' to 'awakening' turning point - from high fashion to badge-engineering to the rise of the European/Japanese import in the US

The roots and branches of the 3rd Generation

- Consolidation moves across the Atlantic

The motor industry earned its bread through the forties by underpinning the Second World War effort - with its processes and practices adapted on a co-operative (albeit requisitioned) scale never known before. Its design principles based on ease of assembly and mass production, were epitomised by the rapid turnout of everything from the trucks it knew well, to tanks, aircraft and ships - with the 'liberty ship' effectively sustaining Britain in terms of the delivery of those war supplies and, of course, basic nourishment. The industry's turnover back to the peace-time production of automobiles to tempt the returning troops, air and sea crews did not however leave the structure of the industry in Europe quite the same. Whilst the American industry had already undergone evolutionary, but nevertheless substantial, consolidation from the early twenties, the war-torn industry in Europe had to be rebuilt.

The 'alliances' of war work already provided a foundation for consolidation in Britain, where a return to the 'pre-grouping' motor empires of Nuffield, Austin (and to a lesser extent Rootes) seemed illogical given the multi-national competition of Ford and GM, the pressing need was to compete, especially in export markets, on an equal footing. This 'pseudo-nationalisation' was marked with the formation of 'The British Motor Corporation' in 1952 which combined the 'Fordist' forces of Austin with the 'Sloanist' organisation of Nuffield. Rootes, with its Hillman and Humber brands took over the ailing Singer Motor Company in 1955. These early moves marked only the beginning of consolidation in Britain which quickly started to adopt a more defensive than offensive guise, with its global export leadership in 1950 rapidly eroded by the German industry, overtaking Britain in 1956. The rebuilding of the German and Japanese economies with Allied support provided new, inbound

investment in the German and Japanese motor industries whilst the British (and later American) industry overworked its ageing assets and products.

- The failure of Fordism and Sloanism?

This industrial infrastructure and product neglect in Britain and the USA, was coupled with the progressive operational failure to combine and sustain the management methodologies of Henry Ford and Alfred P Sloan. At a time when W.E. Deming's complementary, 'statistical process control'-driven technique of 'total quality' was noticed, adapted and successfully applied in Japan, Ford's scientific model, steeped in reductionism of process, specialisation of labour paid at flat daily rates and waste elimination through cost control had deviated into piece rate volume productivity incentives to absorb overheads and utilise capacity. This had, in turn, back-fired on the US and British factory floor into an epidemic of demarkation and rate-driven pay disputes together with declining productivity and quality.

Equally, the market-responsive ideals of Sloan's 'staff and line' divisionalised management structures and delegated authority levels started to degenerate into the creeping 'ivory tower' detachment of an unresponsive centralised, financially-controlled bureaucracy - the trade marks of which were political in-fighting between corporate functional 'chimneys' and devaluation of the inputs of those directly involved in the making and selling automobiles (**Pascale, R.** *Managing on the Edge: How successful companies use conflict to stay ahead.* New York: Simon & Shuster, 1990; **Wright, J. P.** *On a clear day you can see General Motors.* New York: Avon Books, 1979). With these two debased management styles operating increasingly in concert at the 'Big Three' of GM, Ford and Chrysler and their overseas subsidiaries and acolytes (including BMC and its descendent forms of BMH and British Leyland), the ultimate effect of this combined disfunction of management practice led to increasing insensitivity to external market and internal operational needs. As J Patrick Wright expresses the words of John De Lorean:

"Though it was not recognised inside or outside of the corporation at the time, the delicate balance at the top of the world's largest industrial corporation was starting to

tip toward the financial side of the business, and in the process, the substance of the organisational system so thoroughly thought out by Sloan was beginning to dissipate. I doubt Sloan himself realised what was taking place. To his death in 1966, he touted the Donner (head of corporate finance) team because, I suspect, he like many others at the time was blinded by the financial successes of the Donner administration which culminated in records for sales and profits in 1965. What was happening was a predictable result, however, when the control of a consumer goods company moves into the hands of purely financial managers, short term profits are dramatically improved, but a lack of sensitivity for product, for markets and for customers also sets in, which is usually detrimental to the long term strength of the corporation."
(op cit 1979)

So, Sloan's annual model change, which he intended to encourage the customer to trade up into a better-specified product began to reflect the worst excesses of 'badge-engineering' and 'planned obsolescence.' Mass-marketing-bred consumer dissatisfaction with their current automobility 'lot' then created a craving for 'me too' products differentiated with trivial sheet metal changes - bigger and better fins, head and tail-light cluster treatments and added chromium trim rather than genuine product improvement. Though it was not the exclusive preserve of the motor industry, the worst excesses of this almost cynical disregard for the auto customer in the US and Britain had significant consequences for it. John De Lorean relates to this abuse of Sloan's annual model change concept in J Patrick Wright's book:

"Some time in the late 1960's I cannot remember when, a nagging suspicion about the philosophy of General Motors and the automobile business began to overtake me. It was the kind of feeling that you have and quickly dismiss. But it comes back again and again. Pretty soon you find that you are thinking differently than you once did. My concern was that there hadn't been an important product innovation in the industry since the automatic transmission and power steering in 1949. That was almost a quarter-century of technical hibernation. In the place of product innovation, the automobile industry went on a two-decade marketing binge which generally offered up the same old product under the guise of something new and useful. There

was really nothing essentially new. But year in and year out we were urging Americans to sell their cars and buy new ones because the styling had changed. There really was no reason for them to change from one model to the next, except for the new wrinkles in the sheet metal, which to me weren't sufficient reason. While this was an indictment of myself as well as my fellow auto executives, it was true that each year all we were offering to the customer was a supper warmed over.

"It struck me that not only was this management dereliction, but also unfair, even immoral practice, because the heart of this system was to take some American wage earner who was working his fanny off trying to pay for a car, and , just about the day that he got it paid off, convince him that he should start the payment process all over again. His thirty six months were up. Now he should take his token residual value in this used car and plunk it down on another car. He just starts the whole godammed procedure all over again. He is tied into a new series of payments for another three years. Somehow, this did not seem a meaningful contribution to society and business.

"If we could give the new car buyer something really new, such as power steering, power brakes, a more efficient engine or vastly improved durability, then that would be a good reason for him to move from a product without these innovations to one with them. There would be a benefit to him because these kinds of innovations make people better drivers, or they make the car safer and easier to drive, more trouble-free, or more economical to operate. This broader view of our business was a marked departure from my outlook earlier in life.

"....I got the empty feeling that 'what I am doing here may be nothing more than perpetuating a gigantic fraud,' a fraud on the American consumer by promising him something new but giving him only surface alterations - 'tortured sheet metal' as former chairman Frederic G. Donner used to say - or a couple of extra horsepower and an annual price increase. A fraud on the American economy, because I always had a vague suspicion that the annual model change may be good for the auto business in the short term but it wasn't good for the economy and the country. Couldn't the money we spent on annual superficial styling changes be better spent in reducing

prices or in improving service and reliability? Or seeking solutions to the sociological problems which our products were creating in areas of pollution, energy consumption, safety and congestion?

"And a fraud on our own company because, when General Motors began to grow on the principle of annual model changes and the promotion of something new and different, cars were almost all alike with the same basic colour - black. There was room for cosmetic changes as well as the substantial advancement in technology with new and better engines, more sophisticated transmissions, improved performance and comfort characteristics.

"But now there was nothing new and revolutionary in car development and there hadn't been in years. As a company, we were kidding ourselves that these slight alterations were innovative. They were not. We were living off the gullibility of the consumer combined with the fantastic growth in the American economy in the 1960's." (op cit 1979)

- The rise of the anti-motor industry lobby

The 3rd Generation of the car and its industry was developing in a world where the voice of protest gathered strength. After the heady idealism of returning conscripts in the immediate post war period, these younger people and the following 'baby boomer' generation started to question some of the basic tenets of a modernistic society. It was in this era that in the sixties saw a rapid growth in popular protest movements - whether it was 'Ban the Bomb', 'Stop the War' or towards the end of the period - a nascent 'Save our planet'. In this environment, some reaction against the sort of excesses described above and the role played in them by corporate American multi nationals in general and the motor industry in particular became ripe for development.

First, poor product quality, reliability and robustness - in which the engineering philosophy of 'planned obsolescence' played a major role - coupled with the exploitation of the customer through mass marketing led to a growing anti-motor industry backlash from the customer and public at large. Vance Packard in 'The

Waste Makers' blamed American commerce and industry for the stimulation of mass consumption and the creation of waste. He singled out the motor industry as an example (if not the *driver*) of the mass consumption movement. He exposed planned obsolescence as a key ploy of the industry. This exposee moved the argument on a broad 'environmental' front for the first time. Packard quotes Arthur Miller's Lament of Willy Loman in 'Death of a Salesman' to open his 'tongue-in-cheek' chapter entitled 'Progress through Planned Obsolescence':

"Once in my life I would like to own something outright before it's broken! I'm always in a race with the junkyard! I just finish paying for the car and it's on its last legs. The refrigerator consumes belts like a goddam maniac. They time those things. They time them so when you've finally paid for them, they're used up."
(cited in **Packard, V.** *The Waste Makers* (1960).UK: Pelican Books, 1964)

Packard continues in the following chapter 'How to outmode a $4000 vehicle in two years':

"The automobile industry was the first major group to become fascinated with the increased sales that might be achieved by imitating the women's-fashion stylists. Decades ago, General Motors took the automotive leadership from Henry Ford I by successfully insisting that competition be on the basis of styling rather than pricing. Mr Ford in fifteen years had brought the price of his Model T motor-car down from $780 to $290, by sticking to the basic design except for minor changes. Such fanatical dedication to the ideal of an ever-lower price-tag made competition on the basis of price unattractive. Competitors such as General Motors did not relish trying to match Old Henry in either production know-how or pricing, so they emphasised a yearly change and a variety to choose from.

"In the twenties and thirties, significant technological innovation such as balloon tyres, shock absorbers, and four wheel brakes were available almost every year to captivate the public. By the early fifties, however, the automobile industry was finding itself with fewer and fewer significant technological improvements that it felt

were feasible to offer the public. Consequently, at all the major automotive headquarters - Ford now included - more and more dependence was placed on styling. One aim was to create through styling 'dynamic obsolescence', to use the phrase of the chief of General Motors styling, Harvey Earl." (op cit 1960)

Packard exposed the myth about product change by specifically targeting GM and its objective from 1956 to work towards changing the body sheet metal on every product every year - whilst making no real 'under the skin' developments to the key components of chassis and power train. He congratules a columnist for 'Advertising Age' of the time criticising the 'new' range of Buick cars :

"We find it difficult to assume that such complete and utter nonsense is justified by the need to sell 7,000,000 cars in 1957. If our national prosperity is to be founded on such fanciful, fairyland stuff as this, how real and tangible can our prosperity be?" (op cit 1960)

Packard saw the importance of the engineer being overshadowed by the stylist and related the emphasis on style to the loss of quality, quoting the US News & World Report (undated) under the sub title 'The Big Changes coming in Autos - Ahead Much Restyling':

"Let us look at evidences of quality in the motor car field. Some of the evidence of quality loss can be attributed, as indicated, to the frequent shifts in design produced by the straining to create obsolescence of desirability. But there is also some evidence of quality loss that cannot be explained by frequent styling changes." (op cit 1960)

This inconclusive evidence, however, was further backed up by the admission by Clare Briggs, a Chrysler executive in 'Time' (2nd June 1958) that quality was worse than 10 years before and that the industry had 'treated the public badly, to say it mildly.' Packard makes the point:

"But still (Briggs') observation about the general decline in the quality of cars was a squalid commentary on an industry that boasts of spending hundreds of millions of dollars each year on 'research and development'. Little of the money appears to have gone to improve the longevity of motor cars. In 1956 the motor cars being led to the scrapyard chopping blocks were three years younger than the motor cars being scrapped in the late forties." (op cit, 1960)

Packard uses this onslaught on this deliberate deterioration in automotive quality coupled with its associated mass marketing of style to increase consumption to illustrate the wasteful defects of a consumer society - with the problems it causes a feature not just of the car but of most so-called 'durable' and even 'perishable' commodities. The spread of Miller's commission-driven 'hungry salesman' *'selling on the never never'*, makes the customer 'prey' rather than 'king'. Packard sees this as another key function of mass-production generated consumerism which preys upon the consumer's material insecurity to ensure that an ever increasing supply of (non-descript) goods is absorbed through a money machine which emphasises the social acceptability of credit (remember it was GM who first started this process 1919 with their GMAC retail finance subsidiary - a venture resisted by Ford until 1928).

Packard closes his book with a chapter which, with great foresight, debunks the possibility of sustaining 'Ever-mounting Consumption?' (op cit 1960). After linking the onward march of consumerism to the need to continuously expand the (*buying*) population he questions the 'implications of a system that demands that its people engage in ever greater consumption.' Whilst he recognises that the US (and the West in general for that matter) has become prosperous from its mass-production, mass marketing formula of economic growth, there must be a natural 'limit' to its (*global*) application . He develops his nightmare scenario, seeing that unfettered economic growth would change the shape of American society - with the over-expansion of industrialisation and its adverse by-product effects on the overall quality of both urban and rural life. As his book progresses, the titles of its chapters assume an almost surreal relationship with current thinking - Chapter 18 - 'The Vanishing Resources' homes in on Fairfield Osbourn's observation that 'We Americans have used more of

the world's resources in the past 40 years than all the people of the world had used in the 4,000 years of recorded history up to 1914....Man is becoming aware of the limits of the earth' and looks on not only the direct as well as indirect consumption of resources but the by-production of waste and pollution; Chapter 23 - 'Respecting the Eternal Balance' where the argument centres on ' All enduring societies - human or animal - have had to achieve a tolerable balance between their population and their supporting environment, including resources' - returning to the motor industry, he quotes a dismayed Californian design engineer in Product Engineering in 1959 who stated that:

"I think the current auto design trend indicates a moral decay in America that is most alarming. When such a large share of the national income is squandered on useless glass, fins, overhang, etc., which require excess horsepower and attendant wasted fuels, then it is about time the federal government stepped in and placed a tax on auto body weight and horsepower....If an automobile requires over 100 horsepower, it is too big and wasteful." (op cit 1960)

Packard's jottings in 'The Waste Makers' crystalised the emergent concerns about consumerism in general and the role of the car and its industry in such a society hell bent on growth through consumption. His penultimate chapter - 'Facing Unmet Challenges' has an opening quote from Barbara Ward which captured the 'green' movement in the bud :

"Bright new cars in sordid streets, ranch-type or split level homes besides garbage-filled gutters, the family picnic basket in chromium beside the polluted stream - these are the symbols of a national pattern of expenditure in desperate need of redress."
(op cit 1960)

From the mid-sixties, this growing discontent became apparent with some of the negative attributes of mass production-driven automobile consumption being taken on by a much broader-based lobby. This achieved the milestone shift into the domain of regulation with the rise of concerns about both automobile safety and, towards the end

of this 3rd generation, auto-related air pollution and energy conservation. The latter, however, was probably as much a result of an expedient, short term reaction to the other 'big picture' events - notably the Oil Crises of 1974 and 1979 - rather than a response to the need for the longer term conservation of global resources, though the early signs of environmental protest were already present. A coordinated 'Earth Day' took place in the US on 22 April 1970 when environmental protest groups took to the streets and campuses, and protests against the building of London's 'Westway' overhead motorway took place - though their immediate focus of attention was that of air pollution rather than the volume of traffic itself.

- Regulation and not before time

The first body blow to the industry's modus operandi came with Ralph Nader's relentless crusade for better product safety culminating in his book 'Unsafe at any speed' (1965). In the preface, an uncompromising Nader states:

"For over half a century the automobile has brought death, injury, and the most inestimable sorrow and deprivation to millions of people."
(**Nader, R.** *Unsafe at any speed.* New York: Grossman, 1965)

A position somewhat at conflict with the vision of Henry Ford who saw the car as the provider of great joy to those same millions - Nader concentrated on the downside of mass motorisation - a death toll of c50,000 per annum, and damage to property, medical expenses, lost wages and insurance costs as a result of motor accidents in 1964 alone of $8.3 billion - and as a result of his lobbying created a new level of automotive safety-consciousness in the consumer and a continuing influx of auto-borne safety-related features. He maintained that "there is little in the dynamics of the automobile accident industry that works for its reduction" (op cit 1965). Indeed, to adapt his words, it could be argued that there is (was?) little in the dynamics of the automobile industry that works(worked) for the reduction of accidents since he went on to prove the presence of a commercial inertia which bordered on negligence within the industry. Reminiscent of Packard, Nader states:

"The consumer's expectations regarding automotive innovations have been deliberately held low and mostly oriented to very gradual annual style changes.....The time has not come to discipline the automobile for safety; that time came over four decades ago. But that is not cause to delay any longer what should have been accomplished in the nineteen-twenties." (op cit 1965)

The particular focus of the book was the failure in service of GM's Chevrolet Corvair from 1961, the faulty design and engineering of which had led to the death and injury of its occupants. Nader, as a result was hailed as a pariah by the industry and a messiah by the consumer lobby. He maintained throughout that he only brought to the public at large what was already known to General Motors (Automotive News, '100 Events that made the Industry', June 26,1996). Indeed, Nader's book uses the Corvair case as an example to reveal a disturbing tendency of the then motor industry to ignore, diminish, if not suppress relevant information, and governmental agencies to leave the safety of such products to be self-policed by the manufacturers themselves. He states in the closing lines of his book:

"There are men in the automobile industry who know both the technical capability and appreciate the moral imperatives. But their timidity and conformity to the rigidities of the corporate bureaucracies have prevailed. When and if the automobile is designed to free millions from unnecessary mutilation, these men, like their counterparts in universities and government who knew of the suppression of safer automobile development yet remained silent year after year, will look back with shame on the time when economic candour was considered courage." (op cit 1965)

This case and the safety legislation that followed it in 1966 (the US Traffic & Vehicle Safety Act) was a landmark in the industry's history - not only because it held the world's largest auto manufacturer liable for the tragic consequences of poor product 'value' (i.e. cost-down almost at any price) engineering and inadequate dissemination of key information - caveats in small print were meaningless to sellers and buyers alike - but also because it subsequently revealed the seamy undercover tactics of the company to smear Nader personally in the hope of destroying him and his campaign

and thus avoiding corporate responsibility. J Patrick Wright's publication of John De Lorean's memoirs (op cit 1979) gives a frightening account of the lengths to which the GM management machine were prepared to go to avoid blame - he (De Lorean) sees the episode as a dangerous example of 'group think' amongst individually 'responsible' executives which would not even openly consider the reality that a lethal fault existed despite its declared recognition at 'line' engineering level and even the tragic loss of life and injury of some of its own staff and family members due to it:

"My doubts about the annual model year change were just part of a growing concern I had about the general level of morality practiced in General Motors, in particular, and American business in general.

"It seemed to me, and it still does, that the system of American business often produces wrong, often immoral and irresponsible decisions, even though the personal morality of the people running the businesses is often above reproach. The system has a different morality as a group than the people do as individuals, which permits it to willfully produce ineffective or dangerous products, deal dictatorially and often unfairly with suppliers, pay bribes for business, abrogate the rights of employees by demanding blind loyalty to management or tamper with the democratic process of government through illegal political contributions.

".....The whole Corvair case is a first class example of a basically irresponsible and immoral business decision which was made by men of generally high personal moral standards. When Nader's book threatened the Corvair's sales and profits, he became an enemy of the system. Instead of trying to attack his credentials or the factual basis of his arguments, the company sought to attack him personally. This move failed, but, in the process, GM's blunder 'made' Ralph Nader.

"When the fact that GM hired detectives to follow and discredit Nader was exposed, the system was again threatened. Top management, instead of questioning the system which would permit such an horrendous mistake as tailing Nader, simply sought to

preserve the system by sacrificing the heads of several executives who were blamed for the incident.....

"Those who were fired no doubt thought they were loyal employees. And ironically, had they succeeded in devastating the image of Ralph Nader, they would have been corporate heroes and rewarded substantially. I find it difficult to believe that knowledge of these activities did not reach into the upper reaches of GM's management . But , assuming that it didn't, top management should have been held responsible for permitting the conditions to exist which would spawn such actions. If top management takes the credit for a company's successes, it must also bear the brunt of the responsibility for its failures." (op cit 1979)

Wright sums up:

"There wasn't a man in top GM management who had anything to do with the Corvair who would purposely build a car that he knew would hurt or kill people. But, as part of a management team pushing for increased sales and profits, each gave his individual approval in a group to decisions which produced the car in the face of serious doubts that were raised about its safety, and then later sought to squelch information which might prove the car's deficiencies...

"The corporation became almost paranoid about the leaking of inside information we had on the car." (op cit 1979)

This regulatory shock to corporate America in general and General Motors (if not the motor industry) in particular did not stop with safety - it went on to tackle the issue of air pollution towards the end of the 3rd Generation with the 1971 US Clean Air Act and energy conservation with the mounting crisis in the Middle East following the Arab-Israeli wars of 1967 and 1974 resulting in the 1975 US Energy Policy & Conservation Act and the related move to 'CAFE' (Corporate Average Fuel Economy) standards from 1978. Even these later regulatory moves were (and still are)

resisted by the inertia within the industry - 'what's good for General Motors is good for America' - or as J Patrick Wright records the views of John De Lorean:

"Never once while I was in General Motors management did I hear substantial social concern raised about the impact of our business on America, its consumers or the economy. When we should have been planning switches to smaller, lighter cars in the late 1960's in response to a growing demand in the market place, GM management refused 'because we make more money on big cars.' It mattered not that customers wanted the smaller cars or that a national balance of payments deficit was being built in large part because of the burgeoning sales of foreign cars in the American market.

"....Refusal to enter the small car market when the profits were bigger on bigger cars, despite the needs of the public and the national economy, was not an isolated case of corporate insensitivity. It was typical. And what disturbed me is that it was indicative of the fundamental problems with the system." (op cit 1979)

The car-safety lobbying activity of Ralph Nader marked a fundamental shift in initiative from the industry into the hands of those representing the consumer and the public at large. This change of emphasis of anti-car 'voice' has subsequently extended into that of more general environmental concern with the industry and its product and has been a stimulant for many new technologies aimed at making the car more socially- and environmentally-friendly. Ironically, however, Edward Tenner makes the point that such technological developments can have a paradoxical 'revenge effect' which potentially negates their benefits (**Tenner, E.** *Why things bite back.* London: Fourth Estate, 1996). For example, the driver, subconciously mindful of the benefits to him (and his passengers) of safety-related features such as seat belts or anti-lock braking, takes a higher level of risk (i.e. drives more recklessly) negating the positive effect. Also, whilst those inside the car may be better protected, those outside of it are not and it is they who face a greater risk of death of injury as a result of less careful driving. The impact of such paradoxical environmental side-effects has become increasingly evident as the car and its industry moved into the next generational era.

- The rise of the 'import'

This home-grown negligence of the 'Big Three' left their market door wide open - first for mainland European volume products such as the VW Beetle and Golf which were perceived to more radically different, offering better quality, style, and value for money - and then in late fifties and sixties the European volume car invasion was supplemented with that of the European 'specialist' car - BMW, Mercedes Benz, Volvo and the like followed by the Japanese - who rather more radically changed the customer's expectation in terms of quality, value for money and low overall running cost - reflected not only in terms of product reliability but also fuel economy which became a new competitive priority after the Arab-Israeli wars led to the Oil Crises of the seventies.

- The Toyota Production System - re-engineering the industry on a grand scale

For the Japanese, whose motor industry reputation (notoriety?) had been forged on the provision of cheap 'copy cat' products of poor quality, Toyota's Taiichi Ohno and academic Shigeo Shingo took Ford's process-driven approach and the key principles of Deming's 'total quality' philosophy and re-engineered the tenets of mass production in terms of flow and waste elimination, developing the 'Toyota Production System' (TPS) - a wholist approach to the manufacturing process which has become a 'world class' benchmark for the 'extended' motor industry in particular and industrial operations in general (**Ohno, T.** *The Toyota Production System: Beyond Large Scale Production* (1978). Translation: Cambridge, Mass: Productivity Press, 1988; **Shingo, S.** *A Study of the Toyota Production System.* Cambridge, Mass: Productivity Press, 1989; **Toyota Motor Corporation.** *Production at Toyota.* Undated; **Toyota Motor Corporation.** *The Toyota Production System.* 1995). The principles developed now form part of the day to day language of modern business - 'kaizen' or continuous improvement, waste elimination through the replacement of the manufacturing 'push' philosophy of mass production and mass consumption with its attendant long production runs and batches, high inventories, standard costing and cost absorbtion techniques, maximum utilisation and 'hard sell' with a customer 'pull' modus operandi based on building wherever possible to customer order. TPS is underpinned

by 'lean thinking' (a label developed latterly by **Womack, J. Jones, D. & Roos, D.** *The Machine that changed the World.* New York: Rawson Associates, 1990; **Womack, J. & Jones, D.** *Lean Thinking.* New York: Simon & Shuster, 1996) - a bundle of practical business techniques which include 'kan ban', 'just in time', 'batch of one'(levelled production), 'single minute change of die' (SMED), 'poka yoke' self inspection prompts backed by 'Jidoka' or 'autonomation' (automation with a 'human face'). 'Kaizen' is at the heart of 'TPS'. It is founded in Deming's statistical analysis of results (SPC), the team-based 'quality circle' overlaid with 'the five whys', a discipline which attempts to get to 'root causes' rather than 'quick fixes', and the capture and adoption of a constant flow of ideas from the shop floor. In this context, 'TPS' is founded upon respect for and trust in the worker - they know best - where controls exist, they are the responsibility of the operators themselves, not management (who are more coordinators and advisers) or inspectors who study results after the production event.

The adoption of 'TPS'-like disciplines was not restricted to Toyota - Honda, Mazda and Nissan progressively adopted their closely-related variants. Honda specifically focused on its engine technology (a product of the expertise of its founder, Soichiro Honda), production engineering and 'just in time' internal manufacturing process without the adoption of total lean thinking in the extended enterprise (they are still 'pushers' of the finished product). Mazda has less successfully developed a formula which is not dissimilar to that of Honda, albeit that it has set its stall out more in a 'niche' product market of sports cars and saloons and power train technologies such as the 'wankel' rotary engine. Nissan has more faithfully followed Toyota's original 'design' - as a competing follower, it has had little choice. It's prime focus has been on 'kaizen' with 'sell one, make one' (Nissan's 'customer pull' slogan for their TPS equivalent) becoming an objective only relatively recently in the nineties.

The formulation of Toyota Production System, in its infancy and growth in the 3rd generation of the car and its industry has proved a watershed in the world motor industry and has caused a reverse in the flow of industrial 'tourists' between East and West - with western automobile executives of the 4th Generation observing Japanese

management principles and processes at close quarters in the nineties following in the footsteps of their Japanese competitors who visited the US (and Britain - v.a.v. Nissan's post war licensing agreement with Austin/BMC) to learn the principles of 'mass production' in the late forties and early fifties when unlimited growth was still foreseen for the industry and its product. This change of industrial direction only took off when the import damage to the US and British industry was already done in the late sixties/early seventies when Ohno at Toyota had already recognised that motor industry growth was finite:

"Starting from need

".....Prior to the Oil Crisis, when I talked to people about Toyota's manufacturing technology and production system, I found little interest. When rapid growth stopped, however, it became very obvious that a business could not be profitable using the conventional American mass production system that had worked so well for so long.

"Times had changed. Initially, following World War II, no one imagined that the number of cars produced would increase to today's level. For decades, America has cut costs by mass producing fewer types of cars. It was an American work style - but not a Japanese one. Our problem was how to cut costs while producing small numbers of many types of cars.

"Then, during the 15-year period beginning 1959-1960, Japan experienced unusually rapid economic growth. As a result, mass production, American style, was still used effectively in many areas.

"We kept reminding ourselves, however, that careless imitation of the American system could be dangerous. Making many models in small numbers cheaply - wasn't this something we could develop? And we kept thinking that a Japanese production system like this might even surpass the conventional mass production system. Thus, the principle of the Toyota production system was to produce many models in small quantities.

"- Slow Growth Is Scary

"In the periods of high growth before the Oil Crisis, the usual business cycle consisted of two or three years of prosperity with, at most six months of recession. At times, prosperity lasted longer than three years.

"Slow growth, however, reverses this cycle. An annual economic growth rate of six to 10 per cent lasts at most six months to one year, with the next two or three years realizing little or no growth, or even negative growth.

"Generally, Japanese industry has been accustomed to an era of 'if you make it, you can sell it', and the automobile industry is no exception. I am afraid that, because of this, many business managers aim for quantity.

"In the automobile industry, the Maxcy-Silberston curve has been used frequently. According to this principle of mass production, although there are limits to the extent of cost reduction, the cost of an automobile decreases drastically in proportion to the increase in quantities produced. This was proved thoroughly in a period of high growth and the principle has become embedded in the minds of people in the automotive industry.

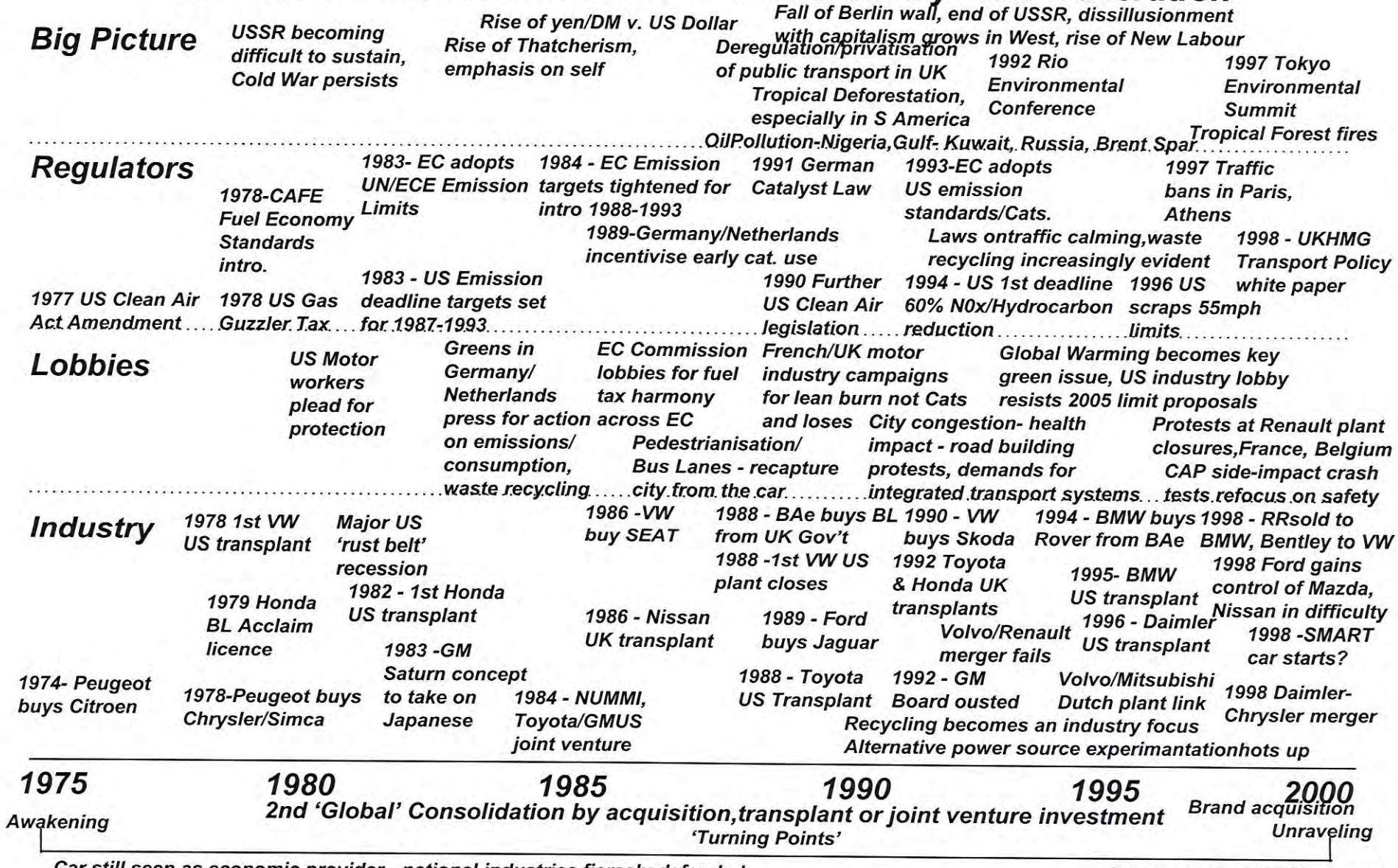
"In today's slow growth era, however, we must downplay the merits of mass production as soon as possible. Today, a production system aimed at increasing lot sizes (for example, operating a die press to punch out as many units as possible within a given time period) is not practical. Besides, creating all kinds of waste, such a production system is no longer appropriate for our needs."
(**Ohno, T.** *The Toyota Production System: Beyond Large Scale Production* (1978). Translation: Cambridge, Mass: Productivity Press, 1988)

Albeit that Ohno's focus of attention was the business of 'mass customisation' - many models developed from a common core in small quantities - rather than the more 'specialist premium producer' route adopted by the Europeans, this foresight has put Toyota in particular in the vanguard of the 4th generation - with their principles

adversely impacting upon not only the American volume multi-national players - Ford, GM and Chrysler but also has left the European specialists exposed with the application of Toyota's low volume at low cost methodology in the premium market segments (especially in the US) with their 'Lexus' luxury brand. This has, on the one hand, has ultimately forced the Europeans to reinforce and heavily market their brand characteristics to meet the needs of the more 'discerning', individualistic customer, whilst on the other, focus on their high costs of design, engineeering and production. Indeed, the principles upon which the Toyota Production System operates are increasingly seen as impossible to avoid in the industry at large, though their emulation is neither easy to implement nor sustain.

Entropy to Destruction? - Fragmentation - Brand v. Commodity Value

The Time Line of the Motor Car and its Industry - 4th Generation



Freeway, Crossroads or Cul de sac - The Crisis of Personal Mobility - Peter Bailey 1998 - Figure 5

4. The Time Line of the Motor Car and its Industry - 4th Generation - Entropy to Destruction? - Fragmentation - Brand versus Commodity Value

From 'Awakening' to 'Unraveling' turning point. Industry consolidation takes on a global perspective through acquisition, transplant or joint venture investment. The conflict between the car and its extended industry as an economic provider with national auto capacities fiercely defended to preserve jobs and 'prosperity' faces head on the growing realisation that the car (and its extended industry) represents itself as the enemy of the environment and the excesses of self-interest - no longer a utilitarian commodity but an icon of brand image, virtual perception and marketing hype with the choice of car reflecting to the world at large the status of its user.

The beleaguered leviathan?

Over the three previous generations of the car and its industry, we have seen a pattern emerge which graphically not only illustrates the 'positives' of economic growth but also demonstrates the the growing negative implications of providing a transportation mode which underwrites 'wanderlust' and expressively reinforces individual 'liberty', extending the right to roam from the privileged few to the population at large. However, despite the 'freedom of the open road' becoming largely an illusion for the millions who live in the world's overcrowded cities and well beyond their limits in many countries, the motor car has become a powerful global symbol of individual independence, personal success, hope, prosperity and material wealth - even more powerful than that peculiarly British phenomenon of the owner-occupied home. Perhaps, the car (and its supplying and supporting industry) more than any other product has, over its first seventy five years, become the icon of progress, the very foundation of modernity. Moreover, in the developed economies, the opportunity of multi-car ownership (or access through the 'never never' or the 'company car' perk) provided access to personally-directed mobility to those previously reliant on public transport - the housewife, and young people still resident at the family home. The paradox of this surge in car ownership and the independence it confers on its users is that it has created in its wake a generation dependent on the car, without which the

opportunity or even basic right of access to the 'necessities of life' such as work and shopping is denied. At the same time, with the car becoming an achievable goal for so many, it has increasingly robbed the higher echelons of society of the valuable differential of private, sedate, and rapid mobility it gave them in its first generation.

As such, the car has assumed not only commercial but growing political importance both in the developed and developing economies, where it now commands the attention of so many aspiring consumers. In John Adam's paper 'Carmageddon' (**Adams, J.** *Carmageddon.* In *Town & Country*, Barnett, A & Scruton, R (Eds). London: Jonathan Cape, 1998), he quotes Anthony Crosland 'A Social and Democratic Britain', OECD, 1970, to make the point:

"My working class constituents....want cars, and the freedom they give on weekends and holidays....They (the affluent middle classes) want to kick the ladder down behind them."

Adams goes on:

"All around the world most people who do not have cars would like to have them and governments everywhere applaud this aspiration and seek to help people realise it.....
(op cit 1998)

The problems created by this populist ambition (and its achievement) are only now, in the fourth generation becoming so obvious that there is a growing recognition that the world the car has played a significant part in shaping cannot be sustained. The car and its industry are quickly becoming victims of, and making victims through, their very success. These emergent car and motor industry-related themes provide an ideal vantage point from which to view the development of a complex, interdependent network of re-inforcing subsidiary effects which result from such growing popularity. Edward Tenner, in his book, 'Why things bite back' (1996) focuses on 'technology and the revenge effect' and whilst his analysis is not by any means exclusive to mobility and the car, he devotes some time to the position of the almost 'natural'

negative feedbacks which have defeated (and presumably will continue to defeat) the best efforts of those occupied by the provision of individually-directed, convenient, fast personal mobility.

Tenner argues that the negative effects of the car have largely been ignored not just because of the car's almost universal popularity and but also because the problems associated with it came about not through major, identifiable events - such as rail or air accidents or the sinking of the Titanic but through the cumulative 'chronic' effect of millions of individual small scale incidents spread across an enormous landscape. Whilst flying may be the safest form of travel, the low statistical significance of a single air accident would be psychologically overshadowed by the perception of the loss in one incident of hundreds of lives. He illustrates the point:

"Historians of technology have long pointed out the importance of indignation over early railroad tragedies in developing the first complex control systems in American business, not to mention safety hardware like signals and air brakes. But there is an equally interesting side to the intensification of transportation by the railroad: the rise in automobile transport. Casualties from car accidents occur as a steady series of small disasters, not the few-but-great wrecks involving trains and steamships. The automobile invited chronic catastrophes. Indignation built more slowly."
(op cit 1996)

Whether it was the effect of the Nader lobby which finally put the car safety issue finally on to the statute books in 1965, in the car's third generation, (which marked the first really successful external 'hit' on the industry since its inception) or that of fuel economy in the seventies, air pollution in the eighties, greenhouse gas emissions and congestion in the nineties, together with growing consumer dissatisfaction with the industry's perceived inability to deliver value for money, the negative effects of the car's creeping popularity have taken some time to register with lobbies and thereafter regulators.

Tenner draws the parallel of the contrast between the efforts of the regulator to control the interests of the powerful railroad and steamship providers whilst accepting the chronic chaos that largely independently-owned horse-drawn traffic imposed on city streets. In this context, the car was seen as a blessing not a curse:

"The automobile was an answer to disease and danger. In fact, private internal-combustion transportation was almost utopian. The congested tenements of the center city spread dirt and disease. Dispersing people into the green suburbs was a favourite theme of city reformers.....

"Automobiles may have begun as rich people's toys, but thanks largely to Henry Ford, they soon came to represent independence *from* the rich: from railroad interests, traction (streetcar) companies, city centre landlords. By the 1950's and the 1960's, the automotive industry had come to represent big business at its most arrogant, but motorisation won because it rallied so many small businesses. Diffuse interests were its political strength. Motoring did not benefit only car manufacturers and petroleum producers and refiners. It enriched tens of thousands of small businesses: trucking companies, suburban developers, construction contractors, dealers and parts retailers, service station operators." (op cit 1996)

To this broad business church, not forgetting that this industrial community represents a substantial employer community in their own right, one should add the millions of private motorists, whose motorised conveyance supports, in turn, their domestic and working lifestyle. However, the 'chronic'nature of the automotive problem, has, during the course of the fourth generation, developed from millions of under-exposed minor irritants at local level into an issue of national (and increasingly global) interest as the negative impacts of traffic (at the heart of which lie the car and its industry) have grown to a pitch where the headlines of impending vehicular disaster are being regularly reported at national and international level as towns and cities grind to a halt, pollution levels force cities to exceptionally exclude cars, and road rage and motorway madness spread like a disease.

The car has now brought alive the global environmental debate to millions in the developed and developing world for whom its effects are unavoidably experienced on a daily basis (as contributors or sufferers or both) where the chronic underlying implications of deforestation or ozone layer depletion, for example, remain more distant (but nevertheless related) issues, the control of which is beyond the individual, or their local or even national governments. The paradoxical experience of the car as liberator and imprisoner has not been lost on the motor marketer either with themes which build the illusion of the freedom of the open road and rapid transit on the one hand and protection against the crowded, stressful, unsafe world outside on the other. The reality that the car driver (and any other occupant) is trapped in their polluted and polluting conveyance for increasing periods of time at a standstill is either ignored by the open road fantasisers ('off-road' advertising has developed a special penchant for this) or indirectly implied by those seeking to endorse their product's technical safety or occupant creature comforts.

Tenner quotes Le Corbusier and Ivan Illych to make the point:

First, Le Corbusier, commenting on the 'disurbanist' Soviet planners of the time in 'La Ville Radieuse' in 1930:

"People were encouraged to entertain an idle dream: 'The cities will be part of the country; I shall live 30 miles away from my office under a pine tree; my secretary will live 30 miles away from it too, in another direction, under another pine tree. We shall both have our own car.We shall use up tires, wear out road surfaces and gears, consume oil and gasoline. All of which will necessitate a great deal of work....enough for us all....." (cited in op cit 1996)

Henry Ford would have warmed to this.

And then another, somewhat differing perspective from Ivan Illych, in his book, 'Energy and Equity', in 1974:

"The typical American spends over 1600 hours a year (or thirty hours a week, or four hours a day including Sundays) in his car. This includes the time spent at the wheel, moving or stopped, the hours of work needed to pay for it and for gasoline, tires, tolls, insurance, fines, and taxes.....For this American it takes 1600 hours to cover a year total of 6000 miles, at four miles per hour. This is just as fast as a pedestrian and slower than a bicycle." (cited in op cit 1996)

Henry Ford's theory that cars bring roads and roads bring prosperity, if not well-being, for the masses through ease of distribution worked for a while, though this line of thinking is now increasingly discredited. It is now widely accepted that more roads rapidly generate more traffic, more dislocation of mobility, more pollution and less well-being.

As it is put in the present Government's Integrated Transport White Paper:

"Simply building more and more roads is not the answer to traffic growth. 'Predict and provide' didn't work."
(Department of Environment, Transport & Regions. *A New Deal for Transport: Better for Everyone.* London: TSO, 1998)

The signs of reaction against the aggregated effect of the car and its industry are now difficult for the regulators to ignore, though they present a challenge of schizophrenic proportions - that of balancing current social and economic 'needs' with responsible longer term environmental stewardship. This balancing act has put governments on the line between the forces of growth and sustainability with their respective downside risks of waste and regression. This dilemma is illustrated by John Adams (op cit, 1998) who draws attention to the uncomfortably illogical shift in governmental policy to a position where increased car ownership and restriction of use are somewhat conflicting objectives. Car ownership remains a sacred cow which cannot be viably slain for either hard economic or soft social reasons - a bridge too far for regulation. Adams illustrates this with the dilemma faced by regulators across the political divide in the UK (op cit 1998).

First, from the Royal Commission on Environmental Pollution set up under the Conservative Government which reported in 1994:

"We have recommended that the increased cost of mobility should be imposed on the use rather than on the ownership of cars, in part because we do not consider it equitable to erect high barriers against car ownership."

Second, from the much vaunted 1998 Labour Government White Paper 'A new deal for transport: better for everyone':

"Cars in particular have revolutionised the way we live, bringing great flexibility and widening horizons. And we do not want to restrict car ownership - with our vision for a prosperous Britain where prosperity is shared by all we expect more people to be able to afford a car. But the way we are using our cars has a price - or our health, for the economy and the environment."

Adams starkly illustrates the political dilemma faced by the regulator (or regulatory aspirant) to whom both the motor industry (including its employees) and society at large (including car user and 'victim') look for support:

"Before the last election an editorial in 'New Ground' - the journal of the environmentalist wing of the Labour Party declared that 'it would be electoral suicide to go into an election advocating reduced car ownership.' This view appears to be common ground for almost all politicians everywhere in the world." (op cit 1998)

This statement in 'New Ground' on behalf of ostensibly 'green' political opinion reveals the ambivalence of, on the one hand, promoting societal inclusivity through increased car ownership (and therefore increasing the capacity for personal mobility) whilst on the other wishing to restrict use through some form of exclusive, often price-related rationing mechanism to manage its negative effects - as if the satisfaction

of car ownership can be achieved by the greater populace without the delivery of its prime purpose, - mobility.

In the closing paragraph of Adams paper, he succinctly sums up:

"The root of the problem, the nettle that government will not grasp, is car ownership. Its own forecasters make clear; the growth of car ownership - which the government still welcomes - is 'the major contributor to traffic growth.' When people acquire cars they use them. They also need space to park them, and the urban car park is now full. The transport problems of the town and country are intertwined. A further increase in the nation's car population could only be accomodated by further dispersal of town dwellers into the countryside.

"The first priority of an environmentally, socially, politically and morally sustainable transport policy must be the creation of a transport and land use system in which every citizen has the possibility of leading a full, happy and prosperous life without owning a car." (op cit 1998)

While he is right to draw attention to the underlying problem of ownership, it is interesting that the one adverb that Adams omits from his string of sustainable imperatives is 'economically' - though he is concerned that everyone has a 'full, happy, and prosperous' life. He thus ignores the importance of the motor industry as an economic driver, provider and distributor of wealth to the millions of employees and their dependents in its 'extended entreprise' of suppliers and service providers who are, in turn, customers of many other businesses apart from those product and service business operations which are supported by the use of the car in the field.

The conflicting relationship of the environment to economics is too important to be overlooked in this way. It is this sort of paradox that has increasingly come to the fore in the car's fourth generation and it is these conflicting elements that I will explore in more depth.

Putting the fourth generation into context - the landscape model

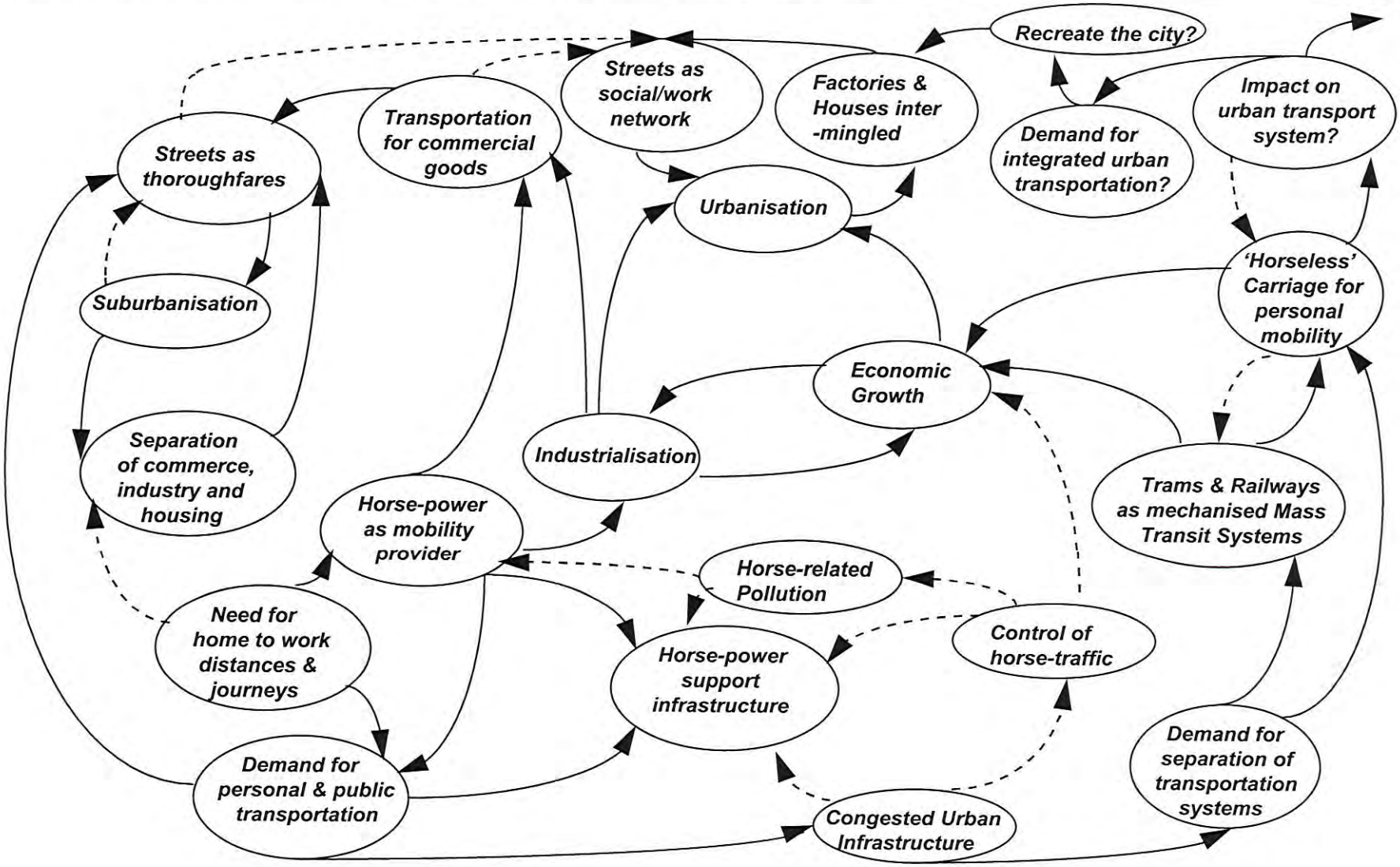
Gareth Morgan, uses a 'contextual analysis' (**Morgan, G.** *Images of Organisation.* Thousand Oaks, Calif.: Sage, 1997) to illustrate the limitations of taking a simple, reductionist, linear approach to establishing cause and effect, his argument being that, simplifying relationships at such a level rarely takes account of the wider connectivity to much larger 'systems' in which the factors reaction or proaction can have effects or be affected by factors 'external', but nevertheless related, to those being studied. What, at first seems, a product of two related events, may be related to the activity across a much wider network of connected issues. Morgan promotes the use of such contextual analysis since:

"(This) kind of contextual analysis....allows one to arrive at a different way of formulating the dynamics through which the total system is evolving and to formulate different corporate responses." (op cit 1997)

Morgan's model, with its concepts of positive and negative feedback is diagramatically akin to Tenner's principles of 'reinforcement' or 'revenge effects' and Peter Senge's 'system methodology' backed by his rules of the 'indivisible whole': - 'today's problems come from yesterday's solutions'; 'the harder you push, the harder the system pushes back'; 'the easy way out usually leads back in'; 'the cure can be worse than the disease'; 'faster is slower'; 'cause and effect are not closely related in time and space'; 'small changes can yield big results - but the areas of highest leverage are often the least obvious'; 'dividing an elephant in half does not produce two small elephants'(**Senge, P. M.** *The Fifth Discipline - The Art & Practice of The Learning Organisation.* London: Doubleday, 1992). These insights provide a useful platform from which to examine the fourth generation of the car and its industry.

The car and its industry's 'system' are a part of a much wider political, economic and environmental landscape (as was the horse-driven world before it), which are, in turn, examples of complex systems where simple solutions to overcome problematic events rarely have the desired effect (in time or space). It could also be argued that the car and its industry are a representative symptom of the effects of the 'modern age', in

From Horse to Car, Changing the Urban Landscape ?
(adapted from Gareth Morgan, 'Images of Organisation', 1997)

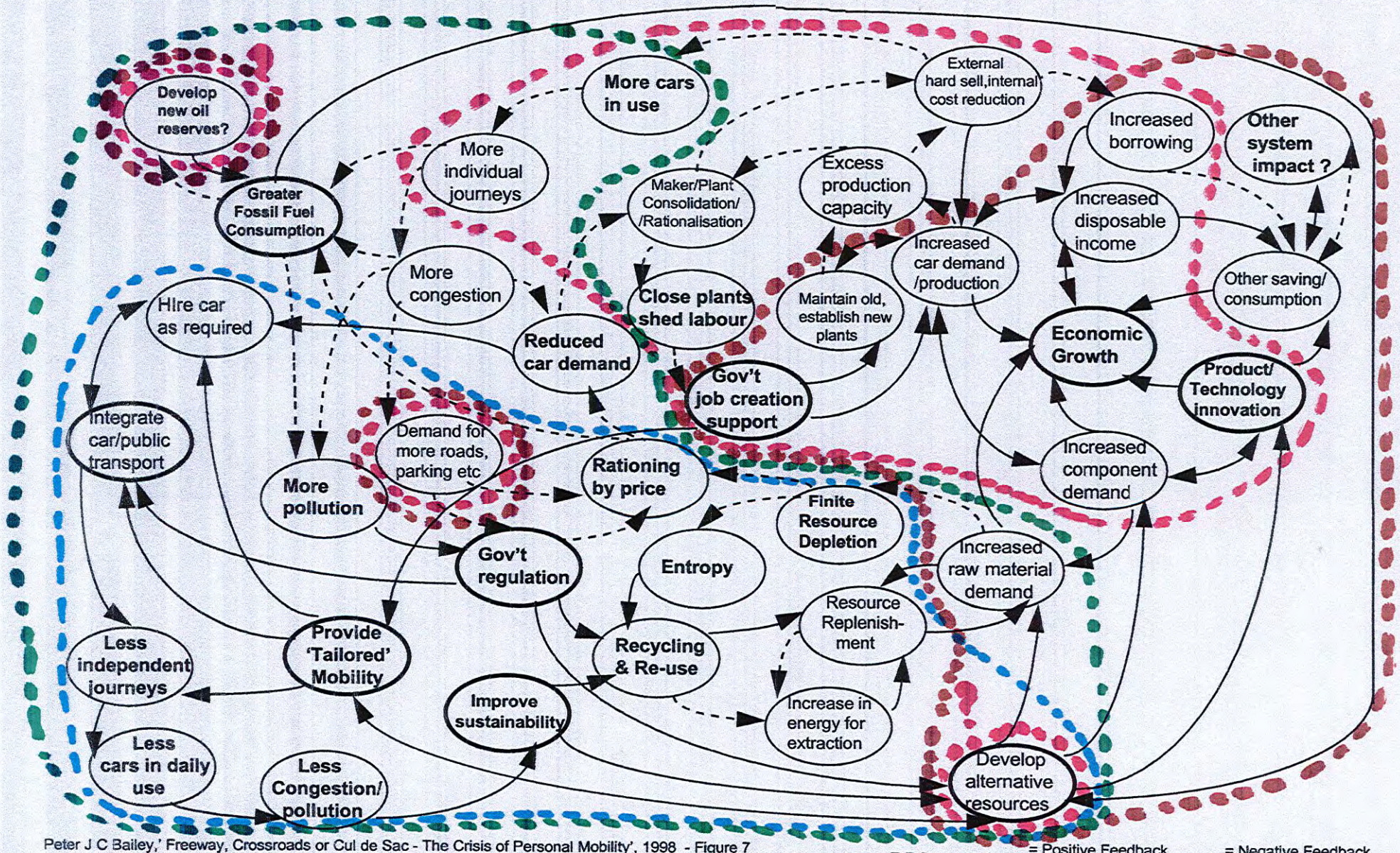


Peter J C Bailey,' Freeway, Crossroads or Cul de Sac - The Crisis of Personal Mobility', 1998 - Figure 6

_____ = Positive Feedback = Negative Feedback

The Motor Car, its Industry and Contextual Landscape

(adapted from Gareth Morgan, 'Images Of Organisation', 1997)

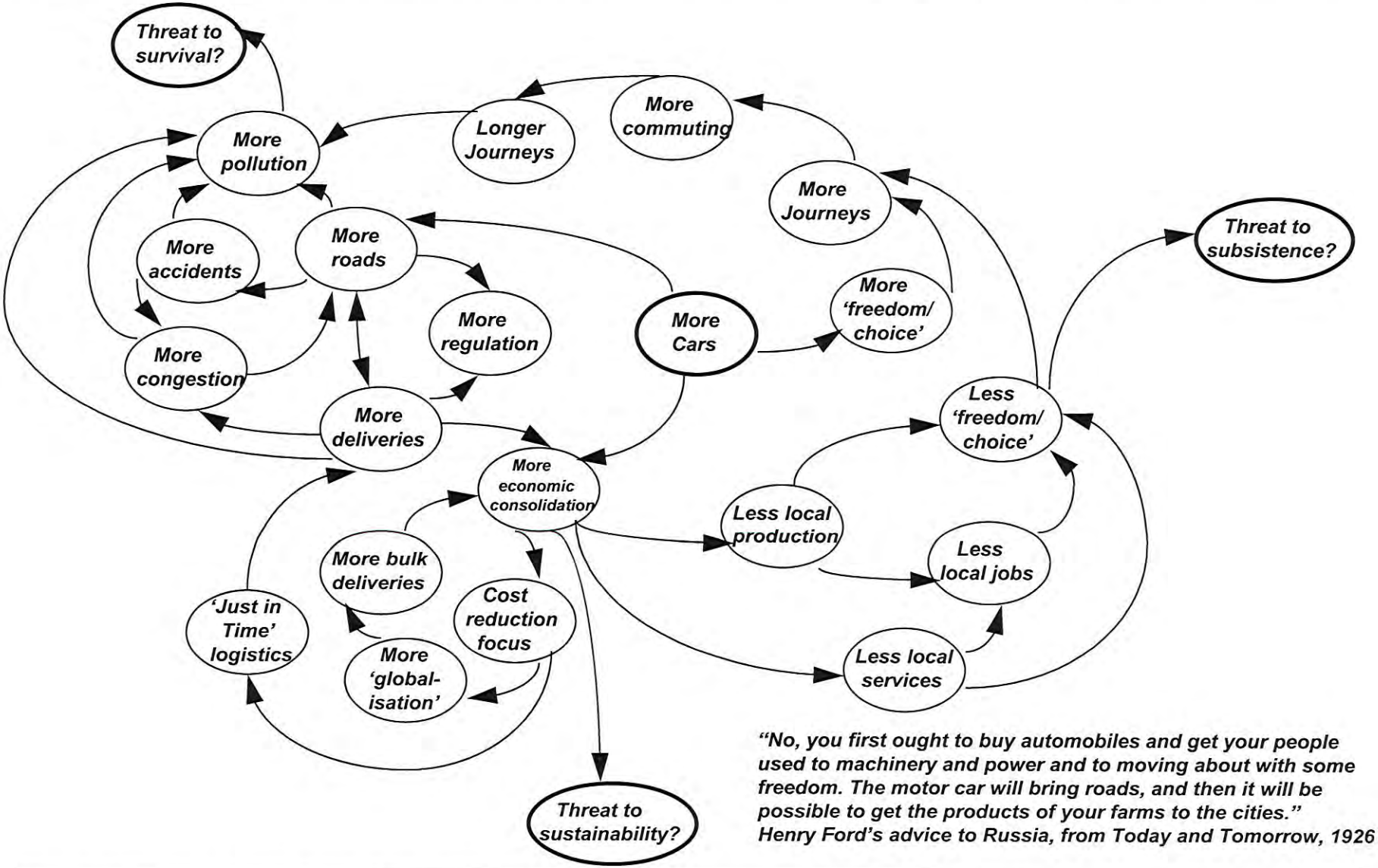


Peter J C Bailey,' Freeway, Crossroads or Cul de Sac - The Crisis of Personal Mobility', 1998 - Figure 7

Interest Groups

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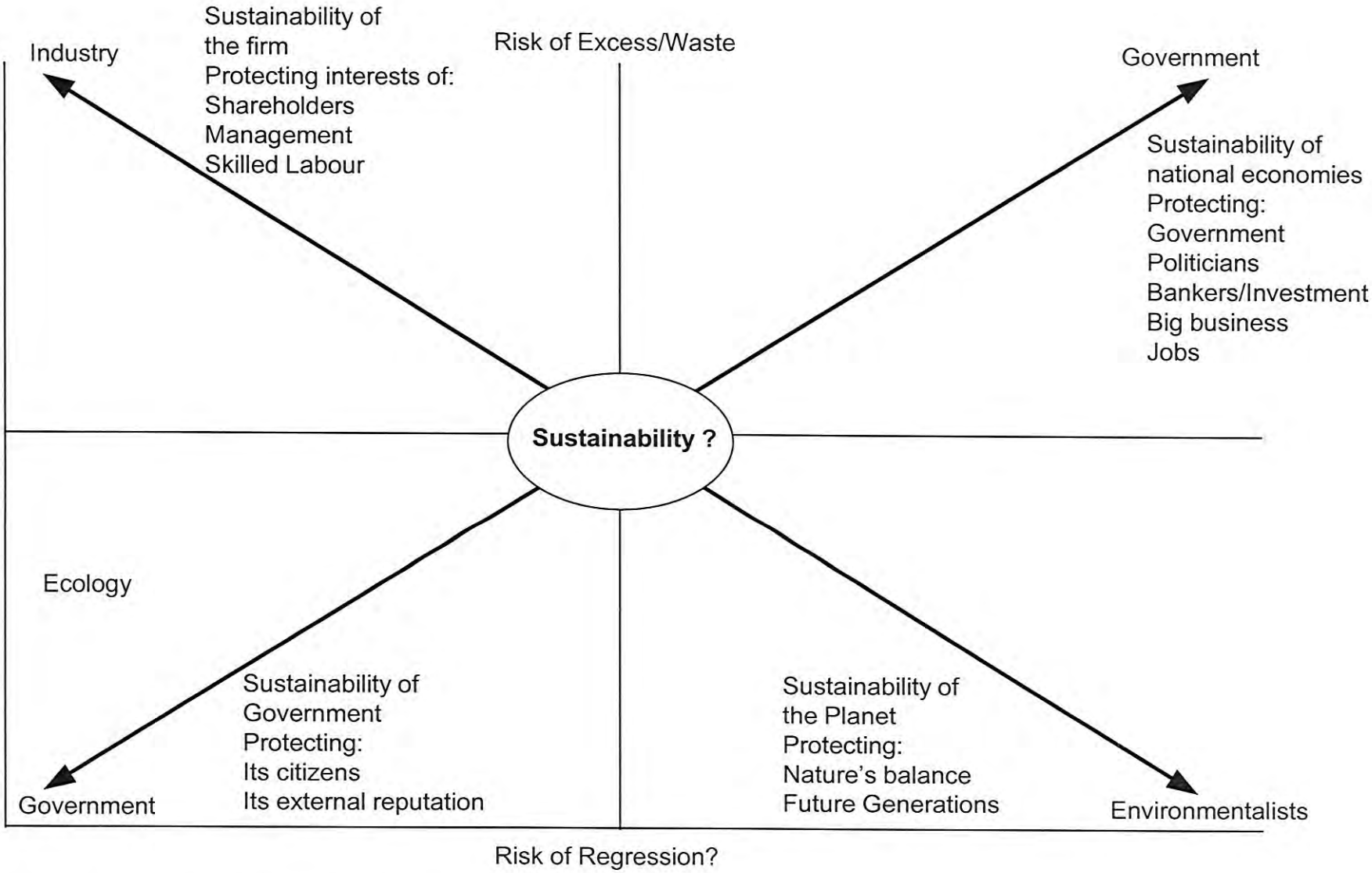
The Environmental Threats of the Motorised Society - A Doomsday Network?



"No, you first ought to buy automobiles and get your people used to machinery and power and to moving about with some freedom. The motor car will bring roads, and then it will be possible to get the products of your farms to the cities."
Henry Ford's advice to Russia, from Today and Tomorrow, 1926

Peter J C Bailey,' Freeway, Crossroads or Cul de Sac - The Crisis of Personal Mobility', 1998 - Figure 8
- interpreted from John Whtielegg, Critical Mass - Transport, Environment and Society in the 21st Century (1997)

The Motor Car, its Industry and Contextual Landscape



Peter J C Bailey,' Freeway, Crossroads or Cul de Sac - The Crisis of Personal Mobility', 1998 - Figure 9

which the chronic incompatibility between the economics of growth and environmental sustainability are being revealed. I have, therefore, derived three contextual landscapes based on Morgan's conceptual model to illustrate how the car and its industry have progressively become a victims in the fourth generation of their own success and in turn are making victims of the car-dependent societies and economies in which they operate and the environment at large. The first landscape (figure 6) shows the effects of the shift from horse to car on the urban landscape and second (figure 7) presents the current state of affairs which demonstrates the growing effects of the car's popularity. A third landscape (figure 8) reflects on the negative socio-economic and environmental effects of the 'doomsday network' seen by a growing number of pressure groups. Moreover, what is also apparent from the current landscape is that whilst the tension between the industry on one side and environmentalists on the other is clear, the strains that this is placing on the tightrope of responsible management that is expected of governments and regulators makes ambivalence and uncertainty an almost certain outcome. The interaction between these stresses and strains around the pivotal position of sustainability are represented diagrammatically in figure 9.

Drawing the battlelines - the high ground of allies and enemies, compromised by and compromising the regulator

As can be seen from the landscape (figure 9), the economic ground on which the industry stands and operates and the 'economic' system of which it is an important part stands in a fundamentally different place from that of the environmental lobby - they both occupy largely opposing positions and the effects of change on either side of the equation impact on the other. The role of government, however, is stretched across this divide with the industry and government economic management largely aligned, heavily weighted to the short term (even though 'long term, sustained growth' remains a key part of governmental vocabulary, their focus tends to be on the lifespan of their political term of c5years) whilst government's longer term environmental responsibilities nominally, at least, stand in accord with environmentalist forces.

I have interpreted the nature and effects of the opposing forces and the straddling role of government across the divide and have suggested the key motives of the different factions - the industry and its governmental economic colleagues taking a far more micro (exclusive) rather than macro view (our firm, our management, our skills, our national economy, our *wealth*), with the environmentalists being very much in the macro, inclusive, global camp with their concerns over total system sustainability and the future. The position of government's environmental interfaces, however, is compromised to the extent of their concern with the protection of their citizens interests (especially those with power and voice) on the one hand and their external reputation on the other. One thing is for sure, the micro bias of the industry and governmental economic players risks excess and waste creation while unbridled environmentalism risks economic (and, therefore societal) 'regression' both of which are unacceptable to the responsible manager (and regulator?).

Using these landscapes as a foundation, I shall describe the developing position of the car and its industry and some of the conflicting dynamic connections between the environmental and governmental elements of the landscape. Illustrations will be drawn which critically demonstrate the established positions of the parties involved by reference to publications which represent their cause, drawing connections with those contributing factors inherited from previous generations of the car where appropriate.

From scarcity to excess

- the fight to protect 'brown field' automotive capacity

Right from outset, the fourth generation of the car from its 'awakening' point in the seventies started to look ever more problematic for its traditional, and economically important, industrial base in the Western developed economies of the USA and Europe. The position of the industry started to become (and still is) a fiercely defended bastion of national economics when it came under pressure from the increasing impact of the imported car in the USA and Europe. The American consumer, in particular, - epitomised by the 'baby boomer' generation moving into parenthood - became tired of years of stagnant vehicle development at the hand of the 'stylist' and 'badge engineer', the increasing cost of change, indifferent quality and

reliability and was further shocked into fuel consumption consciousness by the Oil Crises of 1974 and 1979. At the same time, they. As a result, they deserted the 'gas guzzling' cars of the 'Big Three' in droves for the small 'compact' import. This threat to the US home industry was led by first by the VW 'Beetle' and then, even more dramatically, by Honda's Accord.

However, it was the VW Golf (known locally as the 'Rabbit'), which was not only marketed but also *built* in the US. Volkswagen's venture into US-based manufacture in 1978 marked a watershed for the American industry as, for the first time, Ford's overseas 'transplant' philosophy returned home to roost. The establishment of non-US car manufacture in the States was not completely new, of course - with Mercedes Benz assembling cars under licence in New York from 1905-7, and even Rolls Royce building c3000 Silver Ghost and Phantom models in Massachusetts from 1921-31 - but the VW operation was on an entirely different scale, unknown in the USA post Ford. The VW plant employed nearly 5000 staff and went on to build well over a million 'bread and butter' vehicles in its ten years of operation until 1988.

The method of VW's entry into US production was ground-breaking in its own way. VW had been massively troubled by the impact of the increasing value of the deutschmark versus the dollar - with its 'Beetle' sales falling from over 500,000 units in 1970 to just over 200,000 in 1976. The effect of exchange rate movements on the stability of sales in general and automobiles in particular rapidly established itself as an economic feature which first hit the German marques, followed by the Japanese (and now, in the late nineties, the British?) and has developed into a key contributing factor in the 'globalisation' of the industry in the fourth generation when it has become increasingly untenable to operate and export solely from one's home market base. New models and plant capacity investments were now being made not only in markets where sales potential existed but where manufacture and assembly costs were low, labour more flexible and access to other local markets was less constrained.

The VW move into the USA was interesting in other ways. It formed part of an extensive package of government-backed support to offset the problems (especially

the oil crisis) of the American motor industry. The investment in that first VW plant in the US was also in part underwritten by government aid to protect automotive capacity and jobs in Philadelphia. Governmental support packages of this type have developed into a significant motor industrial feature in the US and Europe of the fourth generation. The assembly plant was acquired from an ailing Chrysler, which was almost bankrupt after its over-reliance on large, fuel inefficient, cars in the US. The economic effects of letting Chrysler go to the wall were unpalatable for government. Therefore, to sustain it in its hour of need, Chrysler secured ground-breaking, direct US federal aid with a loan guarantee for $1.5 billion to bring its own compact 'K' car into production. This heralded the arrival on the US motor industry scene of 'protection' of 'brown field' capacity (and jobs).

At the same time, Chrysler 'rationalised' its European base, selling out its UK and French manufacturing interests to Peugeot which, in turn received local goverment aid to support Chrysler's Simca and ex-Rootes Group plants. This policy of underwriting through direct subsidy ailing motor industry activity had already become a feature of the fourth generation of the car with governments in Europe, including the UK, being brokers (and often 'dowry' providers) of at first national, and now international deals to sustain existing brown field motor industry capacity - in recognition of the unpalatable economic effects of losing capacity, jobs, support industry infrastructure. Government-assisted consolidation in the early years, such as the creation of British Leyland in 1968, the Peugeot take-over of Citroen in 1974, VW's purchase of Seat in 1986 and the merging of the Italian motor interests of Fiat, Lancia and Alfa Romeo, have now given way to more internationally justifiable 'economic development' and 'regional aid' support, v.a.v. Ford's re-investment in Jaguar in the West Midlands and Merseyside, BMW's engine plant investment in the West Midlands and the probable (at the time of writing) support for its re-investment programme at the Rover Group's Longbridge site provide examples of this. Also, such 'regional development' aid, directly linked to local economic and social support, has more often than not ruled out the more radical form of industrial consolidation practised elsewhere where significant 'rationalisation' of less efficient facilities and jobs - if not the removal of competition - was a key objective in delivering 'economies of scale'. Examples of

such rationalisation are, for instance, the closure of Renault's assembly plant in Belgium in 1998 (marked with a furore played out at the level of national politics), and the lesser, more progressive moves to shift re-investment from plants in western Germany to the east, for example, that of the VW acquisition and rebuilding of the Trabant plant in Mosel, Saxony in 1990 at the partial expense of its mammoth Wolfsburg facility.

- from opportunistic overseas assembly to a transplanted manufacturing strategy

VW's establishment of its assembly base in the USA was, however, not entirely successful, despite its links to state aid of the type discussed above. Its 'piecemeal' approach to manufacturing with its two satellite plants, a body pressing facility in South Charleston, West Virginia and a component operation in Fort Worth, Texas producing air-conditioning units and trim parts, could hardly be described as a local 'supplier village'. This, coupled with its high cost dependence on engines and transmissions imported from Germany was rather more a product of VW's opportunist (not unlike BLMC's incursion into Spanish manufacturing in the seventies) rather than the strategic approach to transplanting which subsequently became the hallmark of the Japanese - led by Honda. In a subsequent turning of the automotive tables, a second VW assembly plant investment in Michigan was ultimately sold unused to Chrysler in 1983 and it all went downhill from there with VW finally pulling out from US manufacture in 1988 as a result of their 'importer' rather than local 'manufacturer' mentality. Whilst the Golf had successfully replaced the Beetle as the Company's (if not the German industry's) icon in Europe, it did not have the same impact as its predecessor in the USA and its lack of post launch product development effectively sealed its fate. 'Rabbit', the US Golf, remained basically the same for over 10 years while its American and more notably Japanese competitors worked on much shorter product development timecycles of 4 (Japanese) - 6 (American) years.

However, the process of establishing a base on American soil from which to exploit the biggest automobile market in the world, started by VW, rapidly became the focus of the Japanese, who are credited with the development of transplanting into a global

automotive art form. The Japanese motives for investing in the US, however, were not primarily a function of state aid. They were spurred on by the opportunity created by the unresponsiveness of the 'brown field' multi-national 'Big Three' to the needs of their own market backyard and the rise of the yen against the dollar which made Japanese imported products more expensive. At the same time, the Japanese were faced with increasing anxiety over the clamour for protectionism in the US where hundreds of thousands of jobs were being shed in the American 'rust belt' around Detroit as a result of the rise in import penetration.

In this economic environment, it was Honda - the smallest and least home market-dependent (if not most US market-dependent) of the Japanese 'Big Three' - which seized the initiative and moved into full-blown manufacture, not just assembly, in the USA to protect its interests there and, in doing so, proving its intent to be a fully-fledged local American player. Its advent starting in 1982 was not without controversy, with long-running arguments about its local US content levels and support for Japanese (albeit US-based) rather than American component suppliers simmering throughout the eighties and early nineties. However, Honda had built its automobile business on its export-based US rather than Japanese home market. It took the view that manufacturing establishment in North America was critical to its long term survival.

- the counter-scramble for inbound 'green field' automotive investment, encouraging transplants which do not cure the ailing patient

Honda's transplant model, which included not only final assembly but engine and transmission manufacture, pressings and local supplier specialists (often, but not always, Japanese such as Nippon Seiki), has subsequently been transported to Europe (Swindon, UK) and the style adopted by its greater stablemates, Toyota and Nissan (in the USA, UK and France) and latterly VW, Mercedes, and BMW (in the USA), also marked another significant change in investment approach - the move to the 'green field' location. National and regional governments in the US and Europe were (and are) now faced with a new regulatory balancing act - the conflicting need to support existing 'rust belt' capacity and jobs and thus prevent urban deprivation and decay (in

places such as the motor-reliant West Midlands in the UK), whilst, at the same time, having to compete inter-regionally and internationally for job creation in so-called development areas by supporting new inbound investors which want to shape their own low cost operations and their workforces without inheriting the outdated, inefficient plants and restrictive practices of the indigenous motor industry. Local, national or regional governmental support for this new 'green field' motor industry investment has further increased the competitive pressure on the existing players and has further expanded an industry capacity which is ever more difficult to absorb.

-the essential conflict between 'green' and 'brown' field support

It is interesting to note that whilst the motor industry has continued to gain from such local support, other national (if not nationalised) industries (especially in the US and UK) such as shipbuilding, steel, mining, have been allowed to meet their (natural?) fate and go into (terminal?) decline with little governmental interference, accepting the economically and socially adverse effects on their substantial regional communities. Many of these less fortunate industries were no less economically or socially important, no less ravaged by the problems of 'inefficiency'- struggling with their institutionalised management and labour practices and faced with intense cost competition from overseas. Their subsidies, often a product of national ownership rather than 'partnership' with private industry were no less prevalent. However, in the end, support was withdrawn from them whilst it has flourished in the motor industry both in terms of attracting new 'green field' inbound investment and supporting the retention and redevelopment of the old 'brown field' facilities. Perhaps this is a tribute to the political pulling power of the motor industry. After all, these other industries became publically-recognised symbols of 'inefficiency' and state interventionism, lacked 'appeal' to the owning and buying public at a time when the motor industry was no less afflicted.

Nevertheless, support for the motor industry has not, at least so far, been in question, perhaps as a result of its more motivated consumer body, and the positive symbolism of its product, which, has continued to confer on its industry a mark of social progress and prosperity. All this has been in an era when the institutional image of some of its

larger players has waned and waxed in the public eye from time to time - British Leyland in the seventies and its comeback as the Rover Group in the eighties and early nineties, the ebbs and flows of Fiat and VW in the nineties, Chrysler's death throes in the seventies and its subsequent rebirth in the eighties, and GM's faltering existence throughout the period. Despite the growing atrophy of motor industry institutions, the attraction of motor industry-related investment was and still is in many quarters seen as a fundamental part of economic sustenance. Indeed, it has and is considered a 'modern' substitute for other 'outmoded' industrial formats and their regional homes such as those discussed above. Whether we are now reaching, at the turn of the century, the point where the motor industry will suffer a similar structural failure is a question which has to be faced in the fifth generation as the industry's post modern consumer body starts to lose interest in a product the usefulness of which is ever more limited by regulation if not its very ubiquity and the image of which is increasingly labelled as 'anti-social'.

In such a changing economic environment, the continuation of governmental support for existing and new motor industry investment in the saturated, developed markets of the West must be questionable. By now an in-built feature of global motor industry economics, the competition for job preservation and creation has created in its wake significant over-capacity. In turn, this has resulted in pressure for most motor companies to produce to capacity to absorb overhead cost regardless of 'natural demand'. The build up of massive excess stocks of both new and used products has been the outcome. This has led to an ever-increasing hard sell through ever more sophisticated consumer (and corporate) acquisition mechanisms on the one hand, but reliance on the continued existence of the most bizarre inter- and intra-market and customer price differentials on the other.

The clamour to defend the 'retail' consumer in this environment has ebbed and flowed dependent on the relative pricing position of industry players in the major markets as exchange rates and local tax rates moved - though the argument has been very much in the ascendant during 1998 (witness various recent press articles; 'Car Industry braced for MMC Enquiry', The Times, 28th October 1998; 'UK Drivers invited to

buy their cars abroad', The Times, 26th November 1998; 'New car prices are rigged, say MPs', The Times, 9th December, 1998; 'Rip Off - Roger King is the spokesman for the car industry. He says we get good value. But we don't,' Paul Nuki in The Sunday Times, 13th December 1998).

In the current UK context, the high exchange value of the £ Sterling in relation to the Deutschmark, Franc, Lira, Dollar, Yen etc has seen UK-based manufacturers struggling to maintain export volumes and contributions at the same time as importers have been able to increase, at the expense of the home producer, their share of the UK market with pricing set more competitively and yet still making an above average contribution given the relative 'devaluation' of their home currency. Thus importers are in a position to 'profiteer' whilst local manufacturers are accused of inefficiency since they are not in a position to adequately respond in terms of immediate cost cuts and price reductions without threatening their corporate existence.

Pressure is increasing on Western governments in particular to defend jobs (i.e. support existing brown and new green field motor industry investment), and, at the same time, to regulate against the use of the industry's product for environmental reasons. In addition, with the increasing cries of 'foul' from the consumer lobby and their supporting media over inter-market pricing differentials (which, in turn, reflect market exchange rate and local market motor-related consumption taxes, the need for manufacturers to maintain market presence to provide a long term customer service, as well as the market-variable manufacturer cost bases), it is hard to see for how long governments and other regulatory bodies can keep astride and purport to control these extremely divergent forces. As it is, we witness increasing volumes of 'grey import' business where European law permits customers to buy their car (or beer, wines, spirits for that matter) wherever they wish within the EC and those able to follow this route are in a position to 'save' hundreds, if not thousands, of pounds whilst 'depriving' local businesses and governments of revenue. The classical economist would argue that such interference in the market mechanism could never work.

Industry players on this uneven field, their investment and operations sustained by government subsidy and thus politically discouraged from radical rationalisation (or even extinction), have had to turn to other measures to manage their own survival. Two other important strategems have emerged to foster their survival and growth - the first being a search for further productivity improvements and cost reductions to eliminate 'waste' and slack within their system, the second being the quest of 'brand management' to break out of the 'killing fields' or 'rational desert' (insider phraseology used by the 'specialist' BMW and widely quoted in the media) of the commodity markets through product (and service) differentiation coupled with 'premium pricing'. It is to these sometimes conflicting and sometimes complementary policies and their effects that I now turn.

- making ends meet in car manufacture and the revenge effects of doing so

Whilst direct and indirect governmental subsidies have played a role in keeping the industry in its present form alive during the fourth generation, key industry players have also embarked on a variety of strategies of their own, designed to sustain their implementor in the face of the growing difficulties of the 'system'. The key themes of these developments have seen:

- industry consolidation move from national or regional to inter-regional levels
- the emergence of brand acquisition and exploitation on a global scale as a 'virtual' palliative against product commoditisation
- an apparent conflict develop between the drive to globalise purchasing at the lowest cost whilst retaining leanness, flexibility, just-in-time operation and product differentiation.

These strategems further mark the stresses and strains of attempting to maintain underlying momentum (or even survival) of the system which on the one hand cuts cost at an industrial level through consolidation (and *rationalisation* where politics permit) of facilities and processes on the one hand, and on the other, stimulates market fragmentation (with its attendant adverse impact on the management of complexity) to revive flagging consumer interest. These policies, whilst potentially strengthening the

hands of individual players in the short term, develop their own complementary revenge effects and have further contributed to the problems of the motor industry system at large.

-the 'lean machine'

As we have seen from the third generation, the success of Japanese industry in general and its motor industry in particular, especially in the realms of 'total quality management' inspired by Deming and rooted in Fordism, led them to adopt an entirely different costing philosophy. Where the Western manufacturers attempted to keep the costs of their bought-in component parts at a bare minimum at product launch, driving a hard 'piece part' bargain with suppliers and accepting that such costs would rise as components were re-engineered to meet the needs of post launch product developments, product line extensions and the like, the Japanese motor manufacturers (notably Toyota, Honda and Nissan) together with their suppliers, thought much more carefully about the whole (if not subsebquent) product life cycle from outset, designed components which would fit a number of product uses and configurations. On the face of it such components cost more -if costed purely on the basis of the investment in the product being launched - though, in reality, costs fell as the investment in tooling and skill could be spread over a much larger volume of products. As result, the Japanese expected component cost to fall, not rise, over its lifetime once the initial investment cost was recovered. With such a high proportion of non-visible parts carried over from product to product - often developed by or jointly with the suppliers themselves, the Japanese manufacturers' design functions were able to focus their efforts on the minority of parts which needed development which were really noticeable by the customer. Whilst a large part of the core of the product remained the same, wide ranges of differentiated products could be extended from a basic product platform to fit the 'needs' of many individual customers all at a substantially lower cost. 'New' product derivatives were brought to market thick and fast from Japanese stables whilst their Western counterparts struggled to re-engineer existing product lines with less radical mid life styling 'face lifts' alongside entirely new products, engineered from the ground up, taking much longer to move from design into production. This Japanese-led design philosophy not only enabled these

manufacturers to keep engineering costs low but also, gave them the opportunity to design and produce cars which were not just commodities. The same principles were applied to volume and 'specialist' products alike hitting the American multi-nationals (Ford and GM) and, at least initially, Europe's marque specialists alike with a continuous array of successful cheap, high quality, global commodity products such as the Corolla, Accord, Camry and specialist cars such as Lexus, Infinity and sports cars like the Supra and MR2. These latter products aimed at more discriminating, premium sectors enabled their manufacturers to maintain a highly competitive stance on pricing whilst retaining higher profits due to their lower cost profile. Brands such as Cadillac, Lincoln Mercury, BMW and Mercedes Benz were badly hit in the early nineties as a result in the USA. It took some time for them to adjust to this onslaught.

This approach to design disciplines, epitomised by Toyota, was the first step in a more comprehensive 'lean' process which minimised internal waste in that company. However, its application first to a commodity sector and then to its imported luxury models had two interesting side effects. Customers in the commodity sector, even in their home market did not order anything like the variety of specifications that were available - they just wanted a relatively standard product in a short time. Second, in the luxury car market, especially in the US, the distance and delivery time between the manufacturing plant and the market were extended. This meant that to offer a satisfactory delivery time to the customer, vehicles were built with a high level of specification as 'standard' to diminish the risk of guessing what the specification of stocks should be. Because of their ability to manufacture these cars at low cost in comparison to their US home market competitors, Toyota were able to get away with selling such comprehensive specification packages and still make money. The rise of the yen against the dollar meant that it became unsustainable to manage the variety that had been designed. Whilst every effort was made to maintain variety that was important to the customer, Toyota dramatically reduced its variety levels (by c25%) to maintain a low cost base. The tone of their company annual report changed quite significantly in the early nineties. A proud Toyota announced in 1990:

"Capturing the imagination of the motoring public in the 1990's means addressing an unprecedented diversity of needs and wants. In 1990, at Toyota, it meant making tens of thousands of different sets of specifications a month. The company made nearly five million cars and trucks during the year. And according to Dr Toyoda, its output for any single set of specifications - body colour, engine size, transmission, braking system, and whatever - averaged no more than a handful of vehicles per month."
(**Toyota Motor Corporation.** *Annual Report.* 1990)

The foreign exchange pressure on Toyota led them to make the following statement in 1993:

"Cost management is going to be for the automobile industry in the 1990's what quality control was in the 1970' and 80's.

"...Waste is any expenditure of time or money or material that does not add value for the customer."
(**Toyota Motor Corporation.** *Annual Report.* 1993)

In 1994, a somewhat chastened Toyota in 1993 sought to redress the cost-related problem of supporting this variety:

"In addition to using fewer kinds of parts in our cars, we are reducing the number of model variations in our product line. One main model, for example, comprised 97 model variations at the end of the 1980's, of which less than half accounted for fully 95% of total sales for that model. In other words, more than half of the model variations were generating only 5% of sales.

"Many low-volume model variations are important, of course, to users in special circumstances.....And we have a reponsibility as a full line automaker to fulfil such needs, even if they do not support large sales volumes. But a lot of the model variations that had accumulated in our product line were simply redundant. We can eliminate a lot of them without inconveniencing the customer."

(**Toyota Motor Corporation.** *Annual Report.* 1994)

This standardised approach, even in the luxury sector, was reinforced by other cost saving measures exploiting not only the above approach to design - reducing the number of parts in a car and the number of its potential configurations, Toyota initiated a whole crusade on waste to reduce cost in the production and delivery chain and claimed to have saved $1.5 billion in the process (**Toyota Motor Corporation.** *Annual Report.* 1994).

-the conflict between the 'just-in-time' revolution and 'globalisation'

The novel attack on the product development process discussed above, originally a GM speciality, was not the only front opened up by the Japanese. Whilst Toyota's product designers and engineers brought products to market much quicker, concentration on improving the flow of products through the manufacturing process further eroded the cost position of the US and European players. The perfection of 'just in time'- and 'design for assembly'-enabled, flexible, production techniques meant that the manufacturing process itself became potentially much more responsive to the ebbs and flows of the market place. No longer would long, batch runs of components or finished vehicles the order of the day in such factories. Where such disciplines are in place, the manufacturing process runs with minimal stocks of components or finished goods - further reducing the cost of production, relying on upstream activities providing just what is needed to support the production of what is required to meet the customer's order downstream.

These 'sell one, make one' logistics techniques were developed to be applied throughout the supply chain, spreading both upstream to suppliers and downstream to sellers. However, it was soon realised that their piece-meal application to just one, normally powerful, part of the 'supply chain' could mean that those areas operating such a demand-led process could selfishly reduce cost within whilst transferring the cost burden without. For instance, a 'lean' manufacturing or assembly environment could be achieved by transferring the cost of carrying component (or raw material) stocks to the supplier or high cost, finished product stocks into distribution to meet

variable demand. Such anomalies can only be overcome if JIT's flexibility is applied to the supply chain as a whole - creating a 'lean' extended enterprise at the foundation of which is a 'batch of one' made to meet the customer order.

Few in the motor industry have achieved this utopia, however. Despite spending millions on the application on lean and flexible techniques, the pressures to maintain, if not grow output to ensure that capacity in terms of capital and human resource is utilised to absorb its investment cost, have meant that the application throughout the industry of such a frugal but comprehensive modus operandi has been fragmented. Manufacturers, driven by the culture of their powerful functional 'chimneys' of finance, purchasing and production - wedded to an industry accounting formula based on standard costing structures which are struck at a certain level of overhead absorption to cover the laid-down investment capacity - were far more likely to maintain batches and long runs to meet their volume-led productivity criteria within while rigidly controlling bought-in component cost without. It is perhaps ironic that the tendency to control inbound (through 'piece part' costing) and manufacturing cost (through building to capacity), meant that most 'just-in-time' focus was contained in this upstream area. Few successful attempts have been made to start where JIT began, with the customer, i.e. at the distribution end of the business. Within the plants, timed deliveries of components, have enabled operations to achieve component stock turns of hundreds of times per annum. This has produced paper savings of millions of pounds in supporting component stock holdings. At the other end of the process in distribution, however, such slick, low cost methods have regularly over-produced thousands of unwanted finished products, each of which occupy 16-20 square metres of space and cost conservatively over £5 per day to support (fund, store, maintain, dispose) and hundreds of pounds in discounts to sell to a customer, whose real needs have been compromised.

The overall drawbacks of grafting parts of the 'lean machine' process have been recognised by James Womack and Dan Jones take as their home base Toyota's statement that value for the customer is the starting point for lean process application (**Womack, J. & Jones, D.** *Lean Thinking*. New York: Simon & Shuster, 1996).

'Lean' which is entirely internally or even shareholder-focused on cost reduction is, in their words, *'mean'*, and does not necessarily reflect the 'needs' of the customer, who would never wish to be charged for 'waste' in the system.

Womack & Jones (op cit 1996) are the first to admit that that though the wholist philosophy of JIT has rarely been applied, it should not be forgotten that its context was external - 'just in time' was steeped in customer 'pull' not supplier 'push' with required goods being made available at the point of sale at the right time. JIT is often part-applied as another cost cutting tool with other tools which are in conflict with JIT's touchstone of flexibility and waste elimination. They make the point that the motor industry is one where the fixation with cost reduction has always gone hand in hand with the need to invest in more and more complicated manufacturing technology based in the belief that automation eliminates rather than creates cost. The belief is that such advances can further the elimination of the increasingly fixed expense of labour (the fact that labour takes only 15-20% of a vehicle's cost, and that bought-in materials and the far greater balancing cost of maintaining 'slack' in terms of stock buffers of raw materials, components and finished vehicles, is conveniently ignored).The problem is that such technology is neither cheap nor simple. It feeds a centralist, if not globalist, perspective to make 'economies of scale' and, therefore, its significant investment cost demands that it is used to capacity to 'earn its keep' - all of this tends to bring with it more inflexibility and waste. Its central location means that it is far away from most of the markets which it is supporting and therefore there are likely to be far higher distribution costs and stocks to absorb the extended delivery lead times for which customers are unwilling to pay. Such a supply route incurs a much higher risk of missing market opportunities, as Womack & Jones put it:

"However, there is a fundamental problem with (such a) strategy in most applications, notably that it is a classic case of optimising one tiny portion of the value stream while ignoring the costs and inconvenience to customers created elsewhere.

"To achieve the scale needed to justify this degree of automation it will often be necessary to serve the entire world from a single facility, yet customers want to get

exactly the product they want exactly when they want it. This is generally immediately. It follows that oceans and lean production are not compatible. We believe that, in almost every case, locating smaller and less automated production systems within the market of sale will yield total lower costs (counting logistics and the cost of scrapped goods that no one wants by the time they arrive) and higher customer satisfaction." (op cit 1996)

This point is similar to the intermediate technology-based development philosophy espoused by E F Schumacher (**Schumacher, E. F.** *Small is beautiful* (1973).London: Vintage, 1993); this theme is taken up subsequently in the views for Generation 5.

A key part of Womack & Jones lean thinking philosophy relates to flow - however, the flow should be triggered or 'pulled' by the customer not through the manufacturer seeking to absorb sunk cost through 'pushing' an unwanted product on to the market - Womack & Jones make the point:

"The most basic problem is that flow thinking is counter-intuitive; it seems obvious to most people that work should be organised by departments in batches. Then, once departments and specialised equipment has been put in place, both the career aspirations of employees within departments and the calculations of the corporate accountant (who wants to keep expensive assets fully utilised) work powerfully against switching over to flow." (op cit 1996)

Again, Schumacher (op cit 1973) identified these issues are symptomatic of a complex, highly automated world with high levels of indirect, distant administrative control and isolation from the 'front line' of the retail shop counter or production shop floor.

As such, the conversion to such a customer-driven modus operandi is unlikely to take root in an industry steeped in a mass production flowline philosophy, which even let Henry Ford down once his product was no longer sought after by the customer. Womack & Jones state that the overwhelming thrust of economic development is

based on the application of ever more complicated technological solutions. In the motor industry's case, there is such an enormous pre-existent investment in mass production that it is unlikely that any complete change of approach will be forthcoming for most significant players and yet a third internal cost cutting force is gaining prevalence - a globalised approach to major and minor purchasing decisions which again ignores the flexibility and responsiveness to the customer that a smaller leaner scale of production would offer. Such developments have seen significant batches of component parts travelling across continents and oceans to their centralised scale assembly destination. While on paper, the costing decision on the individual part looks sensible, the adverse impacts on flexibility of manufacturing response to changing market needs due to distance from the supplier and batching in transit apply and are rarely considered when the supply contract is being negotiated. Such arrangements might meet the needs of traditional short term accounting and exchange fluctuations, but the effects of the forced trading cycle that follows fires up an ever increasing demand for more cost cutting of the same ilk. Savings achieved are being put against the runaway, excess investment cost of high tech manufacturing facilities, often supported by governments trying to ensure the continuity of their nation's economic prowess (and *jobs* - though it is accepted that every new investment of this type, to be productive, employs less people).

Womack & Jones definition of 'lean thinking JIT' envisages the production point on most goods becoming ever closer to the point of sale. It again bears more than a passing resemblance to the principles of 'buddhist economics' used by E F Schumacher whose assault on 'the idolatry of giantism' (op cit 1973) makes a powerful case for commodities (which for many in the developed and aspirant developing world, the car is) being provisioned *locally* whilst luxury goods (a few car products would have such a nametag) have always travelled greater distances to their consumer with the product's scarcity offsetting the customer's impatience to take delivery. Schumacher's problems with the economics of scale are best summed up in his words:

"The economic calculus, as applied by present-day economics, forces the industrialist to eliminate the human factor because machines do not make mistakes which people do. Hence the enormous effort at automation and the drive for even larger units."

Schumacher goes on to suggest that such automation deprives an increasing number of people of work and that this has even greater societal and economic disadvantages - these people are no longer customers for the large volumes of 'commodity' goods provided by the manufacturer.

At the same time, some pundits argue that just-in-time, a key objective of which is to avoid the waste of uncalled-for production, has unwittingly contributed to the number of journeys on our roads with increased delivery frequency throughout the day and night. John Whitelegg writes:

"A manufacturer or distributor now requires raw materials or intermediate products to be made available at a precise time and location to fit in with a production schedule that reduces the need for storage and warehousing and uses the road system as a conveyor belt.

"(JIT) represents more than just technological change. The whole culture of production has had to adapt to the new regime and to strict contractual conditions about delivery times and schedules. This increases the number of lorries on the roads and reduces the number of circumstances(under current organsational and technical conditions) where rail can perform as well as road."
(op cit 1997)

However, it could be argued that whilst individual motor manufacturers have always contributed to this (component stocks always had to be 'topped up' at assembly plants and the scale of individual road-delivered consignments from suppliers has not dramatically changed), even the delivery of its finished products from factory gate to dealer involve consignment loads little changed over the duration of the fourth generation. Increased numbers of individual 'drops' at dealerships delivering vehicles

that have been sold as opposed to ordered for stock have replaced the very high level of inter-dealer vehicle transfers which were once a feature of car sales in the UK at least (some 35-40% of cars were transferred at least once between dealers before sale). So whilst the motor industry could be held responsible for high levels of delivery-related vehicular movement to service its manufacturing and distribution infrastructure, its overall impact in this respect at individual plant level has remained fairly steady over a long period of time, with many 'giant' brown field assembly sites handling a significantly smaller volume of output than they were in generation 3. Some increased (substitutional?) movements will have resulted where new 'green field' manufacturing operations have been established though often such delivery movements were a welcome replacement for lost jobs (and transportation) in other local industries (Toyota in Derby replacing Rolls Royce, in Deeside replacing British Steel at Shotton, Nissan in Washington, near Sunderland replacing mining, shipbuilding and steel, Honda in Swindon replacing British Rail). Other increases in movement length (but not necessarily frequency) has occurred with the increasing tendency in the nineties to source components from distant lower cost suppliers. But it is an unfair burden to thrust on to just-in-time, the message of which, albeit diluted to suit the calculations of cost accountants, is to only make what is wanted when it is wanted and to avoid waste which has no value for the customer.

Nevertheless, what started as a crusade against waste in the motor industry system (or even in parts of an individual manufacturer system), is seen to create waste and pollution without of it, though it has to be said that the real waste and pollution comes rather more as a result of the nature and the popularity of the motor industry's product - the overall increase in parking requirements and moving traffic levels is mainly a result of the increased access and ownership of the car itself (the deliveries to and from car plants are individually incidental to this but cumulatively contribute to the problem). Also, given that excess capacity exists in the industry and the industry and its governmental supporters will not let the spare capacity become 'unproductive', the likelyhood is that there will be pressure to exploit the laid-down capacity and, thus, create high levels of unsold new and used stock in the system - this in turn wastes the land on which it stands. Its ultimate liquidation may increase marginal car access and

use (second and third cars, self drive etc) which will have an adverse impact on traffic levels and congestion. None of these, largely internalised, initiatives have yet delivered a turnround in the fortunes of the industry.

- Consolidation, Rationalisation & Intelligent Brand Acquisition

One further developmental pattern has emerged, however, in the mid to late nineties, a vogue built on the philosophy of William C Durant of General Motors in the first generation who saw success being secured through the penetration of different market segments through a diverse portfolio of brands each having attributes which appealed to particular customers. The re-engineered version of this, backed by ever more sophisticated production methods, has seen (often but not exclusively commodity) manufacturers seek to strengthen their product lines by developing and more recently *acquiring* for development (potentially) 'premium' brands, the image of which can justify a premium price position and assist a shift in their marketing position to a more comfortable (and profitable) place. The irony here is that it would appear that what the *customer* values (or what certain customers value) *is* what delivers most profit and the 'product' bought can be more than the car itself, i.e. there is something intrinsic to the marque or brand in question which has the potential to 'de-commodify' its product.

Several variations on this strategic theme, rooted in consolidation, have developed. I shall look at three.

- Ford pays the price for Jaguar

In 1989, when Ford paid what seemed to be a mint of money (£1.6 billion) for the over-valued, privatised and superficially renovated Jaguar, it seemed as though a dreadful corporate mistake had been made in Detroit which, on take-over, could only see poor quality, minimal investment, no product plan worth having, and a massive exchange problem brought about by the over-extended reliance on the US market. Looking back on that decision now, one might suggest that it had a deal of foresight (whether this is the case or just the luck of the draw is difficult to say). Ford's own luxury brand, Lincoln (like its GM sequel, Cadillac) was being badly mauled by luxury imports such as Mercedes Benz and BMW shortly to be joined by the cost

leader, Toyota's Lexus brand in its own home market. Ford had reason to think radically about its luxury market position in its own home market. The second developing effect was in Europe, where Ford's position in the so-called executive sector was also coming under intense pressure - the time was up for its its long-standing, highly successful offering in the sector, the Granada or Scorpio and its replacement had all the hallmarks of another 'Edsel'. But, behind this something was happening to the aspirations of executive company car drivers. No longer impressed by the Ford badge, the change to Scorpio, and its bolt-on complement of 'Ghia', such owners were now far more 'designer' image conscious. The old sector was being de-constructed in favour of a much broader one where a new style of corporate elitism was being fuelled by the 'user chooser' perk. No longer could Ford rely on major fleet deals with corporate transportation buyers covering everthing from the office run-about to the rep's car, topped with high specification Granadas for senior executives. Many corporate fleet arrangements were now lease not purchase-driven, and through the adoption of a manufacturer-independent fleet management operation far more choice for users was possible. Increasingly, the old fleet market dominated by the commodity suppliers was absorbing the same luxury products, led by Mercedes Benz and, especially BMW, the customer desirability of which had caused so much damage in the USA. We now see that the use of Jaguar in an entirely different light. No longer is it a range of one saloon and a sports car for rich enthusiasts - it shortly launches its BMW 5 Series and Mercedes E class competitive offering, the 'S' type. This is to be followed by the X400, a BMW 3 Series, Mercedes C class competitor in 2001. (Both of these product developments have been 'won' for UK production with significant government regional aid to preserve jobs in the West Midlands and Merseyside). So, what can be seen in this first example of brand acquisition-related strategy is that, whilst what was almost a major disaster at outset has become a vehicle for Ford to try and regain sales lost in larger, executive, cars through the re-invention of the Jaguar marque. If the discriminating buyer at the millenium buys the *re*newed Jaguar badge and ignores its Ford 'heritage' (it has many parts in common with Lincoln), Ford may make more profit than it ever did from its Granada, being able to sustain a price position previously impossible for the company and with a subsidised cost structure which its main competitors cannot (as yet) meet. One thing is for certain, unless

something goes terribly wrong with the new Jaguar product quality, if the excursion into the premium-priced luxury sector can be sustained, it can only provide some breathing space for Ford's commodity products where the pressures of the market and competition within it can only increase *(see Post Script to Generation 4 for update).*

- BMW & its acquisition of Rover Group - protecting the brand at all costs

BMW has been continuously a very profitable motor company for 30 years - but it is still a very small, largely privately-owned player in manufacturer terms. It has succeeded in making returns on its sales and investment at levels consistently over a period in which bigger (multi)national players and their commoditised products suffered a roller-coaster of a ride on the back of the 'economic cycle' ebbs and flows. Even the mighty Mercedes Benz, with its broader product portfolio has faced more than one local difficulty. What BMW has done is to find a formula that works and has stuck to it - its reputation for engineering excellence is in some, but not every way, leading edge - it's rear wheel drive format and the evolutionary styling of its family of cars is a testimony to that. This approach has certainly caught the imagination of an ever-growing body of customers. For BMW, its marque is *sacrosanct.* It must not be over-exploited and it cannot chase its up and coming competitors 'down market'. Under no circumstances will it dilute the prestige of its brand.

However, as a global player, BMW is a minnow. It must support a higher cost base, essential to the individuality of its product offer and a reflection of its scale of operation. These features make it vulnerable to larger-scale predators for whom the capture of such a premium marque would be seen as a major prize - a goose that could go on laying golden eggs for its owner. BMW is under pressure from such competitive efforts to move up market into BMW's 'premium' territory. Ford's intent for Jaguar is an example of this - however, it is not the only one. It is facing a similar onslaught from a highly successful heavyweight competitor in its own back yard. The Volkswagen Group has already developed its multi-marque strategy well beyond that of Ford. Its Audi division is able to take the cream off the premium market segments with their A4, A6, A3, and A2 developments sharing key underlying componentry, investment in manufacturing technology and purchasing clout which support the

uppercrust of Audi and its commodity-based marques - VW itself, Seat and Skoda (this strategy is the subject of a more detailed review below). BMW has no access to such 'advantages' of scale.

Daimler Benz, BMW's arch-rival in the specialist manufacturer league, is moving into a competitive position of a wholly different dimension. While it recognises that the prestige image of its Mercedes marque is a critical piece of corporate furniture, it has risked it in ways that BMW would never consider. Its move 'downmarket' with the small 'people-carrier' A Class (which carries the Mercedes badge) is being complemented with its SMART 'city car' - the controversial product of the highly-publicised link up with Nick Hayek's SWATCH operation - are proof that it does not see the threat of association with the Mercedes name in the same way that BMW would. Perhaps this, in turn, is the result of the Mercedes marque having a more workmanlike 'alter ego' with a significant proportion of the world's taxis, trucks and buses carrying the three-pointed star, thus it can hardly be said that Mercedes Benz is an exclusively premium car product player? With its new global link up with Chrysler, the least multi-national of the 'Big Three', Daimler Benz has potentially put itself into a far more powerful position to both exploit a broader portfolio of brands and take operational advantage of its scale than BMW ever could.

Such developments, coupling the exploitation of exclusive marques with the 'economies of scale' that a broader commodity brand base offers could be considered a risk for BMW. Into this developing maelstrom of marque alliances and acquisitions came the opportunity to acquire the Rover Group. Here was a barely healthy ex behemoth, still on a Honda-driven life support system in terms of product and production engineering, but it offered great possibilities. It had a number of potentially attractive marques - Rover, Land Rover, MG, Mini plus those sleeping - Triumph, Austin -Healey, Riley (and a few more) which could be re-engineered if not totally re-generated to build the corporate scale of the BMW Group and could provide the vehicle to take it into market segments and niches into which it would not go for fear of diluting its precious BMW marque. However, whilst the initial investment decision was a 'cheap' one, the marques of the Rover Group could only succeed if

substantial investment was made in them over a protracted period of time. BMW sees an immense opportunity to establish a viable position for these marques in different market niches - always at the premium end of the competitive spectrum. The Rover-related marques must be complementary to but never substitutional for the BMW marque itself. At the same time, BMW nevertheless believes that whilst maintaining different external marque 'faces', significant internal advantages of scale - in terms of engineering, purchasing, logistics and other group functions - can be achieved without adversely affecting the real differentiating features of several premium marques. BMW is trying to become a specialist multi-marque operation, gaining some advantages of scale but without the 'ballast' of a high volume commodity marque.

One thing is certain, however, BMW's avoidance of the commodity *'killing fields'*, (from which Rover is wrestling to withdraw) whilst effectively playing at the more profitable edges of a much larger number of market positional groupings, is not a low risk strategy. However, BMW's direction needs to be put in the context of the sort of problems the 21st century car faces as a whole (the point of this dissertation). To be able to have a number of potential product and market routes available to meet the needs of those customers best in a position to continue to afford personal automobility over the next 15-20 years could be a powerful advantage.

The strategically-mixed position of the Volkswagen Group with its VW, Seat and Skoda commodity and Audi premium brands is more stretched with its dependence on a commodity base as an all-important corporate driver. It is worth considering the possible position of the larger (national and multi-national) commodity manufacturers if they continue to plough their current mass production-derived furrow. Their commoditised personal automobility solutions are perhaps set to suffer the most in the saturated markets of the West, especially in Europe, where current population density and networked urban developments offer the best public transport potential and accompanying risk of car use regulation (or 'rationing'). It is in these developed markets that the more discriminating, affluent, customer will continue to be in a better position to support car ownership or 'tailored' access for occasional leisure use, whilst accepting that many regular journeys may be switched to other forms of transport. In

such a mobility environment, a global provider with a wide range of quality products 'fit for occasional purpose' - from motor bikes to small sporty run-abouts, from medium quality saloons to limousines and on-off-road specialist vehicles - will have a potential advantage in selling or increasingly hiring or leasing such a comprehensive mobility service to a community of customers who are concerned about value but not necessarily absolute cost. On the other hand, those manufacturers dependent on the scale of commodity products to underpin their operations are vulnerable to the problems of over-capacity and intense, price-led competition as the saturated mass markets come under pressure imposed by the increasing, regulation-driven costs of car ownership and use.

These last few sentences may illustrate the approach the BMW Group is taking to stake out a place in the fifth generation of the car, the possibilities for which will be discussed further in the final section of the dissertation. However, the Group's view of its 'home' BMW marque and how it sees the potential for its newly-acquired ones (including in late 1998, Rolls Royce) are matters already widely discussed in the public domain. The BMW position, however, with its nucleus built around specialist rather than commodity marques does represent a differing approach to that of Ford and Jaguar or, for that matter, Mercedes Benz and Chrysler, the heart of which lies in the economics of scale which comes from broadening market appeal to span mass and specialist markets. Given the structural nature of the problems of the motor industry, both internal and external, the current vogue for the acquisition and manipulation of specialist marques cannot be a universal long term solution. However, whether it offers a route to survival for the few which successfully practise it, is worthy of some consideration. If any hope lies in the adoption of this path, at least in the medium term, I believe, the real challenge for practitioners will be in managing the balance between 'real' marque differentiation and badge-engineering. To illustrate this point further, I shall use the example of the Volkswagen Group in my next example.

- VW, Audi, Seat, Skoda, (not forgetting Bentley et al) - Is the marque of beauty just skin-deep?

Volkswagen became multi-marque when it acquired Auto Union from Mercedes Benz in 1965. This was followed up in 1969 when the Audi, NSU and AutoUnion fused with VW holding a 60% stake in the new company. The new company was fiercely independent in engineering, with NSU's investment in the ultimately unsuccessful, but at outset revolutionary, small Wankel rotary engine in its R080 saloon. The first engineering solution transplanted between the companies came with VW's decision to move away from its air-cooled engine heritage with Audi-NSU technical expertise developing the water-cooled power unit of the VW K70 of 1970. This was a small, and not particularly successful technology transfer but one which blazed the trail for many others over the years that followed. Audi design and engineering expertise became a major factor in the development of the Passat in 1973, and in 1974, the Scirocco and the Golf, the latter spun off from the concurrently developed Audi 50. The Golf marked the nadir of VW's air-cooled Beetle heritage in Europe. From that point, Audi design and engineering principles have heavily influenced the VW Group's volume car business.

VW's next major acquisition was that of a majority stakeholding in the Spanish 'SEAT' in 1986. SEAT had been set up many years previously as a joint venture between the Spanish Government and Fiat to assemble Fiat vehicles in this fledgling market. However, Fiat (as a para-nationalised industry itself) was facing significant difficulties. It was making huge losses from its range of outdated products and at the time was seen to be a contender for acquisition or absorbtion under another motor banner. As a result, the Spanish connection was not thought to be a core part of Fiat's business, and the controlling share passed to VW.

Again, it was the engine technology that secured the initial VW-SEAT match. Some new, SEAT product development had already taken place - the original SEAT Ibiza looked very much a Fiat in terms of its sporty Italian shape - but its power unit was VW-Audi. It is interesting that VW has chosen to make this 'hot-blooded' Mediterranean styling the 'official' differentiating factor for its SEAT marque.

Subsequent SEAT cars, developed in the VW corporate stable have continued to have a radically different exterior body style and internal 'ambient' features (such as trim fabric) whilst the basic running train of the vehicle from its base platform and power train assembly to an array of corporately purchased, less customer visible (or critical) parts is VW-Audi. At the time of the initial SEAT move, pragmatic ways of making an assembly agreement work rapidly to maintain continuity were top of mind. However, these basic principles became the formula which offered a viable solution to the VW Group's growing problems in the late eighties and early nineties.

The next step in VW's acquisition path came in 1990 following German re-unification and the subsequent collapse of the Warsaw Pact when the opportunity was taken to absorb the Czech manufacturer Skoda. Again, pragmatism had to be the order of the day. Skoda's ageing product range, powered by light aluminium, air cooled engine technology was at least recognisable on the World auto stage - albeit that it was not really positioned where either Skoda or certainly VW would have wished. As with SEAT, the first effort, was to make the new vehicles capable of carrying VW running gear - this marked a significant departure from Skoda's heritage and was not without problems. I discussed this with Skoda's Chief Engineer just before the delayed launch of 'Felicia' in 1994 - there was an enormous difference in approach between the mighty VW, an expert producer of cars for more developed road systems and Skoda where its engine design simplicity and weight was geared to far less developed infrastructures. The argument from Skoda engineers that their engineering technology was well worth investing in - especially to meet the needs of developing markets where Western sophistication was not a first priority - was lost in favour of VW's rescue and repackaging of an old and valuable marque (Skoda has a much longer history than VW - it goes right back to the first generation - like Rover, its roots were in bicycles!).

The Skoda marque had long become synonymous with poor quality. Its popularity (so much the butt of bar room jokes in the UK) was restricted to economically-deprived and structurally-declining communities (mining and steel for example). Such images were an anathema to marketers whose brief was to create a more positive perception

of the brand with a different motoring public. VW was to 're-engineer' the Skoda marque, quickly bringing German quality and engineering into the product, and moving its 'image' up-market - though the marque was still to be VW's 'price-leader' (though at a price substantially increased over existing levels). Since the takeover, VW has worked hard on the remarketing of its Czech marque to create a different brand and dealer network image - its old one dying with its previous owner (and dealer) community. Skoda's recently launched Octavia (1997), however, is really a re-badged Passat, a product of the Group's platform strategy, derived from the same running gear as the Audi A4. As such, its VW 'family heritage' is somewhat difficult to conceal (it is to this aspect of VW's marque management to which I now turn).

The Skoda story demonstrates the risks and opportunities of '(re)creating' marques in this way. Is there a point where such an approach could attract the charge of 'badge-engineering' - so progressively reviled in generations 3 and 4? Is customer value being created really or virtually and is such 'brand management' a legitimate method of creating such added-value for the customer or is it just a 'trick' to enable unjustified price differentials to be created whilst underlying costs of product development and manufacture can be minimised?

The foundations of VW's product and marque policy date back to the early nineties. After 3 years of near record profitability after re-unification, VW's profits were halved in 1991, all but disappeared in 1992 and posted a record loss of almost 2 billion Deutschemarks in 1993 (results in subsequent years have dramatically improved to levels beyond their previous post-unification heights). At the time, its collection of marques was, rather like Fiat a few years before, in a hopelessly unstructured state despite the establishment in 1991 by the then Chief Executive, Dr Carl Hahn, of a central group management supervisory and policy-making body alongside separate management boards for each marque to protect the individual interests of VW, Audi, Seat and Skoda (reminiscent of GM's Sloan?).

This was not enough to sustain the VW Group through the German post re-unification recession - hence my concern that salvation will not come through marque

exploitation alone - however, it became relevant in 1993 when other, more tangible, developments took place. A major board shake up at the end of 1992 saw the departure of Dr Hahn and his replacement by Dr Ferdinand Piech to whom the job of reforming VW into a far more coordinated group of companies fell. On his arrival, Piech saw the root cause of many of the Group's problems being its high 'cost base' which supported many fundamentally different products, resulting in inherent inflexibility of the different operating units.

Apart from tackling the inflexibility of his German workforce, Piech put in place two other key initiatives - the Group 'platform strategy', and a part-associated purchasing cost reduction programme. Whilst Piech kept the independent marque management philosophy of his predecessor, he separated the *external* product and marketing 'face' from *internal* engineering and manufacturing processes and practices. In this way, the cost of individual product platforms and the existence and cost of all the parts which flowed from them, including those exceptionally designed to create marque differentiation, were rigidly controlled under one group roof. A diverse range of products was planned to be produced under the marque banners, hitting different price segments, using the same high cost foundation components (platforms and power trains) as well as many other *'under the skin'* parts unseen by the customer. To make the most of this strategy, Piech, an engineer himself, employed the now-notorious Jose Ignacio Lopez from GM's logistics operations to head up the component purchasing and logistics strategy with the specific instructions to secure major economies of scale through reduced parts count and parts price reductions from suppliers.

At the same time, more marketing and distribution autonomy was to be given to each marque - an earlier attempt to centralise sales and marketing structures under a Group function was reversed with separate brand management structures put in place both at HQ and market level. This separation has also been extended to retail networks, to concentrate dealer minds on providing a particular marque 'experience' appealing to the appropriate customer target group.

This strategy of using as many common parts across as many different product offerings as possible across the range whilst retaining some obvious differentiating marque cues which form the basis of separate product positioning for the customer has become the hallmark of the new VW Group. The fruits of its 'platform strategy' are now becoming progressively available with new families of products which are fundamentally related but different. Volkswagen illustrated the point in its 1994 Annual Report:

"1994 saw further progress in the Group-wide implementation of the platform strategy which represents a key element of the Volkswagen Group's rationalisation and cost cutting programmes. By mid 1996 the highest-volume models in the Group's range are to be produced on the basis of four different platforms instead of the sixteen used hitherto, a move which will reduce complexity, and component diversity besides generating synergistic effects. This will permit shorter development times and thus a cut in development and production costs, while at the same time enabling us to enhance quality and offer our customers a wider range of options."
(Volkswagen Group. *Annual Report.* 1994)

Since then we have witnessed the Audi A4, A6 and VW Passat using the same 'platform.' The Audi A3 shares with the VW Golf, the new Beetle, and the Skoda Octavia (which shares more than a passing likeness to the Passat anyway). Golf also provides the foundation for the VW Bora and the Seat Toledo. The Polo underpins the Seat Cordoba, VW Lupo and Seat Arosa launched in 1998 and the Audi A2.

But how *real* is this product differentiation? Is it but a finer form of the badge-engineering practised in a cruder form on the VW Sharan and Seat Alhambra multi-purpose vehicles? Is this what the customer wants and values? As far as *Volkswagen* is concerned, the differentiation between the marques is critical - as they explain in their 1996 Annual Report below:

"The individual marques forming part of the Group each have their own historical origins. As a result of those traditions, our customers have different experiences and

expectations in relation to 'their' marque. Distinctive customer marketing is therefore of special importance to the individual marques; it guarantees the long term satisfaction of the customer. At the same time, the only modestly growing markets, such as in Western Europe in particular, can be *exploited* more *efficiently*."
(**Volkswagen Group**. *Annual Report*. 1996, emphasis added)

The words *exploited* and *efficiently* very much reflect an internal rather than external customer need. They go on:

"The central element of a differentiated marketing strategy is appropriate product differentiation between the various marques. For this reason, we are developing target group-specific vehicle concepts which will enable us to attain a high level of exploitation of the total market across a broad scope. The new Audi A3, for example, represents a redefinition of the premium segment within the compact class."
(op cit 1996)

Question: *Is it differentiated enough from its much cheaper stablemate, the new Golf Gti?* They continue:

"In the new mid range, the Passat saloon represents a new high standard seen previously only in classes above it." (op cit 1996)

Question: *How does this well-specified package impact on the much pricier and, in some respects more basic, premium priced Audi A4 - albeit the A4 specifications can be made up at optional cost to the customer?* They follow on:

"With the Skoda Octavia we offer modern quality and safety standards at a highly attractive price." (op cit 1996)

Question: *If the Skoda marque gains its new image - which VW are fully intending it to do - will the Octavia negatively impact on the more basic versions of the considerably more expensive Passat?* They continue:

" The Seat Alhambra in the MPV segment is particularly targeted at price-conscious families." (op cit 1996)

Comment: *A considerable proportion of the families at whom the more expensive VW Sharan are aimed at might very well go for the virtually identical Alhambra, might they not?*

(Note: The extracts from Volkswagen Group Annual Report, 1996 are interspersed with my questions and comments)

Whether customers adopt a more *critical* and less *emotional* approach to making car buying decisions between such closely-related families of products as automotive costs of ownership and use increase will depend to a great extent on the success of companies such as VW in maintaining a sufficiently differentiated reality between the products which the customer believes offers value. There is already a danger that platform design constrains the external features to such an extent that the individual product's basic shapes start to look the same. Add to this the increasing use of common parts and one wonders whether, when new generations of products come off the line, their differences in appearance will shrink even further as the need to retain the efficiency of common design and engineering principles take hold.

As a result, will the Audi A4 customer go on being prepared to pay a substantial price premium for the privilege of ownership, when the VW Passat starts to look and feel the same? The arrival of the New Beetle running alongside its 'clones', the VW Golf and, most important Audi A3 again threatens the loss to the cheaper VW marque of a significant number of its currently discriminating Audi customers. Also the new retail price differential which may keep Audi, VW and Skoda products apart has another dimension - the equivalent used car residual values which dictate replacement cost will be critical to customer retention in the saturated developed markets - if the VW Sharan does not hold its initial price differential against the Seat Alhambra when it is

traded used, the Sharan's position will become untenable - q.e.d. for A3 versus Golf, A4 v. Passat, Passat v. Octavia and their clones to come.

The attempt to move Volkswagen 'up market' to avoid brand commoditisation, coupled with a product 'cloning' policy which suppresses real product difference threatens the well-established, premium position of Audi. This should be avoided at all costs in an uncertain future where the affluent customer is likely to be in a better position to maintain his motoring needs. Such discriminating customers will soon learn that 'all that glitters is not gold.' With the commodity car market being a threatened place in the saturated developed markets where chronic manufacturing over-capacity exists, a premium brand such as Audi (or BMW for that matter) will retain its following whilst its products maintain and develop their real not virtual differentiation from the rest. In this context, the temptations must be high for a volume supplier such as the Volkswagen to attempt to differentiate more and more 'virtually' between its marques, saving cost inputs in design, engineering, common parts purchasing, and low complexity, high volume manufacturing. However, the parallel risk is that physical product characteristics, which set apart an Audi or a BMW from a Ford, Renault, Toyota, VW or whatever, and which matter to the affluent, discriminating customer who is prepared to pay a premium for such attributes, will be lost to the smart 'badge-engineered' product. In this case, the Audi marque could rapidly sink to the level of its more price-sensitive commodity competitors as its ability to sustain a premium position evaporates. Therein lies the real difficulty for the VW (and other aspirant 'marque specialists'), whose very roots are in the mass production where overall cost efficiency will be a key influencing factor on outcomes. In such a 'supply push' environment, there is a real chance that the voice of the customer will be missed.

- the lessons for BMW in VW 'marqueting'?

The risks of VW's approach to cost-effective product development face BMW also. BMW, whose position has remained firmly in the premium sector so far, faces the same risk with the re-creation of its marque acquisitions of Rover, Land Rover, MG, Mini *et al.* Essential marque characteristics could be lost through the imposition of an

over-convergent, internal cost-driven philosophy which may disable each of its brands from establishing and maintaining their own premium customer following - the opportunity for the BMW Group - and create competition between BMW Group marques and, worst of all worlds, dilute the standing of the BMW marque itself.

It is the published position of the BMW Group to remain firmly in the premium market, specialist producer camp. It does not seek to move its 'own' brand, downmarket - BMW aims to continue to position itself in the upper reaches of each of the sales sectors in which it currently stands - with its smallest executive product being the 3 Series. At the same time, it recognises the need to be represented in other sectors of the market, previously unmanned by the Group, in front wheel drive vehicles of comfortable character with its Rover range - focusing on creating a *premium niche* in the medium-sized car market segments; the new Mini is targetted to create a similar premium niche in the 'super Mini'and small sporty car market; Land Rover will (continue to) represent the group in four-wheel drive, off road markets. Complemented with BMW Motor Cycles, each marque would be seen as an entity in itself, each with tangible differentiating characteristics such as BMW rear wheel drive with race-bred engineering, Rover front wheel drive and occupier comfort, and Land Rover on and off road versatility. BMW recognises the problems of global motor industry over-capacity but believes there is a place for a small nimble supplier of differentiated products. Eberhard von Kuenheim, now the chairman of the Group's Supervisory Board answered Horst Moennich's question - 'And what about over-capacity which by the year 2000, will have reached 30% throughout the world?' - with:

"This has existed for years amongst all manufacturers who offer products similar to each other. Manufacturers with the capacity to give their products an *unmistakable* identity are not affected by it."
(**Moennich, H.** *The BMW Story: A Company in its Time* (1983, 1987). Translated, Bastow A. & Henstow W. London: Sidgewick & Jackson, 1991, emphasis added)

Let Volkswagen and Ford beware. For BMW, time will tell whether any compromises will be made of the sort which are driven by VW's platform strategy - though given the differences in basic vehicular technologies presently employed across BMW Group, any fundamental engineering harmonisation plans would take well beyond the millennium to deliver. In VW's case, the die of the platform strategy (with its inherent risk of loss of real marque differentiation) is cast for the foreseeable future and the results, in terms of building a new 'up market' place for VW, Skoda, and Seat (relative to where each stand currently) whilst leaving Audi as premium marque in tact, remain to be seen. I remain convinced that customers, especially those buying the more profitable premium products, faced with increasing restrictions on use and an ever increasing level of apparent variety, can be hood-winked by clever marketing for only so long. In the long run it will be the attractiveness of the 'substance' of difference that will count in the long run.

- *Maintaining and constraining momentum?*

As we have seen above, whilst individual motor manufacturing companies are adopting slightly different mixes, the core of the industry is still mass production and mass marketing-driven. Even those players with specialist operations within their fold of marques rely extensively on flowline production disciplines which are excessively internally-focused, and heavily into accounting practices which are standard cost management and capacity utilisation-based. Concentration on these internal disciplines, to the exclusion of real customer demand, perpetuates 'supply push' mentality which underpins commodity markets where volume and price are the predominant exchange determinants. In such markets, no matter how much is invested in the part application of techniques such as 'just-in-time', 'levelled production', 'batches of one' and other manufacturing flexibilities, if the underlying operation is run on mass production principles, the likelyhood is that laid down capacity in the short/medium run will be filled with unsold stock orders to absorb sunk investment cost regardless of real customer demand. The adoption of truly 'lean' operating principles the spur of which is the pull of customer orders remains an unlikely event for the industry at large. Add to this the now chronic invocation of governmental economic support to either maintain or develop new car production capacity to

preserve or generate jobs, again regardless of the overall demand level, and you have market which is anything but 'free', where each player will inevitably seek to optimise his own at the cost of the whole system. Thus, the risks of creating excessive automotive waste through continuing to maintain existing and develop new capacity have never been so exposed as they are at the dawn of the fifth generation of the car and its industry.

In the Times on 4th January 1999, the following article appeared which illustrates the difficulties in which the industry finds itself:

"Nissan tipped to link with rival

by Our City Staff

"Nissan, the troubled Japanese car maker, is reported to be close to announcing a tie up with one of its biggest Western rivals. It is known to have held talks with Renault, Daimler-Chrysler and Ford for several months, and could unveil an agreement with one of them by the end of the month.

"Experts believe that any such deal is likely to fall short of a full merger or takeover. Instead, it is expected to involve sales and distribution arrangements and some sort of collaboration over the development of new models.

"Reports yesterday suggested that the Nissan car factory in Sunderland, which recently came top of a European productivity league table, could benefit by being adapted to produce more than one car marque. The plant which has operated since 1986, and turns out some 280,000 Primera and Micra cars a year, employs 4,300 people and is poised for expansion.

"An alliance between the debt-laden Japanese group and one of its rivals would be just the latest deal in an industry that is beset by overcapacity and poor profitability.

"Daimler-Chrysler, which has for some time been in talks to acquire Nissan's truck manufacturing arm, is itself the product of the recent $92 billion (£54 billion)

marriage of Germany's Daimler-Benz, which owns Mercedes, and Chrysler of the US."

(The Times, *Nissan tipped to link with rival*. London, 4th January 1999)

Footnote: This rumoured consolidation subsequently came to nothing. Renault, Nissan's other suitor, has now formally announced plans to buy a 30% stake in the Japanese company.

Such arrangements are not new, BL was assembling Hondas alongside its own car products at Longbridge in the early eighties, Mazda assembling Fords in Japan in the nineties, even new plants have been built with such collaboration in mind - Volvo and Mitsubishi assemble S40s alongside Carismas in Holland - nor have they solved the problem of over capacity. Nissan also has already been involved in joint product and production developments - the small 4 X 4 clones, the Nissan Terrano and Ford Maverick were jointly developed and now built together in Barcelona, Spain. It was also Nissan which coined the phrase, 'SOMO' or 'Sell One, Make One' (stalking its larger Toyota competitor) to encapsulate its lean, customer-driven operational philosophy in the early nineties - nevertheless, as the above article demonstrates, the pressure to fill its laid down capacity with production is a significant driver which, in turn will lead to the creation of waste - excess unsold stocks and the like.

It is worth noting that in 1997, western European car manufacturing capacity alone was over 20% under-utilised - **(KPMG European Automotive Practice Report.** *Europe on the move.* Birmingham, UK: KPMG, September 1998) and all this in a world where capacity is still climbing (witness the latent potential at Sunderland mentioned above) though overall world new car demand in 1997 remained stubbornly around the 1989 level of 36 million vehicles per year (KPMG, 1998) despite forecasts in the late eighties suggesting that it would grow to nearer 50 million by the year 2000 (forecasts from Massachusetts Institute of Technology Auto Program, quoted in **Altshuler, A. Anderson, M. Jones, D. Roos, D. & Womack, J.** *The Future of the Automobile.* Mass: MIT Press, 1984).

Equally, car ownership levels were forecast by MIT to grow from just over 400 million cars in 1990 to 540 million in 2000, against which the reality in 1995 has been calculated at 493 million (Source: Society of Motor Manufacturers & Traders, 1996). Over the period to 2006, world new car sales are forecast to grow from their present level to over 40 million. However, these forecasts must remain far from certain since within them US and western European demand (and supply) levels change little over the period, a reflection of the maturity of their largely replacement-driven markets, with the key sales growth assumption in Asia-Pacific local production capacity re-absorbing much of the demand making a come-back following the economic problems of the last two years (**KPMG European Automotive Practice Report.** *Europe on the move.* Birmingham, UK: KPMG, September 1998).

Despite this somewhat conservative industry-based view of the automotive future, the potential outcome of sustained capacity maintenance and development policies in the saturated markets of the US and western Europe together with the growing spare capacity in Asia-Pacific (both already existent in Japan and Korea and newly-developed in China and India) and an overall increase in automobile life expectancy will tend, in the shorter term, to force more cars into use through the desire to absorb fixed manufacturing cost (including labour), and, as a result, create more problems of use - pollution and greenhouse gas emission, with more congestion, more and longer journeys and other adverse effects of increased car ownership and use.

In the longer term, however, it is difficult to see how the mounting volume car capacity can be sustained with not only the returns from such investment becoming ever more marginal (especially for the commodity suppliers and despite government subsidy), but also mounting urban consumer resistance to paying what are perceived to be premium acquisition prices and running costs for a commodity good which is becoming progressively less able to support its prime use. Thus, the absurdity of conflicting governmental objectives designed to further increase car ownership and access whilst, at the same time, regulating against parking and use by the vast majority of its owners who have grown dependent on it to support their lifestyle have drawn increasing criticism from the environmentalist lobby over the last decade.

It is difficult to see how this artificial position can be sustained over a protracted period of time. At the same time, the regulation-responsive focus of the industry at large on moving (slowly, steadily, if not *progressively*) towards an environmentally-friendly vehicle, 'clean' and 'economic' in its production and use, propelled by 'alternative' fuels, its life extended through 'recycling' is being complemented with cooperative research programmes into 'telematic' systems which aid traffic flow and facilitate charges on use. Whilst corporately 'responsible' at surface level, such measures are inevitably wide of the mark in terms of tackling the underlying problem of sustaining an ever-increasing vehicle population. After all, the competitive constitution of each industry player is to ensure an acceptable return (for the shareholder) through growing the market for its product wherever possible. The massive investment in the existing technology of the product and its manufacture makes it difficult, if not impossible for most players to contemplate and execute a controlled commercial withdrawal and re-establishment elsewhere. Their competences are so bound up with the car that they are blind to the developments (both opportunities and risks) of the transport industry they are in. Acceptance of lower sales potential for most industry 'commodity' competitors, whose operations are founded on mass production and the 'economies of scale', is inconceivable over the long term - given the choice, turkeys would not vote for Christmas or Thanksgiving for that matter. Thus, a 'shake out' in motor commodity product suppliers seems inevitable with the battle lines for survival already drawn between the American Big Three (including Daimler-Chrysler), Japan's Toyota (not forgetting the infeebled Japanese number two, Nissan), and a whole host of other large 'national' players struggling to become 'global'- VW, Renault, PSA, Fiat. To these, add the more specialist operations, led by BMW, Volvo (and possibly Honda?) whose strength and future must lie in their continued premium product (and product-related service) differentiation. The threat to these relatively small operations must come from the commodity player-owned or -cloned premium marques (Jaguar, Audi, Mercedes) which could sap the strength of these smaller exclusive brands which do not (and should not if they are to remain truly 'exclusive' marques) have access to the same 'economies of scale' of the larger operations, at the same time they represent

potentially rich marque pickings for takeover or merger - the risks and opportunities across this divide have already been discussed. Even as I write this paper, the rumour mill grinds on about further commodity-player led consolidation in the industry, albeit rumours they are, refuted by the specialist players and 'neither confirmed or denied' by the commodity-based multi-national involved:

"Bid fever grips car industry
by Christine Buckley,
Industrial Correspondent

"Bid fever shook up European motor industry stocks yesterday on repeated rumours that Ford is attempting a three-way link with BMW and Honda and on speculation that Fiat, Volvo and Renault may join in the consolidation in the sector.

"With motor industry gossip going into overdrive during the Detroit Motor Show, shares of BMW jumped more than 5 per cent in early trading before falling back later when both BMW and Honda denied the existence of talks. Ford refused to confirm or deny the speculation. BMW shares closed 1.2 per cent higher at Euro699.

"Analysts believe that while the link of Ford, Honda and BMW would be the dream company as the industry is poised for consolidation, it could remain just a dream. Although a takeover by Ford has been touted, industry experts believe merger agreements are more likely.

"Ford has a market valuation of $72 billion (£44 billion) with about $22 billion in cash while Honda is worth $65 billion and BMW $23 billion. Both potential target companies could be expected to attract bid premiums as they are regarded by many analysts as the best in their countries. With rumours of a tie-up between Nissan resurfacing, Renault shares closed up 1.46 per cent in Paris at Euro 42.50."
(**Buckley, C.** *Bid fever grips car industry.* In The Times, London, 6 January 1999)

This was followed by the following editorial comment in the same 'Times' edition (6th January 1999):

"Motor shows are expensive ways of creating a little excitement. Why else should they be draped with so many posing females, clad incongrously in swimsuits and feathers instead of sensible suits and driving shoes? And no wonder that such cabaret distracts from engine capacity and sends imaginations into overdrive.

"That seems to have been happening in Detroit, from where the latest batch of motor industry merger stories is emanating. Yesterday's story had Ford in macho mood, sweeping up Honda and BMW. The details of the mechanism by which this would be accomplished were as scanty as the traditional motor show costumes, but the idea, despite being played down by those concerned, has dream appeal. The tri-partite get-together would create a truly global group at a time when, in every industry, that much-bandied label is becoming a reality."

Whether or not this wave of speculation comes to fruition, the principle of consolidation still goes on unchallenged though not unqualified. As Bronwen Maddox put it in the Times on 7th January 1999:

"It is a good reminder that even if the predicted mega-mergers take place, they may not lead to rapid cost cutting and easing of overcapacity that the industry's hordes of management consultants would like to see.

"That is particularly true given the sensitivity of Europe's new centre-left governments to the threat of rising unemployment as the continent's growth slows. The political importance of car manufacturers remains: mergers predicated on huge job cuts may prove hard to agree.....

"More mergers will take place, until the industry's grotesque overcapacity shrinks. But as Daimler-Chrysler shows, the profits from those deals will not flow automatically. Nor, even if they follow the transatlantic model of Daimler-Chrysler,

do they buy themselves a cheap bridge across the notorious ocean of differences between Europe and the US."
(**Maddox, B.** Single currency offers no easy route to European car market. In The Times, London, 7 January 1999)

In such a world, the acquisition of the few small specialist players left with the prize of their marques must still remain an objective for larger commodity players with specialist marque clones such as Ford and Volkswagen. What is surprising is that neither GM (apart from its half-hearted absorbtion of Saab in the mid nineties) nor Toyota have figured thus far in this global consolidation debate. Though in Toyota's case, its 'lean' expertise, 'designed for assembly' products, and its often sub-contracted local manufacturing approach, put it in a prime position to exploit the developing markets where simple-to-assemble commodity products are (and will continue to be for some time) the order of the day. As I have stated above, there is no reason to believe that the moves to consolidate and at the same time exploit the images of marque will deliver enough real product differentiation to maintain the interest of a discriminating customer prepared to go on paying a premium price (not just for the good itself, but for its day-to-day use) for what is an over-hyped commodity at heart.

However, the clamour for action to constrain the advance of the car (and its usage - its prime function!), notwithstanding the economic problems faced by its industry seems certain to grow with its centre of gravity shifting from concentration on the adverse environmental effects of the individual car to that of its aggregated use. In 1999, the confident statement below of Altshuler at al in 1984 on the future of the industry now looks to be very wide of the mark at the turn of the century:

"The automobile has made peace with a number of its most vociferous critics in the 1970's. Reductions in emissions, improvements in safety equipment, agreements in many countries to share the proceeds of auto taxation with transit systems and other travel alternatives, and the growing perception of the economic importance of a

healthy auto industry have largely defused the political forces that once threatened to constrain the automobile." (op cit 1984)

This shows very much the level on which the debate rested at that time. However, in industry terms, it *still* reflects the conflict which still exists between the environment and economics with the continued focus of the industry on individual car-borne technical solutions, often regulation-backed, with an acceptance that some form of integrated transport infrastructure needs to be encouraged by regulators backed by tax-based instruments. However, at the same time, there is still an over-riding imperative to recognise the importance of a healthy (that is *economically* healthy) motor industry. It is this conflict between economics and environment which now lies at the heart of the issue.

- *From 'the car's the star' to 'bete noire'?*

So, how and why has environmental regulatory policy developed over the 4th generation of the car and its industry and how has the industry responded to these initiatives? Also, given the government-supported economic (if not social) policy to, on the one hand, preserve if not develop automotive manufacturing capacity through subsidy - in defiance of basic economic 'law' where competition weeds out inefficient plants and manufacturers, and on the other regulate against the side effects of car usage, what policies are being pursued by the industry to ensure their survival and what implications have they for the larger economic and environmental landscape?

As we reach the end of the fourth generation of the car, a great and divergent transformation is taking place in our attitudes towards it. Once the great personal liberator and societal leveller, on the one hand it now increasingly takes on the role of representing the characteristics of its owner (or driver) - from the city 'toff' to 'Ronnie the rep' and 'Dell Boy' - whilst on the other, the negative effects of the car population on society without and driver within have never before been so evident, and never more widely and effectively promoted. There is a paradox where the car (and its intensive marketing) continues to pander to the personal fantasies of freedom of expression of its aspirant or actual owner or driver at the same time as its

disadvantages can no longer be ignored by drivers and bystanders alike. A rise in the most unlikely of alliances has emerged with the 'nimby' landowner siding with the green activist to prevent (albeit unsuccessfully) motorway development taking place at Twyford Down, whilst the car-owning, affluent citizens of Newbury side with the road transport lobby to secure a by-pass against the environmental campaigner to restore traffic-free tranquillity to their market town home.

The adverse effects of modernity, its creation of waste and pollution, represented by writers such as Vance Packard in the late fifties and early sixties, have given way to a much greater global environmental awareness in the nineties - with the car moving to very much centre stage. Car ownership or access may be seen as a material necessity of life by the many, but it now tweaks their environmental conscience and leaves them wondering whether it is a necessary evil rather than good. So effective has been the orchestration of the environmental debate that it has engaged the attention of the regulator - though, as we have seen, governments too are facing the conflicting demands of the sciences of ecology and economics and are trying to have their personal transportation cake and eat it.

This ambivalence of response has not been lost on those groups who are trying to elevate the private transport regulation debate.

"One might expect the Government to have taken on the role of coercion and to have constrained the rise in road transport. By and large, however, this has happened only to a limited extent. The Government has rather attempted to pass back the reponsibility for the control of environmental pollution from road transport back to the users themselves. A striking example of this is the attempt of the Government to encourage road users to leave their cars at home on high pollution days. But the Government's actions are fashioned by a fear of alienating particular groups of supporters. Moreover, the Government is operating under budgetary and ideological constraints which limit its behaviour with regard to transport policy. Private transport embodies the major themes of the current (arguably any 'democratic') administration: individuality and freedom of choice."

(Maddison, D. Pearce, D. Johansson, O. Calthrop, E. Litman, T. & Verhoef, E. *Blueprint 5: The True Costs of Road Transport.* London:Earthscan, 1996, comment in parenthesis added)

Such pleas for 'common sense' tend to fall on deaf ears - likened to an environmental tragedy of the commons:

".....Hardin describes a situation in which each member of the community is allowed open access to a common resource (which could easily be road space), but in using the resource dissipates the available benefits. Some form of restraint would improve the well being of the community as a whole, but individual restraint is not compatible with rational self interest, at least while any other member of the community reserves the right to use the resource (i.e. drive on it) as much as they choose. To attain maximum benefit from the resource requires government intervention. Thus, the massive growth in road transport does not endorse the desirability of mass private transport but merely reminds us that in many instances self restraint is not compatible with self interest. The massive use of the road network is not a vote for the status quo." (op cit 1996)

The increased share of voice achieved by the environmentalists has come about over a protracted period of an entire generation and reaction to it by the motor industry and government has only slowly developed.

- *Regulation bites slowly - after safety, a breath of fresh air?*

As we have seen in the third generation, it was the USA that had first taken a regulatory stand on auto safety with Ralph Nader focusing the American public's attention on the issue, successfully putting the industry in the dock and securing the support of government. It was also in the sixties age of protest that the US state of California, faced with chronic west coast smogs, first took an active regulatory interest in the pollutant emissions from cars. This initiative was taken up by the US Federal authorities which led to the US Clean Air Act being signed by President Nixon in December 1970. This move was not without controversy, however:

"Past federal regulations required relatively low cost equipment, such as seat belts, with benefits that were apparent to the average consumer. The Clean Air Act called for costly equipment that many car buyers did not like.

"Industry officials also protested that Congress set emissions limits and fuel economy goals based on dubious data and without regard for the industry's ability to meet them.

"But such arguments held little weight against the rising tide of public opinion. President Richard Nixon endorsed the goal of mandating a 90 percent reduction in auto emissions."
(Automotive News, *100 Events that made the Industry*, Vol. 2, June 26, 1996)

However, even though the US led the way, prevarication by the industry in particular and the US in general saw the implementation of the goals spread over a number of years with their achievement only coming in 1981. On the one hand, it was argued that the technology did not exist to meet the objectives in the timescales envisaged - a divergence of approach became apparent between GM (who favoured catalyst 'end of pipe' clean up technology) and Chrysler and Ford (who worked on the development of 'lean burn' engines which used less fuel and consequently emitted less pollution). The road to making the regulation happen was further complicated by US Anti Trust Law being invoked to prevent the Big Three working together on the problem after Chrysler's plea that working separately imposed an unfair burden on the less financially secure companies (i.e. Chrysler themselves). Ultimately, these exchanges led Senator Edward Muskie to remark that Japanese and European companies " have contributed more to the protection of America's health than have GM, Chrysler and Ford." (op cit, Automotive News, 1996).

This episode illustrates some of the problems in making regulation rapidly stick. The industry with its investment in the status quo is interested in avoiding major structural change; appropriate innovation (such as lean burn technology which has a more

significant impact on the root cause of the problem, i.e. fuel consumption) tends to lose out to add-on 'clean up' technologies (the catalyst being a good example where emissions are reduced at the cost of less engine efficiency and poorer fuel economy but the investment in basic power train technology is protected). In the end, it was the intervention of 'outsiders' - the Japanese and the Europeans (the Germans, most notably) who saw the market opportunity that awaited those leaders who were prepared to make a quantum leap in research and development which left the US industry laggards with no alternative but to respond to external forces.

So it could be argued that eventually, 'market forces' rather than governmental regulation provided the impetus which brought about 'progress'. This distinction has been made more recently by Peter Hughes (**Hughes, P.** *Personal Transport and the Greenhouse Effect.* London: Earthscan, 1993) where he discusses three ways of making headway on the motor transport pollution issue, which has now moved beyond the suppression of scientifically-recognised 'noxious' emissions (lead, sulphur and nitrogen oxide and carbon monoxide-based) through catalyst technology into the control of the once-thought harmless greenhouse gas emissions (such as carbon dioxide and low level ozone).

The greenhouse gas emission argument once again focuses on not just general fossil fuel economy of the individual vehicle, but the growing number of greenhouse-gas emitting vehicles in use. So, the resolution of the current problem through in-car technology alone can only be successful if the technology is capable of reducing the aggregated output of gas from a growing car population. The addition of this new, still hotly disputed, dimension to the environmental debate is a bitter pill which threatens the fabric of the motor industry itself since the maintenance and, what's more, development of the global car fleet is the core of its corporate agenda. Whilst it can work on technologies which use less (or no) hydro-carbon-based fuels, it (and its related service infrastructure) has such an investment in the use of such fuels to propel its customers, that, with its current parc of vehicles in use, dramatic, short term progress on greenhouse gas reduction seems unlikely without the imposition of some sort of regulation which limits use.

- Hughes three environmental 'policy levers' - regulation and the letter of the law

Peter Hughes argues that there are three 'policy levers' which can be tuned to affect the greenhouse gas outcome (op cit 1993). The first is that of regulation whether applied to the producer or the consumer which he sees as having a place but not necessarily giving the best leverage on the problem in hand:

"They (regulations) tend to demand the same action from all the parties regardless of the cost incurred, and may be seen as an inequitable means of achieving environmental targets (the position of Chrysler in the above regulatory discussions as a producer and of those drivers of older, smaller cars without catalysts bear witness to the difficulties Hughes suggests)."
(op cit 1993, comments in parentheses added)

He goes on:

"For example larger companies are often better placed to respond to new regulations than smaller ones (I would argue the opposite, often the largest businesses in the field concerned have the greatest interest in maintaining the status quo - witness GM and their backing of the catalyst rather than lean burn engine). Similarly, a catalytic converter imposes a proportionately larger cost penalty on a cheap car than it does on a larger, more expensive model (I would argue that a catalytic converter imposes not only an unnecessary cost burden on a small, fuel economic vehicle but also makes a fuel-economic power unit less efficient as a result)."
(op cit 1993, comments in parentheses added)

He makes a further point, again which is symbolised by the outcome of the air pollution debate of the seventies above:

"Regulation can also tend to discourage technological innovation, as they are often set on the basis of what existing technology can deliver, rather than on the standards that competing companies might achieve given the incentive to apply the full weight of

their technological expertise (the side-stepping of the lean burn engine and insistence on the 'quick fix' of the catalyst is an example here - and now, albeit that the catalyst is a regulatory requirement in most of the developed motor markets, lean burn fuel efficiency is now recognised as the more powerful, if not appropriate technology to bring down individual vehicle greenhouse and even noxious gas emissions whilst hydrocarbon fuel remains the car's power source)."
(op cit 1993, comments in parentheses added)

As a result of these pressures, such regulation always tends to be more prone to dilution and compromise in favour of a more 'step by step' approach which is favoured, albeit 'reluctantly' by the producer. Standards set are the minimum to achieve consensus and the least (economic) risk. Despite the reluctant support for regulation of this type from the industry, being compelled to react makes the cost justification for investment in meeting the standards easier, though insiders will always argue against regulation in favour of 'letting the market decide', which is where Peter Hughes' next policy lever fits - that of the 'market-based instrument' (op cit 1993) which reinforces the need to act in an environmentally-friendly way through the application of 'carrot and stick' tax-based incentives and disincentives.

The following quotation from a GM executive at the beginning of 1998 illustrates the difficulty of the ground on which the industry stands in relation to the subject of the environment and environmental regulation.

"As a company, we are committed to environmental leadership around the world in the development of our facilities, and we will continue to use our unique talents and our international scope to promote global sustainable development. We part company, however, with those who believe that rigid, binding government-imposed targets are the answer.

"We have learned that technological innovation doesn't punch a time clock. The Kyoto agreement fails to incorporate the flexibility we must have, to meet the much lower emissions levels it requires, without severe economic disruption to society.

"Today, some of the best selling vehicles in America today are those with large engines and less fuel efficiency; while the US, with only five percent of the world's population, accounts for 22 percent of the industrial emissions of greenhouse gasses. Larger, higher mass vehicles and low energy prices seem to best meet the demands of the current market, but they also conflict with the market's demand for what we might call 'environmental correctness.'

"GM's challenge is to meet both demands. Our new full-size pickups, the Chevy Silverado and GMC Sierra, along with their full-size sport utility derivatives, will make up more than 1.2 million units a year. They are equipped with a more powerful engine, which customers want, but also offer improved fuel economy in the market segment. (*Mental Note*: The Chevy and GMC Trucks referred to have 4.3 anf 5.7 litre engines giving fuel consumption rates of between 13 and 23 mpg!)

"Government cannot and should not dictate the market despite consumers' obvious inconsistencies, even in the name of environmentalism. Our job is to satisfy the customer. Government has a different job. It must provide the enabling framework for the market to succeed.....

"In the end, however, corporate responsibility and innovation, not government regulations, will find the answers needed to protect the environment, and in the process, business will prosper from having done so."
(**Pearce, H.J.P.** *Global Climate Change - A complex issue requiring innovative solutions and a balanced approach.* From a speech, Automotive News World Conference, Detroit, Michigan, 12th January 1998, reprinted by General Motors, comments in parenthesis added)

- Market-based instruments - incentives to perform better - encourage the best, make the polluter pay

The second type of regulation policy, Hughes (op cit 1993) terms the 'market-based instrument'. Such tools, like regulation, can be applied to the producer or the

consumer. They are 'persuasive' rather than absolute in their effect - there is no black and white of violation as such - in this domain of regulatory law, rather the producer or consumer is encouraged to change their 'lifestyles' and adjust their consumption and/or pollution as a result. Environmental measures such as these could seek to rebalance the cost of supporting particular pollutative behaviour so that something more like the true cost of, say using a car as opposed to using a bus or train, is supported by the more 'selfish' car user. Whilst the construction of a market-based instrument can attempt to 'play fair' by, for instance, reflecting 'real' cost, equally the instrument can be a blunt stick which imposes stinging taxes on the use of the car without ploughing back such revenue into improving transportation infrastructure - a classic complaint of driver and transportation lobbyists for many years. Hughes believes to have a positive effect on producer and consumer attitudes to such tax-driven measures, it is advisable to 'reward' more 'sensible' use/lifestyles - offering a carrot to those who do change as well as a stick to those who do not. Thus, by offering subsidised, low cost fares to those who use the trains as well making a charge on those who do not (or cannot) change their car-borne mobility - in such ways, demand can be re-managed on a 'fiscally neutral' basis (op cit 1993). Equally, from a supply-side point-of-view, instruments can be put in place which force the polluter to pay, tax incentivises the 'clean' supplier, who has invested in newer, more environmentally effective manufacturing, service, or product-related developments; such a mechanism could be applied either directly through tax, or indirectly in support of another regulatory instrument which allowed manufacturers to exceed their pollutant quota through the purchase of a 'tradeable permit' (op cit 1993) allowing one polluter to exceed his limit through the acquisition of a balancing environmental credit earned by another company.

It should be recognised, however, that the effect of such instruments are rationing-based. Whilst, it could be argued that these mechanisms make the polluter pay, there will also be the counter argument that they penalise the less well-off with less flexible lifestyles whilst, at the same time, are less of a concern to those in the best position to pay, either for themselves or through the provision of a business 'perk' (often, equally, it is these individual polluters who are in the best position to change their

lifestyle but choose not to). Such democratic appeals are likely to fall on deaf ears, however, with the UK (and most northern European) government(s) seeming intent on increasing the use of such measures, whether it be in terms of metering road use or charging for the use of company-provided car parking spaces. John Adams also sees problems with such a simplistic approach:

"The human scale of settlements is *everywhere* threatened by the growth in car dependence. It is a process in which humanity appears to will the means, but not the ends; opinion polls have established that all around the world most people want cars, but it is far from clear that most people would wish to live in the sort of world that would result if everyone's wish were granted.

"Urban congestion is the main target of most transport planners today. Congestion wastes both time and energy and adds to pollution. The favoured solution to this problem is electronic road pricing. It is now becoming possible, with clever technology, to charge motorists for the use of specific roads at particular times of day. If the charges are properly set and if, when collected they could be directed to improving public transport then, it is argued, everyone will benefit. One of the main advantages claimed for this approach is that it can be aimed accurately; it imposes charges only where they are needed in congested urban areas, not, it is usually added, in rural areas.

"This is a diagnosis and prescription that politicians with rural constituencies find attractive. It would be unfair, they complain, to increase the cost of motoring for those who need their cars because there is no public transport alternative. Both this diagnosis and prescription, I shall argue, are myopic. *The cost of car travel in rural areas should be increased substantially."*
(**Adams, J.** *Carmageddon*. In *Town & Country*, Barnett, A & Scruton, R (Eds). London: Jonathan Cape, 1998)

Adams point is that the main population drift from town to country is caused by those who choose but do not have to live there - rural commuters are a key cause of the

urban congestion as they continue to work and play in the city, whilst living in rural bliss. Many urban dwellers do not need to be encouraged to leave their cars at home when a suitable means of public transport is normally at hand. It is those who live at and beyond the city's outer limits who very often commute the longest distances and complete the most complicated journeys by car. In Adams eyes, it is these commuters whose lifestyle needs to change the most, whose lifestyle is likely to be most stalwartly defended and whose articulate voice of protest is most likely (and unjustifiably) to be heard.

- *Making it better through investment in environmentally-friendly product and infrastructure technologies*

To be fair to Hughes, he uses 'investment' in the narrow sense to reflect direct government investment in public transport infrastructure - whether it be in improved rail or road networks or the mass transit vehicular capacity to support an improved level of service or greater level of capacity. The recent direction given to the Highways Authority by the H. M. Government to come up with new ways of improving flow of traffic through new control technologies to enable an increased volume to the power of four to be carried by the existing and firmly planned road network would be seen as an investment in Hughes' terms. Policies which inflate travel capability through better demand management are not generally popular with the 'green' lobby which has fought with some measure of success to ensure that the UK roads programme is not upgraded to meet traffic demand.

In a wider context, however, under a predominantly modernist philosophy, technology has and still is always seen as a powerful force for progress (and management control). Much faith has been, and still is, placed in technology by the industry (a glance through any one of the major players annual or environmental reports will confirm this), by governments (the latest H M Government's Integrated Transport White Paper - 1998 contains a generous slice of technological solutions), and by the buying public, if not to offer a complete solution to the traffic congestion, at least to alleviate its worst effects. Though as pointed out above, the industry investment in its current internal combustion engine-based technology, its means of mass production

and its existing service support infrastructure will mean that technological progress is more likely to move at more evolutionary than revolutionary speed, prompted to act by public outcry backed by more formal regulation. The GM executive's belief in the customer dictating the pace of change (op cit 1998) is misplaced when the alternatives are so heavily disguised as possibilities for the future quite detached from today's realities to protect the status quo. Research into alternative propulsion technologies (electricity, diesel/battery hybrid, LPG and hydrogen) will continue to play a part in the R & D programmes of manufacturers - though they will argue that take up will only be secured by customer acceptance and such acceptance will be steered by governments. Indeed, whilst the hydrogen propulsion favoured by BMW may be the cleanest of all - with only water vapour as an output - there is still the question about safety within the vehicle (which is not insurmountable) and more important and bigger problem without of it - the provision of a safe, alternative service support infrastructure, 'gas' stations and the like is not a development cost which the motor manufacturer, government or even the 'bunkering' service provider (the oil companies which presently 'own' the support networks involved?) would seek to support without a satisfactory return being available. As fossil fuels become more scarce and their price rises, such a 'distant' possibility may be worthy of consideration - though all the short term signs are that demand for oil in the short to medium term look 'soft' as economies of use are enabled through improved engine efficiency.

In this enclosed environment, the industry's focus has been on the development of in- and on-car gadgets which will reduce air pollution, noise, greenhouse gas emissions and make the individual vehicle 'cleaner' on the one hand while developing traffic avoidance and traffic flow aids on the other. This makes life more bearable for the car's occupants and as a by-product offers a potential bonus to other road users (sitting elsewhere in the resulting shorter queue) beyond its immediate technologically-advanced four wheel box. However, evolving individual vehicular 'cleanliness' does not necessarily offset aggregated pollutant output of increased car ownership and use. Whilst traffic levels continue to rise, the problems of interrupted traffic flow through congestion will still be there regardless of the engine technology employed.

At the same time, the improved flow and therefore increasing capacity to travel in the same conduit achieved by smart, on-board traffic management systems might help those motorists who have them, though their beneficial effects will be dissipated by those who do not have them, and increased traffic levels and flow within city limits might well result in an even more seriously disadvantaged pedestrian or cyclist and create higher rather than lower car dependence.

Clearly, some of these burgeoning technologies are complementary to each other, the smart car telematics systems such as DRIVE and PROMETHEUS being co-developed by various European motor manufacturers with government and supra-governmental aid enable the benefits of automated traffic management to be passed on to the motorist (vehicle speed and distance control, positioning, hazard warning, alternative route recommendations etc) and traffic controller alike (traffic level and flow monitoring, automated charging for road use). The fact remains, however, that such automated solutions are very expensive to develop, install and maintain and that each urban authority is charged with controlling its own area through a highly tailored solution to meet local infrastructure needs. Whilst some sort of generic application could be envisaged for national motorway systems, the linking of local urban schemes into national or even international networks and the provision of compatible software to enable inter-city, inter-regional or international drivers to benefit or control to be maintained without universal application is an undertaking of immense proportions, not easily negotiable and unlikely to succeed overall. Some 'smart' telematic measures will no doubt be implemented (experiments are already underway in Munich and Stuttgart), but their take up will only evolve at a local level over a time scale well into and beyond the fifth generation.

In addition to the normal motor industry array of research activity into the provision of more environmentally-friendly cars - alternative propulsion, vehicle recycling, and on-board telematic systems published in corporate environmental and annual reports, perhaps the most evocative proposal has been presented by Toyota (a company of

impeccable internal corporate waste elimination standards founded in the 'Toyota Production System' itself):

"The 'Forest of Toyota' Project

"....As part of its research on reducing urban air pollution, Toyota instituted the 'Forest of Toyota' project in 1992. The project entails basic research on maximising the environmental benefits of trees. It includes R & D on existing nursery and forestry techniques as well as bio-, eco-, and other advanced technologies. The company is placing special emphasis on the development of technologies that improve the air-cleaning capability of various plants.

".... Toyota also established the 'Foresta Hills Model Forest' near Toyota City in Aichi prefecture as a venue for experiments on environmental improvement and greenery development. The company also set up the 'Adventure Field Wakimiya Model Forest' in Wakimiya, Fukuoka prefecture, where scientists can monitor natural recovery and greenery development. These model forests are ideal for hands-on learning about the natural cycles of nature, and how people co-exist with the earth."

Yasuhiko Komatsu, general manager of the Forest of Toyota project explained:

"We are focusing on plants' natural ability to cleanse the atmosphere.We are developing plants that have a superior ability to recycle air and also researching how to grow these plants in large quantities."
(Extract from **Toyota Motor Corporation.** *Car(e) for the Earth: Toyota Automotive Eco-Technologies*. November 1997)

This project, reminiscent of a John Wyndham science-fiction novel, is to use genetic engineering methods to develop fast growing, pollution absorbent plant strains to absorb some of the pollution that Toyota's primary product creates. This demonstrates just how far a member of the industry is prepared to go in risking a loss of face from cynical opponents.

However, this alternative technology approach may not be as stupid as it sounds - though it is but a very small antidote to the massive global deforestation problem. The principle seems to be gaining ground elsewhere. An article in the Observer on 28th June 1998 reported that car manufacturers, petrol retailers and other companies under pressure to reduce emissions are increasingly under pressure to plant trees. It was stated that three companies, Future Forests, SGS Forestry and the Carbon Storage Trust were competing to plant some 36,000 trees in addition to the 8,000 already underway - Mazda and Tesco were reported to be two of the sponsors involved in the plan. Perhaps Hughes definition of his 'investment' lever could incorporate such developments as the National Forest - though it could be argued that the market-based instrument which makes the polluter pay could divert investment into such areas.

So all Peter Hughes levers are now, in 1998, very much 'business as usual', part of the current political landscape working on transportation in general and the car industry in particular. His approach was very much to focus on the job in hand, to coordinate the use of such levers to meet the required reductions in greenhouse gas emissions by the deadlines set by the national signatories at Tokyo and Rio de Janeiro. He also sees economic instruments and controls playing an important role in changing the modal price paid by the user to reflect a more realistic apportionment of the overall cost to society supporting various modes of transportation. He does not look at the wider environmental and economic implications of increasing dependency on the car (and 'essential' travel) that is an inevitable product of its spreading ownership and use. It is to this underlying case that I now turn.

-the underlying environmental (if not economic) case for a change in direction

Such growing car and travel dependency and the possibility to consolidate into much larger economic units that goes hand in hand with it is changing the not only the environmental but *economic* structure of not just the city, but of regions and nations. These changes, the essence of globalisation, are not just progressive in their impact (though they may be); they can create massive, economic disruption and discontinuity over a very short time frame where the existing local economic framework is in no

position to positively respond to an adverse individual business operational and locational decision in time to offset its adverse impact.

John Whitelegg illustrates the point and not just in relation to the industrial environment of the city where the problems created by personal mobility and car dependence are more obvious:

"Cornwall is a rural county at the south-west extemity of England. It is a long way from the major centres of population in Britain and Europe and policy makers have decided that this is a problem and that the problem has a name - 'peripherality'. Every problem has to have a solution and the solution to the problem of peripherality is to build roads, reduce journey times, encourage more activity and more travel, stimulate tourism and, it is hoped, create jobs. All this becomes part of an even bigger solution to a problem that is never specified, and this particular solution is called 'economic development."
(**Whitelegg, J.** *Critical Mass: Transport, Environment and Society in the Twenty First Century*. London: Pluto Press, 1997)

Thus, he sees that even rural outposts are threatened by this drive to generate economic (and social) activity through mobility. For rural outposts, one could take the establishment of car plants or car component plants situated in 'low cost' economic backwaters, built to support not just the local (or even regional) market potential but a global export market or purchasing policy drive - hardly the customer-focused 'lean thinking' to which Womack & Jones (op cit 1996) would subscribe.

So, what is the compelling environmental case that has set the car's wheels in such a spin and has so successfully exposed the negative impacts of increasing car dependence that regulators have been more actively pulled into the fray? From which direction has it come and in which direction is it going?

As we have seen above, the main thrust of the argument in Generation Four has been mainly a product of the air pollution/quality debate which started in the late sixties

with its development into the greater dimension of global warming in the nineties - this has, up to now, been the essence of the argument that has engaged the mind of mainstream environmentalism (and is the most easily identifiable by the public at large). However, the environmental argument is now being widened by activists such as Whitelegg who, whilst appreciative of its case, has extended his system landscape to include the knock-on socially and economically destructive effects of ever-increasing dependence on improved transportation.

He would argue that the case against the car has come about not just because of its chemically-pollutant effects but also as a result of the voracious appetite of the driving classes for more space (on which to travel and park) and speed (to shorten the journey times and make longer journeys at the wheel viable from rural retreat to workplace or for purely leisure purposes - *i.e. the 'right to roam'*). Though Whitelegg extends the transportation argument into rural or 'undeveloped' (economically deprived) geographical areas, it is recognised that the problems with the car (or the advantages to its user) started in the city. As we have seen from the first generation, the facilitation of personal mobility enabled the city dweller to move out of the inner city and the suburban commuter-belt was born (McShane, 1994). As the car and its supporting infrastructure developed further, it enabled the car user to move further and further out into the rural and semi-rural hinterland to live, leaving the workplace of the inner cities as zones of developing industrial and social decay. At the same time, this increasing access to the car and its supporting road network sparked off the movement of the industrial workplace and latterly a significant proportion of retailing capacity from the inner city to its outer periphery. The car was the crucial enabler of millions of individual worker and shopper journeys; an economically-useful, secondary by-product was the ease of vehicular access granted to the heavier transport needed to sustain these new 'out of town' industrial, retail (and now, 'leisure') developments.

Whitelegg argues that such mobility-dependent centres drain not only the city of its social and economic life but also unnaturally transfer into their geographical sphere of influence the economic and social activity of many other localities which then become

independently unsustainable. In order to prevent such local dislocation (usually after the initial damage has been done), a bit like the nuclear arms race, losing locations are forced to set up their own rival, 'out of town', easily accessable, 'enterprise zones' rather than face extinction - the success of these, in turn, is geared to car dependence also - and so it goes on. Hence 'Cornwall' - faced with economic deprivation and depopulation or development dependent on rapid inter-regional access which then undermines the ability of the locality to sustain itself both environmentally and economically.

As I have said the car, as a mobility product, plays a key part in bringing about these structural community changes. Clearly, if you have no car, you are deprived of the flexibility (and even safety) that it offers to get work and get to it, to go shopping or complete other important domestic 'chores', visits to the doctor, dentist etc - your mobility is at the mercy of unreliable (if existent), inconvenient and expensive public transport, the offer of a lift or a long walk or bicycle ride on crowded (not just urban) roads. However, the disadvantages to the car user are no less prevalent; they are supposedly exposed to worse pollution than those in the open air on the streets; whilst the 'convenience' of the car means they can at least journey directly to work or play, the journey - though short in distance, may take hours in time; and on arrival, the problems of finding a suitable parking place may waste more time and money. On top of this, the noise from the anti-car lobbyists and regulators is such that those for whom access to a car is currently 'essential' to make the criss-cross of daily journeys from out of town or suburban area to industrial estate, to accomodate the 'school run' and other domestic travel arrangements are likely to find costs (as well as frustration) rising as government's policies change to cut car usage, public transport alternatives far less practical and convenient without the expense of moving house or job. And who decides what is an 'essential' journey anyway?

Even the UK Government now appears to be suggesting that we discriminate against certain categories of unnecessary journey already, albeit that :

"We know the issue of the 'school run' concerns many. The concern goes deeper than a wish to reduce congestion by discouraging parents from taking their children to school by car, although the benefits to the morning rush hour would be considerable. Not walking or cycling to school means that children get much less exercise and builds car dependency at an early stage in a child's development.....

"We understand parent's concern about the safety of their children and that for many using a car has become the only way to manage a tight schedule. Our policies will help reduce the need for children to be driven to school by encouraging safer routes for walking and cycling, giving greater priority to public transport and, through our planning policies, improving opportunities to get to work, shops and other facilities without having to use the car."

(**Department of Environment, Transport & Regions.** *A New Deal for Transport: Better for Everyone.* London: TSO, 5.29, 5.30, 1998)

How this quite fits with parental right of choice of educational establishment and the resulting increasing number of 'out of catchment area' pupils being catered for at schools designed to meet local community needs, I do not know.

As such, rationing through some price-related mechanism will hit less 'well off' car users the hardest. The 'executive classes', however, bolstered by their higher disposable incomes, company cars, and expense accounts will be more likely to absorb the increased cost of mobility more readily (though their companies may be less willing to extend such benefits if the cost of supporting the company car, increased through charging for the provision of car parking or road use, cannot be passed on to the user). Paradoxically, it is the same executive classes who will benefit the most from clearing the lower income users of older cars from the roads through pricing regulations - as a result, living beyond the city limits and access within will improve for the rich as the poor are forced off the road, to move back 'in' and use public transport.

Memo:Bill Bryson's experience of the American way of town life

"Now here's a point to consider. Every twenty minutes on the Appalachian Trail, Katz and I walked further than the average American walks in a week. For 93 per cent of all trips outside the home, for whatever distance or whatever purpose, Americans now get in a car. When we moved to the States one of the things we wanted was to live in a town, where we could walk to the shops and post office and library. We found such a place in Hanover, New Hampshire.... Nearly everyone in town is within an easy, level walk of the centre, and yet almost no-one walks anywhere for anything. I have a neighbour who drives 800 yards to work. I know another - a perfectly fit woman who will drive 100 yards to pick up her child from a friend's house. When school lets out here, virtually every child gets picked up and driven from a few hundred yards to three-quarters of a mile home. Most of the children sixteen years or older have their own cars. That's ridiculus too. On average, the total walking of an American nowadays - that's walking of all types: from car to office, from office to car, round the supermarket and shopping malls - adds up to 1.4 miles per week, barely 350 yards per day.

"At least in Hanover we can walk. In many places in America now, it is not actually possible to be a pedestrian, even if you want to be. I had this brought home to me the next day in Waynesboro.....

"Waynesboro had a traditional, vaguely pleasant business district covering five or six square blocks, but as so often these days, most retail businesses had moved out to shopping centres on the periphery, leaving little but a sprinkling of banks, insurance offices and dusty thrift stores or second hand shops in what presumably was once a thriving downtown. Lots of shops were dark and bare, and there was nowhere I could find to get insect repellent, but a man outside the post office suggested I try K-Mart.

"'Where's your car? he said.

"'I don't have a car.'

"That stopped him. 'Really? It's over a mile, I'm afraid.'

"'That's OK.'

"He gave his head a dubious shake, as if disowning responsibility. 'Well, then what you want to do is go up Broad Street, take a right at the Burger King and keep on going. But, you know, when I think about it, it's *well* over a mile - maybe a mile and a half, mile and three-quarters. You walking back as well?'

"'Yeah.'

"'Another shake. 'Long way.'

"'I'll take emergency provisions.'

"If he realised this was a joke he didn't show it. 'Well, good luck to you,' he said.

"'Thank you.'

"'You know, there's a cab company around the corner,' he offered helpfully as an afterthought.

"'I actually prefer to walk,' I explained.

"He nodded uncertainly. 'Well, good luck to you,' he said again.

"So, I walked. It was a warm afternoon, and it felt wonderful - you can't believe how wonderful - to be at large without a pack, bouncy and unburdened....Without, you are liberated. You walk erect. You look around. You spring. You saunter. You amble.

"Or, at least you do for four blocks. Then you come to a mad junction at Burger King and discover that the new six-lane road to K-Mart is long, straight, very busy and entirely without facilities for pedestrians - no sidewalks, no zebra crossings, no central refuges, no buttons to push for a WALK signal at lively intersections. I walked through gas station and motel forecourts, across restaurant car parks, clambered over concrete barriers, crossed lawns, and pushed through neglected ranks of privet or honeysuckle at property boundaries. At bridges over creeks and culverts - and goodness me how developers love a culvert - I had no choice but to walk on the road, pressed against the dusty railings and causing less attentive cars to swerve to avoid me. Four times I was honked at for having the temerity to proceed through town without the benefit of metal. One bridge was so patently dangerous that I hesitated at it. The creek it crossed was only a reedy trickle, narrow enough to step across, so I

decided to go that way. I slid and scampered down the bank, found myself in a hidden zone of sucking grey mud, pitched over twice, hauled myself up the other side, pitched over again, and emerged at length streaked and speckled with mud and extravagantly decorated with burrs. When I finally reached the K-Mart Plaza I discovered that I was on the wrong side of the road and had to dash through six lanes of hostile traffic. By the time I crossed the car park and stepped into the air-conditioned, Musak-happy world of K-Mart I was as grubby as if I had been on the trail and trembling all over.

"The K-Mart, it turned out, didn't stock insect repellent."

(Extract from **Bryson, W.** *A walk in the woods*. UK: Doubleday, 1997)

However, whilst the car has enabled such structural change to take place, the motor industry itself, or parts of it, is playing a part in the creation of such societal disclocation borne out of the two big themes discussed earlier, that of *consolidation* - the ever present quest for 'economies of scale' through the centralisation of production - and *globalisation* - where the establishment of cheaper component parts manufacture and low cost assembly locations is often subsidised to a significant degree by governments seeking to positively influence job creation through 'inbound investment' both directly (through 'development aid') and indirectly (through the provision of an appropriate transportation infrastructure for internal and external distribution, the costs of which are rarely, if ever, supported by the inbound users) leaving existing facilities and their workforces (if not other industries) disadvantaged.

- in sum, what does all this mean for the car and the motor industry?

The 'lean thinking' movement espoused by Womack & Jones (op cit 1996) with its foundation in the customer 'pull' of local market needs, despite its wholist approach to waste elimination, making just what the customer wants when they want it does not sit well with an industry wedded to mass production techniques where the appeal of ever more centralised (automated) production (certainly in the context of assembly) and the need to absorb sunk cost is prevalent. Such operations are more likely to turn

their backs on small batch/run production, supplier villages on-site or within the immediate vicinity of final assembly to an ever more consolidated world which supports large manufacturing plants and distant suppliers regardless of the inflexibility such arrangements impose. The dominant car manufacturing players are driven by commodity supply 'push' - albeit that they have developed a penchant for the acquisition of less commoditised, specialist marques for which they believe they will be able to continue to charge discriminating customers a premium price - for what is essentially, under the skin, a variant of the commodity article which the customer is seeking to avoid. It is these large commodity car players whose colossal structure and market is most threatened in the car generation to come. It is *their* plants in the saturated, developed markets which will suffer as any growth in low cost, motorised (by whatever propulsion system), personal transportation will be provided for in the developing markets themselves - these developments will represent an increasing import threat in the developed, replacement-driven markets of the West (and East for that matter) - what the Koreans have started in the fourth generation, the Chinese, Indians and South Americans will continue in the fifth.

So the pressure on the current global car commodity suppliers, both of competition from within and opposition from without, is set to increase. The question is whether the smaller, specialist players can survive the onslaught from the premium marque-acquisitive commodity providers eager to gild their mass production machine. The best bet for the specialist is to maintain and *build on* their difference, their cutting edge in terms of product *and service*, offering that, richer, more discerning customer, who is most likely to weather the environmental and economic cost storm associated with the future use of the car, a difference which costs more to provide but, above all, *is worth paying for.* This is not yet a forlorn hope - but as the great specialist marques slip under the influence of the commodity players (Bentley-VW, Daimler-Chrysler, Jaguar-Ford etc and more to come?), or as the pressures increase to absorb their own sunk mass production investment cost, albeit that it is applied to specialist products, the risk for the marque specialist mounts. As we have seen, Eberhard von Kuenheim of BMW clearly believes a place for the small independent specialist will continue to

exist despite the problems of over capacity in the industry at large. As to whether the small should fear assimilation into the large, he adds:

"...it is not the big ones who eat up the little ones, but the fast ones who eat up the slow ones."
(**Moennich, H.** *The BMW Story: A Company in its Time* (1983, 1987). Translated, Bastow A. & Henstow W. London: Sidgewick & Jackson, 1991 quoting Eberhard von Kuenheim)

Speed is thus seen as a greater advantage than scale. The slow and unfit for future purpose, small or large, have the most to lose.

So, this is where the industry lies at the dawn of the fifth generation of the car. The essential conflict between the modernist economics of untramelled growth and environmental sustainability are epitomised by the development of the car and its industry. Given this rich background landscape, it is to the exploration of the post millennial possibilities for personal mobility that I will now turn. I will bring into this developing picture some of the elements which are already in existence - for example, recycling - as yet not covered in the paper but for the future, the concept of 'cradle to grave' responsibility for the product could take on a meaning which bears little resemblance to its current regulatory 'obligation' on the industry, a meaning where sale of the vehicular product becomes the exception rather than the rule, with its 'ownership' remaining in the hands of the supplier which sells access as required. This is one possibility which will be discussed in more detail below and which emerges if we consider the car as a (diminishing?) part rather than the whole personal mobility solution.

The developing car journey which has emerged over the past four generations of the car in all its forms has some parallels in biology, where there is some confusion between diversity and disparity. Steven Jay Gould makes the point about the difference between the two terms:

"I must introduce at this point an important distinction that should allay a classic source of confusion. Biologists use the term 'diversity' in several different technical senses. They talk about 'diversity' as the number of distinct species in a group; among mammals, rodent diversity is high, more than 1500 different species; horse diversity is low, since zebras, donkeys and true horses come in fewer than ten species. But biologists also speak of 'diversity' as difference in body plans. Three blind mice of differing species do not make a diverse fauna, but an elephant, a tree and an ant do - even though each assemblage contains just three species....

"When I speak of decimation, I refer to reduction in the number of anatomical designs for life, not numbers of species. Most paleontologists agree that the simple count of species has augmented through time - and this increase of species must therefore have occurred within a reduced number of body plans....

"Several of my colleagues have suggested that we eliminate the confusion about diversity by restricting this vernacular term to the first sense - the number of species. The second sense - difference on body plans - should then be called disparity. Using this terminology, we may acknowledge a central and surprising fact of life's history - marked decrease in disparity followed by an outstanding increase in diversity within the few surviving designs."
(Gould, S.J. *Wonderful Life: The Burgess Shale and the Nature of History.* UK: Hutchinson, 1989)

On this basis, could it be argued that at outset, there was a high level of disparity - real difference between cars, many makes, each part for each car tailor made and therefore different? Even when Ford arrived, whilst his mass production techniques secured identical parts in large batches, it could still be argued that whilst he added disparity - diversity within each of many 'body plans' out there in the market was low. Over time, however, whilst the number of different basic 'body plans' has shrunk dramatically, diversity has increased manifold - lots of different 'variations on a theme'. In automotive terms, limiting the number of 'body plans', or 'platforms' whilst maintaining, if not developing diversity, 'variants', 'derivatives' and 'optional

features' has become a whole new engineering 'art-form' in sustaining a viable level of continuity in terms of both production and customer 'need'- thus, the 'body plan' in terms of 'chassis' has become the focus of most motor manufacturers off which an ever increasing model diversity can spring. Much of what has gone on in car generation 4 could be viewed in this light.

However, Jay Gould went on to make a supplementary, and equally appropriate point:

"Instead of a narrow beginning and a constantly expanding upward range, multi-cellular life reaches its maximal scope at the start, while later decimation leaves only a few surviving designs....

"....Our most precious hope for the history of life, a hope we would relinquish with the greatest reluctance, involves the concepts of progress and predictability.....The greatest threat lies in a history of numerous possibilities, each sensible in itself after the fact, but each utterly unpredictable at outset - and with only one (or a very few) roads leading to anything like our exalted state."
(op cit 1989, emphasis added)

This must act as a useful health warning to me who is now to embark on seeking to make some sense of the possibilities for the future - the identification of those elusive 'surviving designs' - from the complexity of the present. Perhaps, the 'platform', my parallel of the 'body plan' is too convenient - maybe it is this sort of myopia which is preventing the motor industry seeing beyond selling cars? Could it be that the 'body plans' I am looking for are much more than the 'chassis'? Could they be a much more complex combination of personal mobility factors which go well beyond just the physical foundation of the car? Could the different 'body plans' be more radically different forms of personal mobility - some of which are already present but unobserved, or even 'misplaced' in a hierarchy of personal mobility solutions presently predominated by the motor car (dinosaur?) and its place as a possession as we currently know it?

- Post Script to Generation 4 - Another step on the road to decimation?

On Thursday, 28th of January 1999, Volvo, the Swedish specialist car maker, whose name has become synonymous with car safety since the third generation, and which has over the past five years started to shake off its reputation for the design and production of slightly old-fashioned cars for professionals agreed to sell its cars division to Ford for £3.9 billion:

"Volvo said its car business, which had sales of about £7.6 billion last year needed economies of scale....

"Ford said its success with Jaguar, the UK luxury car-maker that it revived and expanded, showed that it could run a foreign subsidiary at arm's length without blurring its identity, tradition or appeal."

(Jones, A. Ford agrees £4bn deal to buy Volvo's car division. The Times, London, 29 January 1999

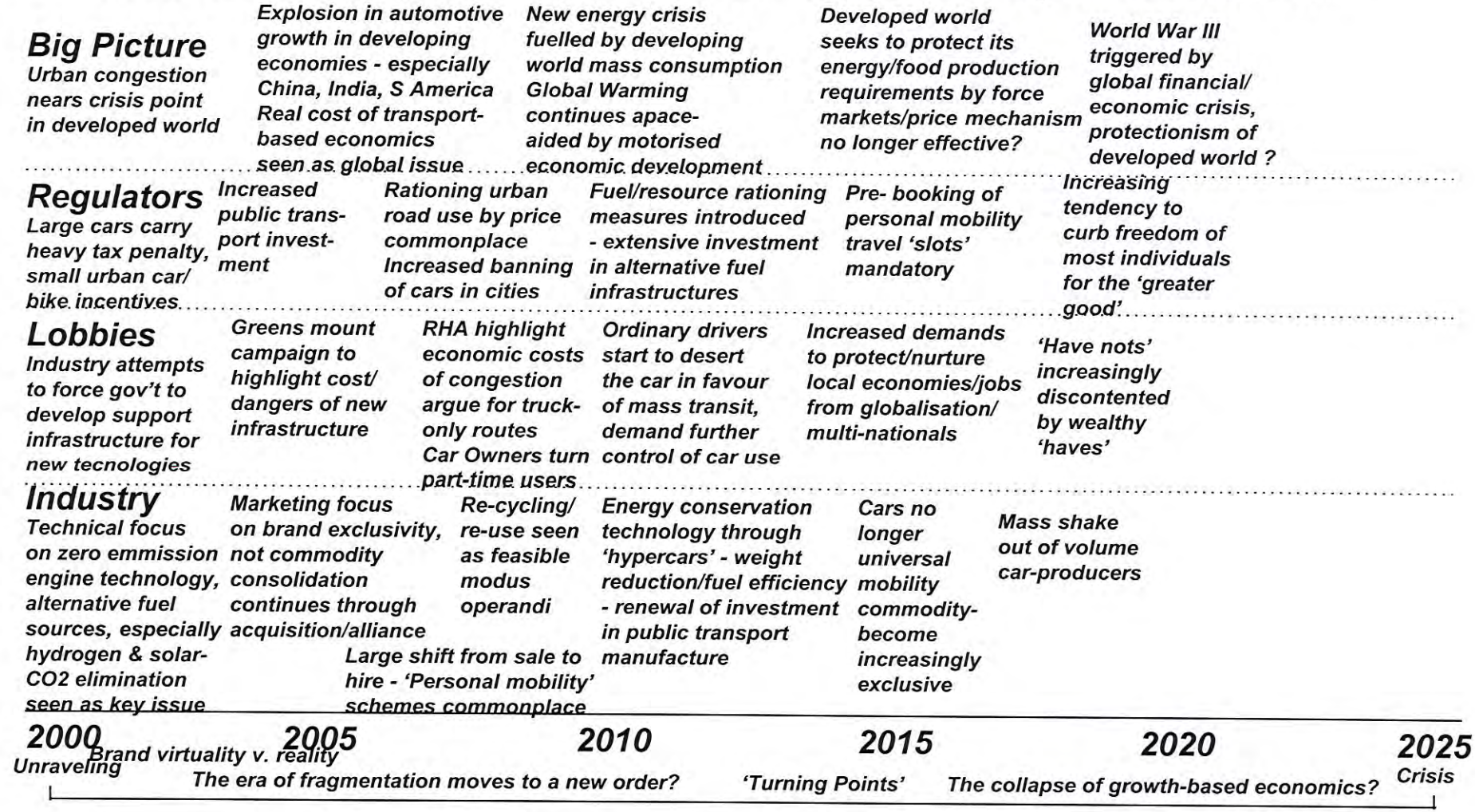
"Ce qui est important, ca ne se voit pas..."

(That which is important is the thing which is not seen)

(de St Exupery, A. *Le Petit Prince* (1934). France: Gallimard, 1987)

The Time Line of the Motor Car and its Industry - 5th Generation

Destruction & Motorised Winter - the end of mobility as we know it?



Freeway, Crossroads or Cul de sac - The Crisis of Personal Mobility - Peter Bailey 1998 - Figure 10

5. The Time Line of the Motor Car and its Industry - 5th Generation - Destruction and Motorised Winter - the end of mobility as we know it?

'Second time round' from unravelling to crisis turning points. The battle between the fragmented luxury of brand hedonism and the utilitiarian necessity to travel - personal mobility scenarios for the 21st Century to 2025. The evolution of a new order in personally-directed mobility - developing scenarios for the 21st century.

A Contrast in Futures?

As we stand on the brink of the millennium, there are signs that the status of the kind of automotive world that has evolved through Generation 4 is showing symptoms of severe structural stress. Whether the subsequent outcome of these developments will see in a fifth generation of further incremental change for the motor industry and the car - more of the same or something of a rather more revolutionary nature - remains to be seen. However, much of the writing on the wall suggests that the present state of affairs is not sustainable. In this final part of the dissertation, a number of possible future automotive scenarios is presented interpreting the published views of a number of interested parties - of the environmentalist campaigner, the dilemma of the reforming regulator, the incrementalist face of the industry, the 'alchemist' at the outer limits of the engineering community, and the logistician to whom information is the key. A final personal view is then constructed which draws on the positions of the other scenarios and attempts to identify those developing strains which may hold a glimpse of what the fifth generation may look like.

'Cars cost the Earth' - an environmentalist view

'Friends of the Earth' is a very much a product of the fourth generation when protest movements increasingly turned their attention to the peacetime excesses of economic progress. Formed in 1971, it celebrated its 25th Anniversary in 1996. In January of that year, it published a pamphlet the evocative title of which - 'Cars Cost the Earth' gives me the headline for the first of the futures to be constructed. The booklet, printed on *'recycled'* paper - yet another sign of the fourth generation for the car as

well as many other manufactured things - uses a mix of green, black and white to broadcast its message. The headlines and text herald a bleak future if car dependency is not shaken off. Under its evocative banner, it states:

"There is little doubt that over the last hundred years, the car has come to dominate modern life. More and more of our everyday journeys to work, to do the shopping or visit the family or friends are made by car. More than this, we have elevated the car to a cultural icon - a symbol of freedom, independence and success. But in reality our car dependency is far from glamourous."
(**Friends of the Earth.** *Cars cost the Earth.* London, January 1996)

It catalogues various 'facts' to support its environmental case, some of which it extrapolates to illustrate its future world. For instance, it forecasts that the number of cars on UK roads will increase by more than 50% by the year 2025 with 480 million cars worldwide, supplemented annually by 29 million newly-produced cars and posits at what cost this feat will be accomplished without a sea change in our attitudes to travel and the direction of transport policy which reduce the number of cars on the road and seek to regenerate, if not re-invent, alternatives such as walking, cycling and links to public mass transit - 'the challenge is to ensure the next hundred years bring clean, healthy, efficient and equitable transport for the planet and for people' (op cit 1996).

It makes the point that 'Cars are bad for your health', citing not only the number of deaths related to motor accidents - but that 'another 11,000 are believed to die prematurely due to air pollution' (op cit 1996). Its shock tactics then discuss the 'cocktail of chemicals pumped out by motor vehicles' (op cit 1996) and the direct and indirect impact they have in terms of health - from the poison emitted (albeit that motor manufacturers would argue that the cars of today produce far less pollutant emissions than a generation before; their citation of the progress of individual car design characteristics ignores the powerful negative offset of increasing volumes of cars in use) - to the less obvious disbenefits of more car use, less personal exercise, more unfitness, more health maintenance cost.

Their next port of call is that of 'The Race for Space' (op cit 1996). A montage of visions of land covered with queued or parked cars in black and white are contrasted with the green of forests. The text is no less unremitting - 'Cars eat up land' (op cit, 1996) and focuses not only on traffic and road developments, but the underlying catalysts of urban sprawl, out of town developments, retail parks and the like. It reinforces its point with the statistics of car-inspired land consumption, which in turn will generate more car journeys and more traffic - 'At least 10,000 hectares of land are swallowed up by out-of-town developments' , 'An area twice the size of Birmingham is devoted to vehicle parking in the UK', 'Planning permission has been granted for more than three million square metres of office space around the M25' (op cit 1996).

This theme has taken on a new momentum following the publication of the UK Government's Integrated Transport White Paper (**Department of Environment, Transport & Regions.** *A New Deal for Transport: Better for Everyone.* London: TSO, 1998) which will form the foundation of the 'reforming regulator's view developed later. In a similar vein, a recent article by Nick Nuttall in the Times was prompted by a report commissioned by the Friends of the Earth which argues that redeveloping half of Britain's car parks could house 350,000 people - such a release of housing development land would help to assuage the growing concern about the consumption of green belt land for housing development:

"The study found there are nearly 6,800 surface car parks - as opposed to underground or multi-storey - with 738,000 spaces. This equates to 1,845 hectares of land, equalling the area of Hammersmith or Tower Hamlets."

"With non-residential private parking such as for offices, the total area of car parks in England is 4,600 hectares of urban land. The report suggests that 2,640 hectares could be practically released for development into housing by 2016 without damaging local economies, and helping to favour buses, cycles and walking."
(**Nuttall, N.** *How empty car parks could house 350,000.* The Times, London, 25 November 1998)

This appeal to make the most of urban or developed environments and its integral relationship to transportation is an important developing feature of the current debate. In a further article in The Times, Lynn Sloman, a spokesperson for Transport 2000 is quoted making the point that:

"the debate should not just be about planning for new homes, but also about integrating them with a transport strategy. The homes we need bring with them new roads, hypermarkets, industrial parks, car parks and so on."

"In the nineteenth century, the building of the railways determined the pattern of new urbanisation; so, today, roads will decide the future pattern of our countryside. The Newbury by-pass, for example, has already attracted applications for commercial development along its rural course."
(**Sloman, L.** *A Brown and Unpleasant Land.* The Times, London, 23 January, 1999)

....And so on for the northern Birmingham relief road and any other such development designed to alleviate the misery of the motorist and those town-dewellers who suffer from the side-effects of close proximity of incessant traffic of existing routes? Sloman's article finishes off with the plea:

"The country's future is yours. Let's make sure it's green."
(op cit 1999)

Thus, this stark choice for the future is presented linking to the well-trodden ground covered by 'Cars Cost the Earth' - that of the threat to 'natural' environments and eco-systems posed by economic developments which are directly related to the onward march of the car and its individual, arguably selfish, form of personal mobility. Returning to the Friends of the Earth pamphlet, the evocative formula of invective under-pinned by numeric examples is continued to bring the same point home under the headline banner of 'Wild places under threat - some of our most unique wildlife habitats are under threat from road-building'; 'The current (1996) National Roads

Programme, if built, is expected to damage at least 50 sites of Special Scientific Interest, 10 areas of outstanding natural beauty and five national parks in England and Wales alone.' (op cit 1996)

The emotive language of the campaigner used, designed to grab the attention of the reader, is interesting in itself - the use of *'wild'* in a country where little of the landscape has been left untouched by human hand - even Twyford Down, the 'home to 27 species of breeding butterflies, including the Chalk Hill Blue and many plants such as the Yellow Rattle and Bastard Toadflax'; terms such as *'most unique'* suggest the direct threat to species that progress presents and *'natural* beauty' ignores the fact that much of the beauty is a product of Man's cultivation rather than the unmanaged wilderness of nature itself further demonstrate the point. The argument moves on to the destructive effect of road building on natural resource depletion and its attendant pollution - under 'Digging up the countryside', it states their estimate of 125 billion tonnes of aggregates used in the construction of Britain's 360,000 kilometres of road with the extraction of such resources scarring the wilderness:

"Plans for a super-quarry on the Isle of Harris will blast millions of tonnes of rock out of the mountains, creating one of the biggest man-made holes in Europe". (op cit 1996).

The neatly woven text then moves on to the waste created by the industry and its product.

First, the waste of 'waiting' time - 'much of the time we spend on our cars is actually spent going nowhere - servicing, washing and maintaining or sitting in traffic jams. Traffic congestion is estimated to cost the UK economy £15 billion a year'; 'the average family spends 16% of its total expenditure on travel, 83% of this is spent on motoring costs' (op cit 1996) This leads to the prediction that 'Despite the hundreds of millions of pounds being spent annually on building or widening roads, congestion is expected to get worse in the future as traffic levels grow' (op cit, 1996) - interesting comments bearing in mind the subsequent UK government's intent to

increase ownership and reduce use of the car and the pledge to *increase* traffic flow on existing road infrastrucure by a factor of four!

Then attention is turned to the physical waste created by the industry itself - 'car manufacture consumes an estimated 4% of the world's iron, about 25% of its zinc, 16% of its aluminium and 9% of its copper' whether this is per year, or whether these are aggregated consumption figures is not stated. The pollutant risks of resource extraction for new car production such as copper and oil are discussed followed by the effects of 'the throw away society' with the scrappage of 1.4 million cars in 1992 given mention without any reference at this point of the efforts to recapture and recycle which are now becoming an increasingly regulated, if not a necessary 'business as usual' feature for the industry. Nevertheless a damning critique of the whole automotive process is well made:

"Cars are highly complex machines, comprising over 15,000 parts made from materials including steel, aluminium, copper, zinc, plastic, rubber and glass. Many of these raw materials are mined and transported long distances across the world. Huge amounts of energy are then used to tranform them into car components and to produce the fuel needed to keep our cars on the road.

"The social and environmental costs of this production process are high. Precious natural resources are plundered, huge tracts of land and wildlife habitats are destroyed, the soil eroded and water sources contaminated." (op cit 1996)

The booklet then goes on to make the point that whilst innovative technology can play a part in reducing the impact of the industry's overall effect, 'the impacts of motoring are too numerous and too varied for any one technoligical breakthrough to solve them all' (op cit, 1996). Thus, the green car is not the answer - the 'positive' environmental side-effects of some of the automotive 'fixes' developed or being developed are then put up to be immediately knocked down - catalysts which take up more engine power, increase fuel consumption and use scarce resources, fuel efficiency efforts negated with increasing vehicle volumes, alternative propulsion systems which merely shift

the pollution and energy consumption to a different place or produce other pollutant effects.

In its closing summary, the pamphlet hails:

"So, there is no such thing as a truly green car. The only real solution is to make it easier for people to use their cars less - by greatly improving rail services and other forms of public transport and by providing safe routes for walking and cycling"
(op cit 1996).

Having revealed that since the mid eighties, UK Government investment in roads has been 114% higher than in the rail network - a feature perhaps to be reversed by the 'New Labour' government from 1997 - the booklet closes by appealing directly to its readers to 'take action today'; 'leave your car at home'; 'use other forms of transport'; 'drive at slower speeds'. These appeals side-step important 'live' issues such as :

If we leave our car at home, how do we get to work or shop?

If we use alternative modes of transport, do they make the right connections, taking us when and where we need to go? This question is not discussed.

Driving at slower speeds is a fact of urban (if not in some instances - inter-urban) life already and it is in such environmental conditions where speeds are at or lower than the speed of horse-drawn traffic and where the most engines are idling rather than running that most pollution occurs.

So, what would the vision of the environmentalist be - with little or no comfort forthcoming from 'Cars Cost the Earth' which tackles the open conflict between a life for the many economically dependent on the car and an environmentally-friendly life without it, one has to say that their vision must be painted black not green - a land increasingly laid waste by the car and dependency on it with its attendant waste-creation in manufacture and support in use. Despite the shift in the public

pronouncements of Government, there is little sign as yet that their or our hypocritical attitude to the car, both in terms of ownership and use are abating as the 'Carmageddon' of John Adams (op cit 1998) approaches. Even the analysis in John Whitelegg's 'Critical Mass' (op cit 1997) foresees the weight of rapid road transport-dependent economic development actively predicating the need for more cars to offset the drift of such development away from the town to its periphery and beyond. Such economic constructs are usually based on some level of centralisation to assist economics of scale which, in turn, actively undermines the ability of local communities to provide for themselves even the most basic of manufacturing or service needs.

In the conclusion to his book, Whitelegg uses the concept of the 'prisoner's dilemma' to good effect in relation to transport where he sees the motorised countries wish to at least maintain their current levels of automobility and that technology will allow them to manage its continued development despite an increasing developing world population which through its own economic development, seeks to adopt automobility as an economic 'reward'. Despite this leading to serious material and fuel shortages and growing concerns about greenhouse gas emissions and their global warming impact, there is a view that both sides can have their car and drive it. Whitelegg states that:

"The importance of the prisoner's dilemma lies in its ability to reveal the choices that face us all individually and collectively, and to reveal that cooperation and collaboration provide a solution that benefits everyone."
(op cit 1997)

He goes on:

"The prisoner's dilemma maps on to traffic and transport problems very well. At the regional and local level in the developed world the existence of significant health problems from vehicle exhaust emissions, serious and worsening traffic congestion and loss of urban, rural and suburban green space and woodland is evidence of mutual

detriment and significant loss where everyone suffers. This correlates to individual self-interested decisions about car ownership and use which have effectively maximised the 'prison sentence'.

"The transport equivalent of both prisoners not confessing and both coming out with the lowest possible sentence is a situation where everyone comes out of their own individual and collective dilemma with very low pollution, low noise, very high road safety, very high children freedoms and child health and very high community interaction based on a rich pattern of local facilities providing employment and diversity. In this scenario, everyone can minimise travel demand whilst maximising accessability and time availability for many purposes other than transport. The same scenario provides maximum availability of local goods and services whilst employing people locally and at the same time not inhibiting purchases and consumption of more distant objects where local availability is insufficient to meet demand....

"The prisoner's dilemma works globally as well as locally, and the high levels of motorisation now being pursued in large parts of the developing world are evidence of self-interested calculations influenced by the blatant example of 100 years of self-interested calculations in the developed world.

"The prisoner's dilemma shows us that globally we are once again on our way to maximising the joint sentence. In this case maximising the joint sentence equates to global warming, stratospheric ozone layer depletion and serious problems from air pollution. The way out of this dilemma is through a fundamental restructuring of the parameters of decision making in such a way as to emphasise the collective, the social and the equity aspects of development. Sustainable development is part of this restructuring but still falters when exposed to the harsh treatment given out by supporters of economic development and supporters of sustainability, as long as it does not impede any development which has an economic objective."
(op cit 1997)

In order to overcome this need to look after number one, which it could be argued is a product of Hardin's 'tragedy of the commons', where individuals are less likely to conserve if they believe their responsible stewardship will merely be absorbed by the self-interest and/or neglect of others, Whitelegg believes that to explain the prisoner's dilemma in terms of transport and the persuade the 'prisoners' that there is mutual advantage which would result from cooperation is worth a try, given the end result if no attempt is made. He sees the debate homing in on five key areas where the advantages of working collectively far outweigh the self-interested approach. All of these areas involve pain (no pain, no gain?):

- the benefits of operating at a lower level of economic intensity, which will relieve the pressure on transport as an underpinning pollutant mechanism

- the benefits of avoiding centralisation and scale operations wherever the product or service would be better provided locally

- the benefits of developing a level playing field to prevent a subsidisation of national or multi-national inbound investment which secures local economic discontinuity

- the benefits of an approach which avoids the pursuit of industrial 'globalisation' which attracts the investors of the developed world desperate to minimise cost, but can introduce alien technologies and processes into a developing world where no local need or demand is present

- and finally, the benefits of encouraging local institutions to establish and operate policies and controls which can be cooperatively applied with their neighbours rather than always look to a superior agency for direction in which local parties have no faith.

It has to be said that this is a tall order in a world increasingly dominated by supra-national, if not globally, operative institutions to which responsibility is either assigned or taken. Reversing the trend to bring about a renaissance of local

cooperatives working to mutually-beneficial ends, checks and balances which do not pitch them at each other or, in turn, those networks beyond is no idle dream but a challenge of monumental proportions. But Whitelegg believes that there can be no real solution to the transport problem in which the car plays a pivotal role without a growing understanding of the workings of the prisoner's dilemma. However, in Eric Tenner's terms, the chronic,debilitating nature of the disease leads to an acceptance of it as part of the scenery, to be endured since no cure is apparent. Without a catastrophic shock to the system, the communication and understanding of Whitelegg's points will take some time to percolate through - it is only through individuals suffering from increasing discomfort from a number of negative transportation-related side effects and making the overall connection, that demands for a different approach may grow. The illusion of the car as a provider of safe, economical personal mobility is even increasing in its influence now at a time when the disadvantages of an *auto*-mobile dependent society are seen and *felt* all round - not only by the pedestrian and by-stander but by the car driving population themselves.

Perhaps Whitelegg could take a leaf from Theodore Levitt's seminal text of the sixties (**Levitt, T.** *Innovation in Marketing: New Perspectives for Profit & Growth.* US:MacGraw Hill, 1962) where he describes 'marketing myopia', an affliction which he saw present in the terminal decline of the American railroad companies which were conditioned to think they were in the railroad business rather than seeing their wider role as a transportation provider. Maybe there is a related form of this disease - 'Modernity Myopia' - in which the unquestioned need, if not right, to travel for the masses but not necessarily travel en masse is the underlying problem, the mode of transport is but a symptom of the disease, if not the disease itself? Such a point was taken up by Stephen Peake who quotes Lester Brown in the introduction to Zuckermann's End of the Road':

"If we are to reverse the pattern of environmental degradation that has become one of the hallmarks of the last century we need to start asking ourselves some different questions. Instead of thinking in terms of parts, we need to look at the whole."

"Instead of moving people around, transportation policy all too frequently becomes a matter of moving cars."
(**Peake, S.** *Transport in Transition: Lessons form the History of Energy.* London: Earthscan, 1994, emphasis added)

The message of the environmental campaigner is not new. As illustrated in Generation 3, in 1960, Vance Packard in the 'The Waste Makers' was highly critical of an economy geared to mass production and a society hooked on mass consumption. He quotes Victor Gruen, a city planner who said:

"although we are the richest nation with the highest individual living standard, we have one of the lowest public living standards of Western nations. Our cities are littered with ugliness and choked with automobiles."
(op cit 1960)

Since then the American standards to which Packard referred, the praise of profitable private 'enterprise' and inherent criticism of the 'bureaucratic cost' burden of public service and investment, have moved across the Atlantic to an 'Old World' (which Packard saw as an example worthy of pursuit) with little sign of abatement other than perhaps, a wider awareness of the problems that such 'progress' can inflict on the social as well as ecological environment. The level of personal discomfort that comes with such knowledge is still bearable for the many who believe there is little that can be done to stop the treadmill and fear what will happen if they step off it.

In the meantime, this American way of life - so criticised by Packard - (with the car, the nature of its industry and the independence of individual mobility at its core) has not only worked its way into the 'old' and developing worlds, but it has shown little sign of displacement in America itself. Given the continuing lack of a compelling need to make radical change to this economically-dominated model, with its effects being 'chronic' rather than 'catastrophic' in nature, the environmental campaigner's view of the automotive future is likely to become blacker and more threatening rather than greener and hopeful in Generation 5. In such an environment, it is hardly

surprising that the movement has increasingly turned its attention to the political arena to attempt to bring about change through regulation and it is to the regulator's view that I now turn.

'A New Deal for Transport: Better for Everyone' - Having your car and not using it - Utilitarian Utopia or Exclusive Privilege? - a reforming regulator's view

Into this hothouse of environmental debate steps the regulator, newly configured, at least in the Old World, in the late nineties as the political pendulum has swung away from the right on a mixed wave of disaffection with the outgoing 'conservative' governments and growing social, economic and environmental concerns. However, expectations of the regulator in the context of personal mobility may be at a far higher level than capability to deliver given the conflicting pressures under which their reforming political masters are operating. The UK Government's much vaunted White Paper on integrated transport, 'A New Deal for Transport: Better for Everyone', published after some delay in July 1998, has been the subject of critical attention both before and after publication.

For what it is worth, the title of the White Paper - 'A New Deal in Transport: Better for Everyone' is not a bad mission statement. However, its utilitarian ring perhaps gives away the difficult line it is attempting to tread between the opposing demands of different interest groups - the have's and have nots, transportation suppliers including the motor industry itself, the consumer from pedestrian to individual public transport user, private car driver and commercial distribution buyers, not forgetting those environmentally and economically-concerned lobbies. Add to this a wider, international audience to whom the UK Government is trying to broadcast an environmentally-responsible view which does not conflict with attracting inbound economic investment and an almost impossible task for the policy develops which rather than offering a 'better alternative for everyone' translates as 'a spoonful of sugar that makes the medicine go down', if not 'no pain, no gain' - an attempt to please everyone which leaves no one satisfied. It is difficult to see how a government voted into power for five years - albeit that a second term my be confidently envisaged - can adopt a truly long term strategy which attempts to correct a private

cost- rather than public benefit-driven policy, the effects of which have taken well over a generation to accumulate (it could be argued that the Beeching Report of 1965 was one of the forerunning catalysts in the process of the undoing in isolation of a mixed and well-integrated rail transport network in favour of a modal shift to road transport with little consideration given to the effects of relieving the trunk and roots of their leaves and branches).

In the paper's Foreword, it makes the point:

"For the last two decades, the ideology of privatisation, competition and deregulation has dominated transport policy. Bus and rail services have declined whilst traffic growth has resulted in more congestion and worsening pollution".
(op cit 1998)

Note: The bus was the unfulfilled modal promise of the Beeching Report, the part application of Beeching's planned solution left the concept of integrated travel networking in a position from which it never really recovered.

In as much as this dissertation is examining the development of the car and its industry, it is the potential impact of the White Paper on these specific elements of the personal mobility equation which forms the basis of the vision for the future of this new brand of reforming regulator. Again, in the Foreword of the White Paper, it is John Prescott, the Deputy Prime Minister and sponsor who states:

"As a car driver, I recognise the motorists will not readily switch to public transport unless it is significantly better and more reliable. *The main aim of this White Paper is to increase personal choice by improving alternatives and to secure mobility which is sustainable in the long term.*

"Better public transport will encourage more people to use it. *But the car will remain important to the mobility of millions of people and the numbers of people owning cars will continue to grow.* So we also want to make life better for the motorist. The

priority will be maintaining existing roads rather than building new ones and *better management of the road network to improve reliability.*

"More bus lanes, properly enforced, will make buses quicker and more reliable. Even a small increase in the numbers of bus passengers will transform the economics of the bus industry, allowing higher levels of investment in new buses and new and more frequent services.....

"We have had to make hard choices on how to combat congestion and pollution while persuading people to use their cars a little less - and public transport a little more." (op cit 1998, emphasis added)

These opening remarks bear witness to the dichotomy the Government is attempting to bridge - a position which has not gone unnoticed by the pressure and media groups pointing out its in-built weaknesses both before and since its publication. The difficulties of accepting a growth in car ownership whilst discouraging use has been discussed before in this paper as has the ambition to increase traffic throughput on the roads whilst relieving congestion and pollution.

These basic flaws have been the subject of a relentless publicity campaign with headlines developing over the period such as:

Pre-Publication

"Prescott to reassure drivers with charter.... The move is an attempt to reassure drivers that they are not going to be penalised by the Government's plans to promote green, clean and environmentally safe forms of transport" (Daily Telegraph, 26th May 1998)

"Can I have my car back? Arthur Leathley finds family life without a car in a town 25 miles from London is simply a tribulation too far." (The Times, 30th May 1998)

"Prescott does a U-turn on anti-car paper" (The Independent, 10th June 1998)

"Blair to abandon new laws for motorists" (The Guardian, 25th June 1998)

On Publication

"£1 billion tolls and taxes to pay for Prescott's transport dawn" (The Times, 21st July 1998)

"No jam tomorrow - an anything but integrated transport policy - How can a government reduce traffic congestion without unfairly penalising the use of the car?" (The Times, Leader, July 21st 1998)

"Prescott's Progress - Anyone who questions our love of the car needs courage and a thick skin.....My own trips to work are a hybrid of car, train and tube; experience of all three makes it perfectly clear why so many business people choose to stay in their private bubble of territory all the way to the corporate car park, and will howl with pain when Mr Prescott taxes it more heavily" (Libby Purves in The Times, 21st July, 1998)

"Drivers must pay more or clear the roads - From crowded journeys to 2001, a space odyssey" (The Times, 21st July 1998)

Post Publication

"Councils oppose Prescott over charge for city driving" (The Times, 17th August 1998)

"Prescott ready to fight for his transport bills" (The Times, 9th September 1998)

"Brown backing off new tax on drivers" (The Times, 29th October 1998)

"Car charges to raise billions for the capital" (The Times, November 25th 1998)

"A nightmare in Toytown - John Prescott's proposals to reduce traffic by charging motorists in city centres are stranger than fiction. Even Noddy and Big Ears are bemused" (Peter Barnard in The Times, December 12, 1998)

"Bus Lanes alone 'will not shift Mondeo man'" (The Times, 7th January 1999)

"Public put brake on road pricing ideas - Plans by John Prescott, the Deputy Prime Minister, to charge motorists to bring cars into town centres have failed to win public support" (The Times, 30th January 1999)

Whether or not 'A New Deal for Transport: Better for Everyone' is allowed to shape the UK's (re)generation of an integrated transportation policy remains to be seen - though the controversy surrounding its intent shows no sign of diminishing. The scope of its integrated transport vision is wide (summarising Section 1 of the White Paper) incorporating:

- *better places to live* - incorporating social benefits related to health (cleaner air), the restoration of life to town centres by breaking the 'stranglehold of traffic' and improving town planning, the provision of quality of housing, increasing prosperity backed by a modern transport system, reducing rural isolation by ensuring people are connected to the transport system, making walking and cycling easier.

- *local transport plans* - developing a national network which connects to support local communities

- *priority for public transport* - improving modal interchange, providing better information, increasing spread and enforcement of bus lanes, changing the focus of road investment to better maintain the existing network for the benefit all road users and improving the efficiency of traffic flows

- *greater emphasis on listening to and consulting with transport users* - developing a new deal for the public transport user as well as the motorist

The major elements of the 'New Deal''s' vision which impact on the car and its user are:

- *in local transport planning* - greater use of traffic management tools including powers to enforce road use and parking charges 'to tackle traffic jams and traffic growth', additional funding to provide 'better interchanges' and removal of bottlenecks (*memo*: removal in one place normally sees re-creation elsewhere)

- *for the motorist* - improved traffic management and maintenance of existing network to speed traffic flow, improve capacity, and reduce standing time and congestion, better motorway breakdown services, less disruption through network maintenance activity, 'improved road safety and safer cars' (*memo*:the UK's roads are already one of the safest in the world), better information before and en route, better car and car park security, more fuel efficient and less pollutant cars

- *in the public transport domain* - more and better buses, more reliable bus services through priority measures which lessen congestion (with the bus being the backbone of the public transport network), more investment in rural transport

- *in the environmental domain* - 'seeing greener, cleaner vehicles that have less impact on our environment', reduction in the rate of road traffic growth, wanting 'to see an absolute reduction in traffic in those places and streets where its environmental damage is worst' (*memo*: how this fits with increasing flows on a better controlled and maintained existing road network remains to be seen), completing a major review of speed policy

- *in the societal domain* - 'reuniting communities cut in half by traffic through traffic management, calming and traffic reduction' (*memo*: see comments in parenthesis above)

- *in the domain of commercial goods distribution* - reducing 'the extent to which a healthier economy results in high levels of road traffic growth' (*memo*: see comments in parenthesis above)

- *in the domain of local democracy* - devolving transport policy power and decision-making to the regions, towns and cities (*memo*: hopefully making connections with national transport networking and preventing major structural shifts in local (or wider) economic activity as a result of locally-applied subsidy).

In summarising the 'New Deal', the appeal is made:

"Much will depend on each one of us as individuals. For example, a significant reduction in car commuting and the 'school run' would help to tackle peak time congestion. We cannot leave it to others to bring about the changes that are needed. We have a shared responsibility. But great sacrifices aren't called for. **It doesn't take too much to make a difference - if we all left the car at home just once** out of the ten or so shopping and leisure trips we make from home each month, we would deal with most of the projected increase in traffic this year." (op cit 1998)

It could be argued that shopping and leisure trips are not at the heart of the problem - the rush hour is - and without a significant change in working and scholastic custom and practice, traffic reductions at a time when weight of flow, slow speed and pollution is highest remain extremely unlikely.

The aspects of implementation of the 'New Deal' vision which impact on the car and its user (and therefore its industry) are then spelt out, the key tools being:

- *reducing traffic growth* - through the application of charging systems on use and parking - effectively travel rationing through price. The proposals on variable road use charging both controlled by local/regional authorities on urban routes or government on national road networks, levies on car parking even on 'private' commercial premises (bringing in places at factories, shops, offices, schools and other public

service establishments such as hospitals) have been widely promoted. The Government suggests that £3 billion can be raised from such charging schemes (Source: The Times, London July 21 1998) with workplace parking offering up the most significant contribution - with an estimated 6 million car parking places provided nationwide and charges of up to £1000 threatened for a place in London (Source: Jill Sherman, 'Employers face big charges for workplace car parking', The Times, London, 8th December 1998). The whole purpose of the charging mechanisms proposed is to transfer the revenue raised into the provision of improved public transport. The mechanisms for collection of road use charging under review are both electronic metering (the technical fix favoured by the Government - pay as you consume the road - and not an inexpensive option to develop and implement and flat rate permit purchase which does not make the polluter pay proportionately, and could be argued to *encourage* use to ensure that the user obtains 'value for money'. The latter method could be up and running much quicker with a lower investment cost, though the cost of effective enforcement is often ignored. As far as motorway (and other inter- or intra-city routes) are concerned the introduction of tolls (linked to both electronic and physical methods of collection) looks to be the favoured charging option rather than through the sale of annual permits (akin to Switzerland's long-standing policy).

These road user charging options are counter-balanced by proposals to ensure that the motorist stays in his or her rightful place with local authorities empowered to create priority lanes for public transport and to prevent the motorist's flight from charge avoidance to the back streets by increasing the use of physical obstructions to traffic flow - pedestrian and cycle priority, car exclusion, traffic calming schemes and the like. In this way the motorist is channelled through ever more restricted and expensive funnels in urban environments. As illustrated in the headlines quoted above, resistance to such a regime is already well developed and gathering pace.

- *enforcing agreed environmental standards* - Especially in the context of greenhouse gases with the UK having a legally binding target to reduce such emissions to 12.5% below 1990 levels by the period 2008 to 2012 and an internal UK objective of

reducing CO2 output to 20% less than 1990 levels by 2010, an important focus on bringing about change falls on the transportation sector which is estimated to need to contribute an 8-14% reduction in the period. The main tool to achieve this in the automotive sector is through motor taxation through 'encouraging people to buy more fuel efficient models', enforcing regular maintenance (for example, through roadside emission testing) and the adoption of other fuel-saving technologies (e.g. the AA's suggestion of fitting low rolling resistance tyres). What we have seen so far in this context is hardly revolutionary with the proposed higher road fund tax on 'gas guzzlers' and reductions/exemptions on fuel efficient cars such as the Ford Ka - so far, the introduction of a more sweeping 'carbon tax' is being given a very low profile. With the UK motor market being two-thirds reliant on business/fleet ownership and 'use' (at least nominally), the present level of tax activity will not secure the target. The introduction of more radical measures (supported by the Liberal Democrats and Greens) is still very much under wraps. It is interesting to note in the related area of air pollution, the Government would appear to have already set in motion a counter-information campaign:

"John Prescott, Secretary for the Environment, Transport and the Regions said yesterday that the target set for reducing the level of particulates by 2005 was unrealistic....

"A review of the National Air Quality Strategy disclosed that levels in this country are affected by winds carrying them from the Continent. The main sources are vehicle exhausts and emissions from power stations. It is thought that particles blown over from the Continent account for up to 40 per cent of the total.

"Michael Meacher, the Environment Minister, said: " This is a problem the UK cannot solve on its own. We intend to discuss with our European partners how this issue can be taken forward." "
(Elizabeth Judge writing in The Times, London, 14th January 1999)

Here we have a country which, with its predominant winds blowing in from the Atlantic, previously accused of transmitting acid rain to Scandinivia now making excuses for particulate levels now blowing in the opposite direction?

- *reliance on technical fixes* - using the words of the White Paper - 'technology taking the strain' - both within the car from improving emissions through more efficient engines and output control (to meet noxious and greenhouse gas reduction agreements) to the adoption of in and/or out-board traffic information and management systems. The other measures and tools discussed above demonstrate the heavy reliance by the Government on technological solutions to deliver the 'New Deal' vision of the future. Such systems and their successful implementation carry with them a high level of cooperation with the motor industry in terms of (largely but not exclusively) electronic car-borne engineering developments to support pollution and greenhouse gas emission and information collectors and transmitters to enable traffic management measures to operate. Such technology is not cheap and whilst the industry is legally bound to respond to emissions regulation (though it will lobby to ensure that its impact minimally disturbs its engineering and manufacturing process), no doubt, in the context of road information and control management will lobby for a subsidy or 'payback'of the tax revenue to be raised to support development cost and /or pass on the cost to the car buyer of the inclusion of these features as part of the vehicle's specification. Such developments, and others, form part of the incrementalist view of the industry to follow below.

- *are the roots of the New Deal so 'new'?*

The structure of the New Deal's future vision for sustainable transport is not new or even revolutionary - despite its claim to represent a radical change in direction and its in-built conflicting objective of supporting higher levels of car ownership at the same time as restricting use:

"Cars in particular have revolutionised the way we live, bringing great flexibility and widening horizons. And we do not want to restrict car ownership - with our vision of a prosperous Britain where prosperity is shared by all we expect more people to be able

to afford a car. But the way we are using our cars has a price - for our health, for the economy and for the environment."

(Department of Environment, Transport & Regions. *A New Deal for Transport: Better for Everyone.* London: TSO, 1.2, TSO, July 1998)

Its content and envisaged methods of delivery would appear to have been very much influenced by various preceding academic sources, notably Peter Hughes, whose book 'Personal Transport and the Greenhouse Effect' (Earthscan, 1993) lays out not only the argument for sustainable transport policies but also provides a review of 'policy tools' which need to be adopted if a sustainable transport policy is to be successfully implemented.

Figure 11: Peter Hughes' 12 Point Plan for Sustainability (Source: op cit 1993)

Policy Measure	Area of Influence			
	Fuel Economy	Alternative Fuels	Modal Transfer	Reducing Travel Demand
Introduction of fuel economy labelling for new cars and regulations on new car advertising content	•			
Introduction of a 'feebate' scheme for new cars based on fuel economy	•			
Establishment of long term programme for the research, development and deployment of greenhouse-neutral transport fuels with consumer incentives		•		
Enforcement of roads speed limits, and possibly downgrading some existing limits to improve average fuel economy	•		•	•
Introduction of regulations requiring employers to reduce travel demand of their workforce	•		•	•
Establishment of an environmental assessment programme for proposed road schemes, whereby CO2 emissions are compared under a number of different optons			•	
Increased investment in, and subsidy for, public and non motorised modes of transport (partly funded by cancelled roadbuilding schemes)			•	
Redistribution of transport taxes to promote fuel economy, alternative fuels, modal transfer and reduced travel volume	•	•	•	•
Business taxes to be related to a measure of accessability to customers and employees			•	•
Introduction of area licensing to discourage the use of cars in urban areas			•	•
Establishment of strategic planning regulations for promoting local access, rather than encouraging highly mobile and energy-intensive lifestyles			•	•
Introduction of a carbon tax to reflect the environmental cost of burning fossil fuels, and to reduce consumption	•	•	•	•

Many, but not all, of these policy areas are included in the New Deal - but all feature in the current heated debate. The basis, if not the 'basics', for making a sustainable transport policy happen, which have been previously discussed in Generation 4 are Hughes three policy 'levers' (Hughes, op cit, 1993) - government regulation to meet standards and targets (which in turn may enforce the adoption of already-known technical fixes; the application of market-based instruments - such as charging mechanisms (i.e. rationing by price?) or encouraging suppliers to develop new technical fixes; and public investment in infrastructure or alternative technologies to support a shift in transportation mode.

Hughes' approach claims that a mixture of the three types of levers plus the supported, prospective technical fixes in his scenario three could secure a 20-25% reduction in CO2 emissions from travel. The underlying assumptions of his calculations (as uncertain as they are) meant that subject to other contributions from more intensive greenhouse gas producers (the power industry, for instance), personal transportation could deliver a share which would support the United Nation's Intergovernmental Panel on Climate Change (IPCC) overall reduction target for carbon dioxide emissions of 60% to stabilise the atmospheric concentrations of the gas.

Subsequently, in 1996, David Maddison et al adopted a similar approach though applying a more cost-focused tack with their 'Policy Measures for a Sustainable Transport System' involving a similarly regulated regime of which the key features were:

- not setting sector-based targets for CO2 reduction - bring in a tax on carbon consumption
- fuel prices based on environmental damage of the fuel concerned
- improved monitoring, measurement of pollution and sustained pursuit of the polluter (roadside checks, pollution cameras etc)
- introduction of complementary noise pollution controls

- no automatic right to open access to central urban road networks, electronic charging being essential
- revocation of area licensing on vehicular movement when pollution exceeds laid-down limits
- taxes on use which reflect road mileage travelled to pass repair costs on to those who travel the most - especially commercial vehicles
- passing on the external costs of accidents, e.g. traffic disruption through a mileage-related levy on all road users

(**Maddison, D. Pearce, D. Johansson, O. Calthrop, E. Litman, T. & Verhoef, E.** *Blueprint 5: The True Costs of Road Transport.* London:Earthscan, 1996)

In 1994, Stephen Peake laid out the barriers to improved transport efficiency, which, I suspect, also helped provide a frame for the 'New Deal'. The barriers he identified were:

- *Lack of Information and expertise among transport users*
  - when assessing the transport implications and lifestyle changes involved in moving house or changing job
  - car users lack information about public transport costs, routes and time schedules
  - transport cost of goods is invisible to the buyer
  - public transport is perceived to be inferior to private travel arrangements
  - health impacts of travel choices are not well known to users
- *Economic Barriers*
  - the marginal cost of driving is small compared with other fixed costs
  - the price paid for transport does not necessarily reflect its full social cost
  - company cars are shielded from the real costs of their car travel and regulations actually encourage unnecessary car travel
- *Institutional Barriers*
  - the funding of road infrastructure is divorced from its use
  - public transport suppliers have no economic incentives to invest in measures which reduce the need to travel
  - decisions by land developers to build shops and other facilities out of town

- employer's location decisions take little account of employee transportation costs to and from work
- cars are potent status symbols, people are conditioned to aspire to own and use a car, and to respect speed and acceleration

(**Peake, S.** *Transport in Transition: Lessons form the History of Energy.* London: Earthscan, 1994)

Whilst the language of the 'New Deal''s' vision sounds radical, it nevertheless represents in its integrated transport ambition an incremental, if not 'revisionist', statement which seeks to regenerate a past level of achievement in albeit a post 2000 backdrop where the drive to integrate is now an environmental rather than just an economic necessity. As a political attempt to manage (or at least talk about managing) the conflicting divide between environment and economy, it looks passe, going over ground well furrowed before its conception largely but not exclusively by the academic domain. An illustration follows which demonstrates that such academic sources which see a more radical governmental role already have a more adventurous vision - and indeed, that such a vision is, in turn, not new but *was once* (and no longer is) enthusiastically generated and promoted by government in partnership with public transport service providers and private vehicle development businesses.

In a recent paper, James MacKenzie, a Senior Associate of the World Resources Institute, professorial Lecturer at John Hopkins University, and visiting fellow in the Woodrow Wilson National Fellowship Foundation Programme in the US presents his view of the future transportation (**MacKenzie, J.J.** *Two Transport Visions.* In 'Transport at the Millennium', The Annals of the American Academy of Political & Social Science, Ed. Long, S.G. London: Sage, Sep 1997 Vol.553, 192-198). In this, he describes the effects of a 'Business as Usual' approach to transportation. His scenario and result is not so far different from the world which the UK Government's New Deal seeks to avoid, though his perspective has the additonal overlay of a nation where there is a higher political resistance to regulate transportation generally and car transportation in particular. The 'Business as Usual' case falls far short of the need to meet the (global) environmental degradation avoidance objectives from which the

USA is not immune (either internally or externally). At the core of the debate is the growth in human population, its car-driving component and car population as a result and the problems in terms of fuel (and other) resource depletion, greenhouse gas (and other) emissions, congestion and land use that result. He makes the point:

"Over the past 25 years, the number of motor vehicles in the United States increased by 80 per cent. This enormous increase in fleet size overwhelmed the relatively modest reduction in per-vehicle fuel use....

"Fuel *(and its resultant emissions)* trends are not the only problematic ones. Congestion is another. It is one of the most troublesome long-term problems faced by motor vehicle drivers and one of the most frequently cited issues in the debate on urban transportation planning....

"Nationally, current trends indicate that congestion will continue to grow. By the year 2005, delays have been projected to increase between 300 and 500 per cent over 1985 levels. In Los Angeles, congestion has already reduced freeway speeds to less than 31 miles per hour; by the year 2010, they are projected to fall to 11 miles per hour....

"The congestion problem is complex, with roots both in demographic trends *and in the failure on behalf of urban planners to provide travel options to reduce dependency on the automobile.*"
(op cit 1997, parenthesis and emphasis in italics have been added)

In relation to congestion, he not only covers the rate of growth in qualified driver population, but also the growth in miles driven per driver, "mainly for family an personal business:shopping, doctor's visits, taking the kids to hockey practice, picking up the dry cleaning, and so forth" (op cit, 1997), the increased number of smaller households - less likely to share their transport or act collectively in terms of travel, and the fall in the real cost of owning and operating a car. The kind of automotive paralysis leads him to suggest *'a more attractive pathway'* (op cit, 1997) which could only be achieved with the cooperation of, if not leadership from, transport planners

and other regulatory authorities. The ensuing vision is far more innovative (if not *'renovative' - see below*)

- innovation or renovation?

MacKenzie then proceeds to describe a future in which the problems of car-driven emissions and pollution have been solved by some technical fix which spurs the change from fossil fuels to a more sustainable and cleaner propulsion source. Thus, this currently growing threat is eclipsed by that of the no less current, growing, but underlying problem of congestion - albeit transformed into an emission-free variety. In this new world, he sees 'personal rapid transit' (PRT) systems playing a vital part in reducing dependency on the car in urban and suburban areas. He states:

"This alternative future would also provide more options to the current exclusive reliance on cars and trucks. Integrated land-use and transportation planning would give greater emphasis to non-motorised possibilities such as walking and bicycling paths as well as innovative forms of public transit such as personal rapid transit (PRT).

"PRT systems consist of small, dedicated, computer-operated electric vehicles capable of carrying three or four seated passengers. The vehicles ride on their own electrified guideways, either elevated or below ground, allowing vehicles to travel safely at high speeds independently of existing motor traffic....

"With sufficient federal and state incentives, financial resources would be available to begin making over major US urban areas. PRT systems would gradually be retrofitted to many cities, especially in suburban areas, connecting residential developments, shopping centers, universities, hospitals, train stations, airports and business centers." (op cit 1997)

Such a development is seen as redeveloping, if not regenerating, urban and suburban life:

"In this alternative future, US citizens would be far less subservient to cars. Streets would be quieter. The air would be cleaner. There would be more options for travel and, at the same time, less need to travel because of mixed residential and retail development....[Such a future] would accomodate different lifestyles and different travel preferences. Best of all, it would be sustainable over the long haul."
(op cit 1997)

But even this vision is not new, either in concept or 'reality', it formed the focus of publically-financed project in France in the eighties, which ran to prototypes and failed (before its time?). This project, called 'ARAMIS', was the subject of a meticulous sociological research 'post mortem' by Bruno Latour and now the subject of a book (**Latour, B.** *ARAMIS, or the Love of Technology*. Translated, Porter, C. Harvard: Harvard University Press, 1996) in which offers a detailed transcript of the project and its failure from the points of view of the key 'actors' involved. As such it gives important insights into the radical change process and the limiting, if not debilitating effects of past baggage on the creation and implementation of such a technologically brave new world.

Problems of 'will', difficulties of democracy and government terms of office affecting commitment, support, and political positioning, make such long term projects unlikely to succeed. They have a tendency to be compromised, and suffer from actors' 'lip service' - what they say and what they do are different, what they say within as opposed to what they say without are different. Will each admit to each other their exact position given the different motives in play - the public face of the governmental domain (at a national and regional level) together, that of the publically-owned, regional mass transit provider as well as the purely private domain of the commercial company board and that of the project team itself? And then there was an external catalyst - the impact of the World Fair - the publicity attractions of the world stage. All these elements combine to make a fascinating story of a multi-million franc project born out of a PRT study in 1969 which almost ran the full course to field trial before being terminated in 1987. It survived changes in government and company structures before its funding was finally brought to a halt.

- *What was ARAMIS?*

ARAMIS was a brave attempt by the French - a society historically not unwilling to consider and deliver 'grand plans' - to solve the downside problems of the car in an urban (and increasingly suburban) environment. Its focus in terms of change was to tackle the land use aspects of the private car, though it would have some positive impact on the management of traffic flow. Its underlying principle was for the public sector to provide a *personal* rapid transit network which would take on board the key disadvantage of mass transit systems - their inability to provide the particular needs of an individual member of the travelling public who wished to travel from A to B without the incovenvenience of self propulsion to or from a distant station and making changes en route to their destination (*sounds like a car, n'est pas?*). However, the key difference between the car and ARAMIS, apart from the latter being in public ownership (not an essential feature though the investment in and commissioning of such a service is perhaps better in the public domain), was that whilst a four seater 'car' would be summoned by the service consumer from a station no more than a few hundred metres away from their location, once the destination had been communicated, the route and progress to it was controlled by the network itself - the 'driver' was effectively not in the cab.

Thus, a form of intimate, individual transportation service, not unlike a 'guided' taxi, was envisioned, supported by a dense network of main lines and branches which was flexible enough to be able to provide such a service without the user incurring the inconvenience of excess waiting time or traffic congestion delays. The system would automatically deliver the right transportation service at the right place at the right time - managing car queueing, flexible car 'batching' with the formation and deformation of 'virtual' trains to match parts of routes which happened to be collectively used by the consumer, and car 'parking' at strategic points in between use from which the optimal coverage of the network's branches could be provided. ARAMIS was not just seen as a complement to existing transportation systems, it was a *substitute* the delivery technology of which would take up far less space than the complex web of public mass transportation systems - the railway, metro and derivatives thereof - and

yet give a much improved individual service taking current cars, parked or in motion, off the crowded urban streets. ARAMIS was not forseen as a part of an integrated transportation system - it was an integrated system in itself. The name of ARAMIS was formed from an acronym which translates as 'arrangement in automated trains of independent modules in stations' (**Latour, B.** *ARAMIS, or the Love of Technology.* Translated, Porter, C. Harvard: Harvard University Press, 1996). Latour records a report of the supplier company, Engins Matra which attempted in 1971 (and in my opinion failed) to set Aramis apart from the car but in a position which does not 'threaten' its automotive mate (or their producers):

"The automobile marks our generation. Weekend gridlock and pollution are upsetting, but they don't stop its development. The quality of service it offers, availability, suitability for door-to-door transportation - is incomparable, and accounts for its appeal. Aramis, a system of urban and suburban on-site transportation, offers an alternative to the automobile, whose very proliferation cuts down significantly on its performance....Aramis does not stand in competition with the automobile, but as a *complement* to it. By offering users a free choice between two equally attractive measures, *it gives the automobile's 'prisoners' their freedom back.* By pulling part of the traffic off the roads, it improves traffic conditions.....

"Aramis' users constitute a clientele that appreciates the advantages of the automobile, while rejecting its disadvantages. For Aramis is like the automobile: it offers comfort, availability, the absence of interruptions. But *in addition*, it offers speed (50km/h), safety, punctuality. An electric powered system on pneumatic wheels, Aramis also protects the environment (no atmospheric pollution, no noise).....To choose Aramis today is to win the wager already, the one our children will make tomorrow in order to live in cities that have a human face."
(op cit 1996, emphasis is Latour's)

From a technological point of view, several key elements formed the foundation of the infrastructure. The cars, the concept and scale of which was based on Renault's 'Espace' model, would not be propelled by fossil fuels - the innovation of an

electrically-powered 'variable-reluctance motor' was at the core of ARAMIS' propulsion system. Another important element was a radioelectric coupling-decoupling mechanism which did not involve a physical connection providing the non-material 'glue' between cars when 'trains' needed to be formed. This feature was counter-balanced by 'CMD' (*Canton Mobile Deformable*) which provided a variable 'space capsule' around each car which adjusted the speed of and distance between cars to make the most of individual car and virtual train movements throughout the system, especially in and around stations where cars whose destination had arrived were separated from informal train formations and guided into a station loop whilst others in the 'set' were guided through a station 'by-pass' without stopping. Clearly, apart from the lightweight track which provided guidance at ground level, the heart of the network was a central traffic management system which was to manage traffic flows and storage when not in use.

Whilst the technology of the ARAMIS project could be described as adventurous, if not ground-breaking, and indeed featured in its downfall, it was not the technology *per se* which was at the root of the problem. The project called for cooperation at a wholly unforeseen level between a diverse number of groups, each powerful in their own right, each with an individual institutional agenda which only part-fitted with the overall objectives of ARAMIS. Differences between the group members' aspirations were papered over for a long period with negotiations and compromises which were not aligned with the ARAMIS vision, being traded and 'tolerated' at a political, administrative level whilst at another, within the project team itself (and sometimes externally to suit the political occasion), the sanctity of the vision remained *inviolate*. Suggestions to 'water down' the envisaged solution were glossed over, for example, using bigger, 10-14 seater cars; concentrating on the suburbs with mass transit systems connectivity; staying out of *La Region Parisienne*, at the core of the traffic problem; retro-fitting some of the innovative technological solutions or applying Aramis automated principles to existing transportation systems, e.g. the 'RER', the 'Francilliene' Paris orbital motorway, the *'Rocade Sud'* , the *'Petit Ceinture'*; combining ARAMIS with other further developed if not already delivered projects (develop 'ARAVAL' from 'VAL', the automated shuttle system first implemented in

Lille, and used subsequently at Orly, Atlanta and Chicago airports - latterly quoted in James McKenzie's paper, op cit, 1997).

It was the failure to manage these political working relationships across such a wide spectrum over an exhaustively long gestation period which lead ultimately to ARAMIS' demise. As Latour reports it:

"If Aramis didn't exist, it would have to be invented. If Aramis had not tried to exist, it would have to be invented. If you had not tried to invent it, you would have failed in your mission. Anyone who does not feel this every single day, taking the Metro or getting into an automobile or swearing in a traffic jam, is not part of our circle, has no claim on our attention.

"Yet we were wrong, we made mistakes, we misled one another. Where is the error? Where is the crime? Maybe the question needs to be put differently: Where is the sin?

"Aramis has been fragile from outset. - we all know that; not fragile in just one respect, in one weak link, as with other innovations, but fragile on all points. It is limited - 'hyper-refined', as you put it. The demand for it is undefined, the feasibility of the vehicle is uncertain, its costs are variable, its operating conditions are chancy, its political support - is inconsistent. It innovates in all respects at once - motor, casing tracks, chips, site, hyperfrequencies, doors, signal systems, passenger behaviour. And beyond all this, it is hyper-sensitive to variations in its environment. A case of shilly-shallying: the history of Aramis is proof. Not one ministerial portfolio has changed hands without Aramis catching cold.....

"Yet in spite of its fragility, its sensitivity, how have we treated it?

"Like an uncomplicated development project that could unfold in successive phases from the drawing boards to a metro system that would run with 14,000 passengers an hour in the south Paris region every day, twenty four hours a day.

"Here is our mistake, one we all made, the only one we made.

"You had a hypersensitive project, and you treated it as if you get it through under its own steam. But you weren't a nuclear power, you weren't the army; you weren't able to make the ministries, the Budget Office, or the passengers behave in such a way as to adapt themselves to Aramis' subtle variations, to its hesitations and its moods. And you left Aramis to cope under its own steam when it was actually weak and fragile. You believed in the autonomy of technology.....

"Don't ask Aramis, don't ask a project, to do something you, as individuals and corporate bodies, find yourselves incapable of accomplishing. Either you change the world to adapt it to the nominal Aramis, or else, yes, you need - you needed - to change Aramis." (op cit 1996)

- ARAMIS lessons for the 'New Deal' regulators?

It must be said that the development, let alone implementation, of such an all-embracing project designed to effect such a fundamental change of direction could not be fitted into a timescale where there is seen to be no immediate compelling need (a prophetic dictator or single party state, a complete and lasting disfunction of the transport system?) and certainly does not conveniently fit the life of a single parliament, regional council, public service authority, company board, or trade union committee (or even consumer?), where the pressure to deliver a visible result is felt greatest. ARAMIS (and arguably any project which attempts to solve our transportation problems through better integration) is not a five minute wonder, it demands precisely the type of futuristic cathedral-thinking which is (inevitably?) deficient in our individual, collective and institutional behaviour. 'Rome was not built in a day' and nor should we expect its modern transportation equivalent to be - an equivalent which, in view of its inevitable impact on the structure of our land, cities, suburbs and countryside, needs some form of long term planning which is not deflected by short term potential changes in political power bases and their need to seek the endorsement of the voting masses to keep power. Such 'popular' appeal is not necessarily retained through the promotion of changes of the sort targetted which

encroach on personal freedom - the right to 'own and roam' on the one hand whilst on the other, placing at risk the present automotive industrial formula which drives a significant part of the economy in terms of output and employment.

The UK Government's 'New Deal' is attempting to move on such a wide public and private front in a society and market that has become used to a more individual, deregulated rather than collective approach. At the same time, it is trying to tackle the knotty social and economic problem of increasing car ownership and reducing urban and inter-urban car use through regulation or 'rationing' up front. With even the French nation's historical capability to work to a grand plan through many public institution-pseudo-private business 'partnerships' (usually with industries that are or were part if not wholly state-owned, run by a cadre which has been drawn from the 'Grandes Ecoles' and 'Polytechniques' which have traditionally under-pinned French political society) stretched to breaking point by ARAMIS, it has to be said that hopes of success for the 'New Deal' must be limited.

However, Bruno Latour, in the closing lines of his book, retains a hint of frustrated optimism for the concept:

"Two years later, on a plane coming back from a colloqium on 'smart cars', I was stunned to read the following article in the April 28, 1990 San Diego Union:

"FAMILY-SIZED MASS TRANSIT CARS TO BE STUDIED AS ANSWER TO CONGESTION

"Called a 'personal rapid transit' system, the idea is to construct a network of lightweight, automated rail lines that make it possible for commuters to direct individual rail cars to a specific destination, without making intermediary stops," Franzen told reporters here.

"You would walk into a station and buy a ticket," he said.
"The vehicle will read that ticket and take you exactly where you want to go."

"The technology exists all over the world," Franzen said.
"It has not been put together in this form anywhere in the world."

"Damn," I said to myself. "If they'd just waited a couple more years, ARAMIS would have been on the right path, technologically! 'This revolutionary transportation system is soon going to transform the city of Chicago....Thereby solving the problems of congestion, ...pollution.' But it's Bardet, it's Petit all over again!...A billion dollars.' They should have held out. 'It's all becoming profitable again. I should have stuck with guided transportation...." (op cit 1996)

Plus ca change, plus c'est la meme chose? - There's maybe hope for us yet.

More of the same or more from less? - three 'evolutionary' views of the car and its industry's future

It is not easy to gather radical views of the car's future from material published by the industry and its affiliated organs. Quite 'naturally' most material tends to be reflective - reviewing performance past, and looking to the immediate future of particular businesses. Whilst, from time to time, a company may give a warning of a difficult year to come, usually as a result of 'external' global market factors, official statements from the industry tend to be optimistic - since the objective of such material is to inspire confidence, and by so doing positively influence market and shareholder opinion. Also, it would be extremely unlikely for such material to reflect any radical intent before it had been put in train. To publicise such strategic moves in advance would be unnatural in an industry where external positions are jealously guarded from the inside.

However, in recent years, industry has moved beyond the world of Annual Reports shaped purely in retrospective financial terms with these publications taking on a much wider brief, illustrating the company in a much wider context. In addition to this, most companies of international repute have sought to avoid broadcasting exclusively to shareholders and are now regularly publishing environmental reports as well as much wider-ranging information within annual reports on their activities to inform and influence public opinion of them at large. The motor industry, given both its scale and potential environmental impact forms a key part of this growing communication movement and it is from the reports of some of its member companies

that this first industry view of the future has been built. Whilst it is accepted that any such 'official' material must represent a carefully constructed case to impress the reader, nevertheless, patterns do emerge across the group which could be interpreted as statements about the thrust of their future intent. The other two views come from industry-related, but not 'owned' sources - the first being sunk in an engineering view of the car's evolution itself, the second in the evolution of the business of the car and how its current product might become just part of a much wider, information-driven, 'personal mobility' business. But first, let us put some directional stakes in the ground from the industry itself.

'The present is the future and more of the same' - an incrementalist view

Since the early nineties, the motor industry has started to use its annual reporting process to not only put its previous year's trading into perspective but also, in some cases to reveal its future intent, both in terms of research and development and, on occasion, its commercial direction. Perhaps the most important single influence on this corporate communications development has been the rising tide of awareness of the industry's external impact, triggered by environmental lobbies and supported by increasing levels of both industrial and product-related regulation. Reporting, in this context, has moved on from the presentation of the industry and its latest products in a progressive, purely economic sense to a point where certain environmentally-sensitive areas of product and process development have become the focus of not just what has happened to meet standards imposed by external bodies but also to reflect the research and development efforts of the companies to explore future 'step change' possibilities for product and business alike.

As a result, certain key future development features have started to form a regular (if not repetitive) part of industry reporting. The thrust of these features mainly centres around the current product, the car itself and the *technologies* within it which are seen to tackle some of the problems that the car creates in and for its external environment. Some other recognition is given to the process by which the car is made and how that is being cleaned up to prevent the more pollutive effects of manufacture, whether it be the change in paint technology to a water- rather than cellulose-base or technologies

being developed in areas such as recycling and reuse which potentially will have a rather more fundamental effect on the product and its life-cycle itself.

From the annual and environmental reports of a number of global motor industry players, a pattern emerges of the emphasis the industry is, at least at face value, placing on its future development. Few of these elements are radical and nor would an informed observer expect them to be but they represent an incremental view of an industry which has substantial costs of entry, operation and exit relating to its existing structure of product and process. That is not to say that more radical solutions and views do not appear in such documents, though they are usually presented in the context of *distant* future 'design studies' or 'experiments' and sometimes more general, corporate *visionary* statements of what might eventually come to pass.

- the 'industry standard' elements of an automotive future

Such elements include certain technology-based approaches which form part of the 'standard' armoury of most players and relate to fuel economy and emissions (now including greenhouse gases as well as previously recognised 'noxious' substances), alternative less pollutive propulsion systems, product design characteristics which impact on the (re)sourcing and manufacturing process - notably recycling and re-use, car-borne features which enable better internal driver control, if not external traffic management.

The table below, extracted from company annual and/or environmental reports, illustrates how these 'standard' elements have become an integral part of the corporate communications of the motor industry. Whilst it only incorporates only a selection of automotive companies, it does reflect what is at least, 'business as usual' in the industry's assessment of the car's environmental 'futures'. Also, while it may appear that certain companies are not involved with particular technologies, it merely illustrates that they do not mention them in the published material reviewed. In this respect, it is known from the author's experience that corporate entities not included in the table are very much involved with research and development in the environmental areas covered and the related 'standard' technologies.

Figure 12: A 'standard table of elements' of the car's future development as seen by the motor industry itself

Company	Fuel Efficiency			Noxious Gases	Greenhouse Gas	Alternative Propulsion Systems					Recycling & Reuse	Car Control & Traffic Management
Particular Vehicular Technology Feature	Drag	Weight	Power Train			Gas	Electric	Hybrid	Hydrogen	On-board Solar		
GM (Global)				Y	Y	Y	Y	Y			Y	
Opel (GM)	Y	Y	Y	Y	Y	Y	Y	Y	Y		Y	
VW Group	Y	Y	Y	Y	Y	Y	Y	Y	Y		Y	
BMW	Y	Y	Y	Y		Y	Y	Y	Y		Y	Y
DaimlerBenz	Y	Y	Y	Y	Y	Y	Y	Y	Y		Y	Y
Volvo	Y	Y	Y	Y	Y	Y	Y	Y			Y	Y
Toyota	Y	Y	Y	Y	Y	Y	Y	Y	Y		Y	Y
Honda	Y	Y	Y	Y	Y	Y	Y	Y		Y	Y	

Important note on constitution of table: 'Y' denotes substantive rather than 'passing' mention in Environmental Reports/Annual Reports of the companies concerned. However, if no 'Y' appears, this does not imply that these companies are not involved in the appropriate research field at any level, it merely records that this particular element is not mentioned in the corporate published material used in the survey.

Sources: 'The Right Road', GM Environmental, Health & Safety Report, General Motors Corp, 1997
'Initiatives for the Environment', Adam Opel AG, 1996
'The Volkswagen Environmental Report 1997', Volkswagen Group AG, 1997
'Ideen, die bewegen. Volkswagen 1998', Volkswagen Group AG, 1998
'BMW Environmental Report 1997/98', BMW AG, 1997
'1997 BMW Annual Report', BMW AG, 1997
'Daimler Benz Environmental Report, 1997', Daimler Benz AG, 1997
'Volvo Environmental Report 1996', Volvo Corp, 1996
'Care of the Earth - Toyota Automotive Eco-Technologies', Toyota Motor Corp, 1997
'Toyota Electric & Hybrid Vehicles', Toyota Motor Corp, 1997
'Changing... the car, Toyota Annual Report 1997, Toyota Motor Corp, 1997
'Honda Clean Air Vehicle', Honda Motor Company, Ltd, 1997
'Honda Corporate Profile', Honda Motor Company, Ltd, 1997
'Honda Dream Solar Car information', Honda Motor Company Ltd, Undated.
'Honda Annual Report, 1997', Honda Motor Company, Ltd, 1997

It has to be said, however, that the research and development impetus in the areas covered above has largely, but not exclusively, been born out of the need to respond to external public pressure followed by tightening or forthcoming environmental regulation with the companies seeking to demonstrate their corporate societal responsibility. The framework and tempo of regulatory focus has been set as follows:

- in the context of vehicle emissions by the US state of California with its leadership over many years of the 'clean air' movement (this presently culminates in its 'zero level emission vehicle' legislation for the year 2003.

- in terms of recycling and reuse, the regulatory thrust has come from Europe - especially Germany.

- in relation to traffic management systems, northern Europe (led by Germany and the Netherlands) with its well-established, ancient, city structures and closely-knitted, overcrowded within and between city transportation infrastructures and general lack of land space has led the way with both regulation and jointly-sponsored industry-governmental (or EU) research programmes.

Despite representing an automotive future intrinsically bound up with the evolutionary development of the car more or less as we know it, i.e. a personally-directed, four wheel form of mobility with space for driver, one or more passengers plus luggage, there are some elements included in the 'standard table' above which are worthy of special mention.

- Interesting experiments in urban runabouts - Opel's 'MAXX' car, BMW's 'C1' bike
Whilst many manufacturers are experimenting with alternative fuel sources (v.a.v. the table above and discussed in more detail below) with the 'city car' often forming their vehicular representation, there are two other well-publicised 'urban runabout' solutions which are not power train focused in their thrust but which illustrate slightly different approaches to personal mobility in automotive form.

The first, Opel's 'MAXX' project is one of a 1990's small car genre, reminiscent of the design thrust of the French, perhaps epitomised by Renault's prize-winning 'Twingo' and latterly the Daimler Benz/Hayek's recently launched 'SMART' car. 'MAXX' has some attributes, especially 'scale', in common with these competitors, however, its ingenuity of design goes one stage further with its tailored versatility, adaptability and recyclability. Hailed as a 'made to measure aluminium suit' (**Opel, Adam AG.** *Initiatives for the Environment.* Adam Opel AG, 1997), it has a basic, lightweight, low corrosion, aluminium frame which can be assembled, and

reassembled into various body configurations of two different lengths to encompass 2 door, 4 door , hatchback, open or closed top, and delivery 'pick up' variants. On to this underbody construction, various coloured external panels and modular trim features using not only aluminium but other plastic-based materials can be added or subtracted to create different automotive solutions for the customer. As a result of the materials used in the concept, its weight is approximately 650kg - half the weight of a 'Mini' - and its small, 'traditional' three or four cylinder power units bring a fuel economy of 4 litres per 100 kilometres. The key points of weight and its impact on fuel economy will feature heavily in what follows.

The second is BMW's C1 motor cycle-based runabout. This product attempts to make the bike more 'civilised', and in so doing making it more acceptable as a car substitute. The bike's advantages over the car for city mobility in terms of its size of its space 'footprint', manoevrability, and fuel economy has suffered for many years through its association with noise, smells, danger (both to driver, passenger and other road users) and rider discomfort. BMW sought to overcome some of these problems and make the bike a really effective alternative to the car in the city. Safety is a key part of C1's design - with its objective to apply some of the car's safety features retrospectively into the framework of the bike - though suffering the inherent instability of a two wheeler, all-round protection is provided to the driver with multi-point seat belts, roll over frame and side protection, and head restraints which negate the need for a crash helmet. Some measure of all-weather protection is also provided by part-enclosure of the roll over frame. In road trim, the bike weighs 170kg and its 125cc engine with catalytic converter delivers fuel economy of between 3 and 4 litres per 100 kilometres through an automated transmission system - approximately 80 mpg. Weight, as with MAXX is kept down through the use of an aluminium frame. So again, weight and fuel economy feature heavily in C1's design criteria. Whilst C1 is hardly revolutionary, it demonstrates through its car to bike technology transfer, that cross-fertilisation between two historically separate species is possible and that the key advantages of the bike can be delivered in a much more user-friendly form.
(Source of C1 product information: **BMW AG**, Press Information, Greener Vehicle Exhibition, Chester, April 1998)

- the future promise of alternative power sources

A key area of research and development focus in motor industry, fuelled by the environmental debate, concern over related regulation and, in the longer term, in recognition of the scarcity of fossil fuels, especially oil, is that of propulsion by an alternative fuel arrangement. Most manufacturers have interests in the field where similar solutions, based around long existent automotive formats - electrical battery power, efficient diesel engines and mixtures of the two - the 'hybrid' vehicle, abound. All offer some advantage but no one holds out a pre-eminent solution. A review of these frequently promoted formulae, their incremental advantages and disadvantages, is nevertheless relevant in the context of Generation 5.

- Fuelling the hydrogen propulsion debate

Several manufacturers including BMW, Daimler Benz and Toyota, whilst remaining in the broad church of alternative propulsion systems research are heavily involved in the development of and experimentation with hydrogen-propelled vehicles with power delivered to the wheels from energy, the only output of which is water. However, both solutions still produce greenhouse gas 'waste' emitting carbon dioxide, albeit at a rate one third the level of a present petrol-engined car. However, neither solution comes without a significant economic, if not ecological cost:

"The development of these alternative energy vehicles presents a host of issues that must be resolved. The wide acceptance of alternative energy vehicles may also depend on the development of a new energy supply infrastructure."
(**Toyota Motor Corporation.** *Car(e) for the Earth: Toyota Automotive Eco-Technologies*. November 1997)

The current approach is two-fold. First, in an approach favoured by BMW, existing internal combustion engines can be adapted to take on board previously-manufactured hydrogen into their fuel tanks. Such a method, however, would mean that hydrogen would have to be produced through electrolysis of water (through replenishable resources such as solar energy if excessive conventional energy costs and greenhouse

gas emissions are to be avoided) elsewhere and distributed via a service station network. The other drawback is that hydrogen, in its natural form takes up a disproportionate amount of space relative to its potential propulsion power (which effectively limits range) unless it is liquefied at -250C and held under high pressure.

In Toyota's case, they boast going beyond a simple, pressurised tank having developed a storage vessel which contains a 'hydrogen-absorbing alloy' which can store five times the amount of hydrogen - thus, in their case, a 120kg *fuel cell* unit is backed up by a 100kg storage unit which weighs less than half that of the battery pack that propels its electric vehicles. The fuel cell of the Toyota system is not unique but forms the heart of the second option which moves the production of hydrogen into the car itself. The fuel cell performs the electrolytic process 'to order' - however, this process is still dependent on the break-down of hydrogen-rich fuel, such as natural gas (which is non-replenishable) or methanol (which is replenishable from the conversion of 'biomass'-related cultivated products) as required to propel the vehicle. Given the instability of hydrogen and the high potential energy conversion cost, it is clear that the latter form of energy production is more preferable (providing that the cell and its gas output can be made safe and environmentally efficient at an economic cost). This method does not come without a cost either, as BMW point out:

"Besides the internal combustion engine, BMW is pursuing a further possibility of using hydrogen: the fuel cell. This is a device for converting chemical energy into electrical energy; it turns oxygen and hydrogen into current that powers an electric motor. Fuel cells have promising development potential, providing the key components can be produced at an economic price through an environmentally compatible process. At present, fuel cells require too much of the precious metal as a catalyst."
(**BMW AG.** *BMW Environmental Report 1997/98*. BMW AG, 1997)

However, the first solution, whilst it sounds relatively easy to convert the existing automotive power train to handle the new fuel, it does so at immense external infrastructural cost in relation to the bulk production of the gas, its pressurised storage

and distribution to specially adapted 'filling stations'. The downside of this approach has another dimension - whilst the in-car storage arrangements can be made 'safe' through reinforced vehicle component structure, distribution infrastructure security both at production and bulk storage sites, during delivery and at retail outlets would also have to be taken into account. Daimler Benz, which like Toyota favours the on-board fuel cell powered by hydrogen released from methanol emphasises the larger ecological point:

" 'Hydrogen: dream or illusion?'
Conventional engines can run on hydrogen, generating less emissions than diesel fuel, for example, since the combustion of hydrogen in conventional engines produces no carbon dioxide. But here too, we have to consider the energy chain in its entirety: for if the hydrogen is produced using fossil fuels, more carbon dioxide is generated in relative terms than in a diesel engine. The visionary approach of using solar energy to produce hydrogen in equatorial regions and then transporting it to regions with high energy consumption, has so far proved too expensive in terms of both cost and energy."
(**Daimler Benz AG.** *Daimler Benz Environmental Report 1997.* Daimler Benz AG, 1997)

In addition to this, it could be argued that any bulk production and storage of such an 'unstable' fuel (gasoline included?) is waste anyway given 'lean thinking' principles which suggest that production and delivery (and any minimal storage) should be *local* (if not *internal*) to the point of use (i.e. on board?) and at the *precise* quantity required to propel the vehicle at *that* point in time. Despite this interest in hydrogen power over many years, economically and environmentally satisfactory solutions to the issues raised above have not yet emerged.

- Putting a brake on friction - the 'hybrid' vehicle
An all-together more pragmatic approach to the economy and ecology of automotive mobility adopted by the industry at large is that of the hybrid vehicle. In an attempt to significantly reduce vehicular emissions, both noxious and greenhouse whilst at the

same time increase fuel economy, this mix of battery-based electrical and small subsidiary diesel or gasoline power lies at the hub of this development. The approach avoids the problems of weight and range associated with pure battery-driven propulsion, and can halve the output of carbon dioxide (Source: **Toyota Motor Corporation.** *Car(e) for the Earth: Toyota Automotive Eco-Technologies*. November 1997) via a system which uses stored electricity from batteries when in motion. The power that drives the wheels or maintains the charge of the on-board battery can come from either an electrical or fossil-fuelled source or a mixture of the two, though the bias is in favour of the use of electrical power wherever practicable. The electric motor provides power for start up and slow speed driving in (urban or otherwise) traffic; it also recharges the on-board battery as a generator and starts the fossil-fuel motor when conditions require it. Another key feature of such systems is that the friction of braking is re-converted into electrical energy through the inclusion of a 'regenerative braking' device, thus the 'wasted' energy of braking is 'recycled' and stored in the battery for future use.

Though its scientific principles could hardly be described as revolutionary, at least the 'hybrid' operating as a whole offers some tangible advantages over its individual components operating independently, giving an acceptable power output and range, a much improved level of fuel economy, less waste of energy and significantly less emissions without the disadvantage of excessive weight carried by the battery-propelled vehicle (and the fact that in such a vehicle, its emissions - greenhouse and noxious - are merely transferred to the electrical energy generating supplier unless its power is sourced from solar, or nuclear, energy).

- Honda's 'Dream', the solar car - 'Cruising speed: On clear day over 56mph'

*(***Honda Motor Company, Ltd.** *Honda Dream Solar Car Information*. Honda Motor Company Ltd., Undated*)*

This 'experiment' has been widely publicised of late, with its product winning, amongst other events the World Solar Challenge in 1992, 1993, and 1996. It is not the normal, incremental 'stuff' of the industry. It does, however, set a development boundary - almost at the 'sci-fi' end of the spectrum - a stake in the ground for the

future out of which other critical elements of the equation of propulsion become manifest.

The concept, founded in electrical power, relies on no form of fuel other than solar energy. In addition to its innovative power generation capability based on on-board solar cells, Honda's solar dream car draws heavily on two other 'advanced' design and engineering technologies. First, its all-round slippery shape, developed to almost 'stealth' proportions, secures a level of aero-dynamic drag which could be claimed for no current street car. Second, and even more importantly, its weight, at 170kg - the typical weight of a current mid-range vehicle is circa 1500kg - is a function of its use of carbon fibre reinforced plastics.

It is, perhaps, these last two factors - weight and drag - which hold the real clue for future vehicular development rather than the adoption of solar energy as an energy source, the main drawback of which relates to the need for 'blue sky' fair weather and daylight for fuel. Attempts to compensate for this key meteorological disadvantage through the incorporation of fuel storage capability would in turn carry the disdavantage of weight which, in turn, carries the further disadvantage of needing more power if the key functions of movement and range are to be achieved. It is to this adverse 'multiplier effect', or downward spiral of propulsion that I now turn.

- 'More from less' - turning the vicious circle of weight into a virtue - an automotive 'alchemist's' view

The effects of weight and aerodynamics (drag) on vehicle design efficiency have long been recognised within the industry. As demonstrated from the 'standard table of elements' above most manufacturers at least recognise the importance of these two items in car design and have accounted for them incrementally in their products in Generation 4 ('streamlining' was a feature from Generation 2, though more a product of design than a quest for fuel efficiency) - with the increasing use of computer-aided design to minimise 'drag co-efficients' to improve fuel efficiency and the use of plastics in some form or other for some, especially 'trim', components to reduce overall weight. The effects of this general industry movement have been evolutionary

and have made some positive steps in steadily improving fuel consumption though, they were often backed by equally incremental improvements in engine and transmission technology - the 'power train'. Very often, the efficiency-related benefits of such 'progress' have been eroded through the adoption of other creature comfort devices which have absorbed the potential savings - for example, the increasingly frequent addition of features such as air conditioning, power steering and braking systems and more recently other automated safety systems, air bags, anti-lock brakes, traction-control systems. Whilst these features may or may not be 'essentials' for modern motoring, they illustrate the overwhelming tendency to maintain, if not increase, the overall weight of the vehicle. When the underlying motor industry dependency on steel body and chassis construction is taken into account, it is easy to see why an unladen weight of c1500kg is considered 'normal'. However, what is not immediately obvious is that this weight is a critical factor in itself in terms of worsening fuel economy and thus emissions of both greenhouse and noxious gases. In addition to this, the many of the additional features mentioned above themselves not only increase weight but also use more engine power and thus worsen even further fuel efficiency and emissions.

Apart from the incremental application of aero-dynamics in design and limited weight saving through the use of plastics, there have yet been few attempts by the industry to radically change its dependence on iron and steel as a foundation for its product. Especially but not exclusively in Europe, there has been a shift towards the adoption of aluminium for power train related components whilst the body shell itself has been largely ignored as a potential for weight reduction. Manufacturers such as Volkswagen have made limited progress in the field - its Audi A8 having an aluminium body and in its interpretation of the '3 Litre Car challenge for the millennium', it makes the point:

"One key element in the realization of the 3 Litre Car is vehicle weight....The traditional material for car manufacturing, namely steel, has also been through a long and positive development process. New steel composites can save up to 15 per cent in weight..... However, the fact that a weight reduction of 100 kilograms only cuts

average fuel consumption by some 0.2 litres per 100 kilometres.... illustrates the dimensions of the challenge facing Volkswagen's research and development engineers."

(**Volkswagen Group.** *The Volkswagen Environmental Report 1997.* VW Group AG, 1997)

Note: - The term '3 Litre car' refers not to engine cubic capacity but a vehicle which needs three litres of fuel to cover 100 kilometres - circa half the current car's average fuel consumption level.

Volkswagen then goes on to place its future bets on another scarce resource which needs significant energy for extraction and 'refinement', that of magnesium:

"Extremely light and extremely stable, magnesium is a *beacon of hope* in the battle to minimise fuel consumption and vehicle weight. With a density of only 1.8 grams per cubic centimetre, magnesium is one of the lightest metallic construction materials. Compared with fibre-reinforced plastics, magnesium has the advantages that it can be cast and sintered, and more easily recycled."

(op cit 1997, emphasis added)

It is to the sub-optimal effects of these 'isolated' pockets of the industry's development that Amory B Lovins, an American engineer, has turned in search of a more comprehensive, 'total system' approach to the inter-related vehicular problems of fuel consumption and emissions. Lovins, a Harvard and Oxford educated physicist, a prolific author of books and papers and well known scientific prize winner, has focused on solutions to the conundrum of energy and its conservation, especially in the automotive and building design and engineering fields. From this research has come his para-*alchemical* concept and reality of 'hypercars' has developed:

"New technologies and new ways to combine them can yield cars that combine ultralight advanced-composite construction with hybrid-electric propulsion. Such ultralight-hybrid 'hypercars' would be severalfold lighter and more slippery than today's cars; an order of magnitude lower in product cycle time, tooling cost,

assembly effort, and parts count; yet also safer, sportier, otherwise nicer, and probably cheaper. This technology fusion is likely to enter the market in the next few years through competitive mechanisms; is about to transform the auto industry (one seventh of GDP); will ultimately save as much oil as OPEC now extracts; could form the nucleus of a green industrial renaissance; *and will both require and complicate parallel reforms in transportation policy to reduce excessive automobility. Hypercars' challenges are not chiefly technological or economic but rather cultural and institutional, such as shifting manufacturers from hardware to software and from complexity to simplicity.*"

(**Lovins, A. B.** *Hypercars:The Next Industrial Revolution.* From the PARC Forum, Rocky Mountain Institute, Colorado, http://rmi.org/hypercars, October 12 1995, emphasis added)

This extract from Lovins' paper not only holds out a hope of a dramatically different automotive formula - albeit that he recgonises that many of the component parts of his concept are already in existence - it is in the *combination* of these individual solutions, systems and methods that he sees a holy grail. In addition, Lovins admits that his rather more revolutionary vehicular outcome may in turn complicate the traffic- rather than fuel efficiency- or emission-related problems of mass automobility.

At the core of Lovin's argument is the paradoxical anachronism of weight described above. More weight demands more power for movement and conversely, less weight demands less power. On top of this simple statement, he illustrates a principle (not unlike the 'multiplier effect' of economics) where as layers of weight are removed, the opportunity to reduce weight even further arises since the weight of other vehicular components to support the new level of car mass is less than weight required to support the previous step in the 'system'. He makes the point:

"Vehicle mass is a critical factor to minimise because it affects power requirements, overall drive system efficiency, tire rolling resistance, and the amount of energy used to accelerate that is later lost in braking. Ultralightweight design can be accomplished

without making the car any smaller or less safe by replacing steel with new materials, such as advanced polymeric composites, in the car's body and chassis....

"Making a component lighter allows for others to be made lighter as well. This principle is called 'mass decompounding.' For example, reducing the weight of the body allows the engine to be fractionally less powerful for equivalent performance. It also allows for the car's transmission and other drive train components to be slightly smaller because they don't have to transfer as much power to the wheels. All these mass reduction limits in turn allow the car's body and suspension to be even lighter because it won't have to support as heavy an engine, etc....

"Obviously, mass decompounding has a limit, but the limit is much lower than might be expected, because reducing a car's mass below a certain threshold makes possible new options and even the elimination of some systems altogether. For instance, a car that's light enough can utilise unconventional lightweight and efficient drive trains and do without power steering. All told, it should be possible to make hypercars that are 50-65 per cent lighter than conventional cars of the same size."
(**Lovins, A. B.** *Frequently Asked Questions: Hypercars.* Rocky Mountain Institute, Colorado, http://rmi.org/hypercars, 1997)

Lovins then illustrates how hypercars could contribute to significantly improved fuel economy (and therefore emissions) by cross-referring and consolidating his 'lightweight' learning disciplines across several key areas of automotive design and engineering:

- *reducing aerodynamic drag* beneath the vehicle as well as over its top, sides front and rear coupled with reducing rolling resistance further through the use of low friction tyres and eliminating unecessary 'idle' resistance in wheel bearings and braking systems. Lovins also maintains that the argument over the limitations imposed on vehicle design characteristics (felt to be of importance to 'marque' recognition) is invalid especially in the context of under-vehicle and less visible parts of the car's anatomy. In the area of reducing aerodynamic resistance, Lovins estimates

that current drag could be cut by 40-50 per cent. Equally, the resistance of friction generating components such as tyres, bearings and brakes could be cut by half.

- *the adoption of the hybrid engine* is seen as the propulsion 'compromise' which offers the most flexible and efficient power to weight relationship as well as its capability to support energy-regenerative braking. Lovins gives some support for the hydrogen fuel cell, making the same overall point that as the car's weight count drops, less weight is required for fuel cells, storage containers, batteries and the like since propulsion of the vehicle is much less power-intensive. He does recognise, however, that the adoption of alternative fuel systems in general in that - 'many factors are likely to influence which fuels are used in hypercars, including fuel price, market preference, fuel distribution and refuelling infrastructure' (op cit 1997) - after all, Lovins' key thrust is concerned with diminishing resistance to movement through weight reduction.

- in terms of supporting other *ancilliary vehicle systems,* optional and accessory features which support individual customer preference would become of increasing importance as overall weight reduced. At present their cumulative impact on the whole vehicular system is absorbed by 'excess' engine power. albeit sometimes with adverse impact on performance. In a hypercar future, where weight becomes a prime mover in automotive design and engineering, more careful attention would have to be given to the need for and impact of such incremental systems on the whole vehicle.

- *the choice of advanced composites* for ultralightweight body and chassis construction rather than metals such as aluminium or steel is based on several factors. First, such composites, in addition to their lightweight attributes which save an estimated two thirds of current auto body weight (versus aluminium at 55% mass reduction and optimised steel at 25-30%), contain a mix of carbon, aramid as well as plastics which between them give a strong, flexible and most importantly a capability to be moulded into single monocoque structures with less 'welded' parts of current steel structures. Second, he maintains that such compounds demand 'two to ten times less capital for manufacturing equipment.... This all results in a cheaper and less

complex manufacturing process, making smaller production volumes economical and hence leading to more agile and responsive product lines with lower financial risk.' (op cit 1997). In this particular context, Lovins makes the link with just-in-time suggesting that:

"Cars could be ordered directly from the *local* factory, made to order, and delivered to one's door in a day or two.... Being radically simplified and ultra-reliable, they could be maintained by technicians who come to one's home or office.... If all this makes sense for a $1,500 mail-order personal computer, why not for a $15,000 car?....Such just-in-time manufacturing would eliminate inventory, its carrying and selling costs, and the discounts and rebates needed to move existing stock that is mismatched to demand."
(Lovins, A.B. & Lovins, L.H. *Reinventing the Wheels.* In Atlantic Monthly, Rocky Mountain Instititute, Colorado, http://rmi.org/hypercars, January, 1995, emphasis added)

It has to be said that whilst such a radical change in logistics techniques may stand a better chance of survival if applied to a significantly different product engineering and manufacturing technology which lends itself to local production in small numbers, these logistics principles can be applied to the present industry structure (see Womack. J & Jones D.T. op cit, 1990, 1996) - *if the will exists.* Lovins real contribution is the extension of '*lean thinking*' (Womack J. & Jones D.T. 1996) into the phyiscal fabric of the product itself and thence to its manufacturing process. The use of composite-based materials is integral to his approach. Their attributes offer design and manufacturing flexibility plus a level of build quality beyond the tolerances in steel- (or other stamping press-) related processes.

At the same time there are the additional benefits of low deterioration (no corrosion), and improved crashworthiness - not to say that apart from preserving the occupants within, overall weight reduction on this level reduces the risk of injury to those without of the vehicle's structure. In this latter context, Lovins makes the point that increasing vehicle mass generally leads to a 'juggernaut strategy' where vehicles are

over-engineered for safety, especially in terms of head-on collision with the outcome being a much heavier vehicle, where his lightweight concept faces an admitted initial disadvantage. He argues, however, that such a disadvantage diminishes as the volumes of hypercars cars in use increases and current cars go to the scrap heap. The point could also be made that the over protection of occupants with sheer mass delivers a false impression of a vehicle's safety capability, lulling drivers into a sense of false security and as a result actually *increasing* the danger to the pedestrian or cyclist struck by such vehicles in accidents.

On the downside, Lovins accepts that the key disadvantages of adopting this composite-based technology are 'their high material cost, steel-based automakers' unfamiliarity with them, and the fact that high-volume manufacturing processes haven't yet been demonstrated for similar applications' (op cit, 1997). It must be said that much of the problem could relate to what Lovins calls 'cultural inertia' (op cit, 1997) or even 'barriers to exit', the effects of which would not impact on outsiders determined to produce and assemble vehicles in smaller volumes at locations much closer to their consumption point. The experience of the small, British specialist sports car manufacturers such as TVR and Lotus and their racing car stablemates testifies to this, where, whilst using traditional power train technologies, glass fibre-based composites and wood rather have been used rather than the heavier steel as a core material for body-building for many years.

- in relation to hypercars' *recycling and reuse*, Lovins makes the point that since the hypercar is being designed from scratch, recycling and reuse principles can be engineered into the design, rather than the re-engineering process which is currently being applied to the current car. He states that:

"the perception that composite materials are unrecyclable is due in part to the problems of plastic packaging and containers.... Junked cars, regardless of what they are made of, have considerable salvage value. Roughly 90 per cent of vehicles retired each year in the United States end up in a dismantler's yard, where their salvageable parts are removed for remanufaucture or reuse - unlike plastic packaging, which

typically is not worth the cost of collecting it. Since the advanced composites proposed for use in the hypercar are expensive, there would be an even stronger incentive to find an economical means of recycling them." (op cit 1997)

Whilst he goes on to state that suitably efficient technologies are available to achieve this, he admits that hypercars are unlikely to be available for recycling in volume for 20 years or more. The type of composite material adopted could affect its recycling capability. Any recycling process, especially when linked to a new technology is vulnerable to product and process improvement which may mean that a high level of 'immovable' automotive waste may be left over. However, this is a risk of any technological change - the current car and its recycling infrastructure not unaffected in this context. He further adds that the longevity of the fabric of the hypercar - with its corrosion-free structure, lower number of moving mechanical parts and the reduced passive wear associated with them coupled with the latent possibilities to make such vehicles in a way which supports their upgrade and refurbishment - means that replacement cycles could (would) be significantly longer than that of a current vehicle.

Herein lies 'the rub', since a motor industry founded on mass production, planned obsolescence and mass consumption, is unlikely to universally adopt a solution which threatens its whole *modus operandi*. Having said that, given the increasing interest of the environmental lobby and regulator in such matters, and the changing nature of the automotive business possibilities in developing new car markets and developed markets where the structure of replacement demand may take on a new meaning, a Generation 4 car producer or mobility-motivated outsider *might* see some advantages in the hypercar approach - but more of this later.

- *'One Plus Two Equals Ten'* - the overall impact of the hypercar?*

In 1995, to drive the overall message home, Lovins stated that:

"Decades of dedicated effort to improve engines and power trains have reduced to only about 80-85 per cent the portion of cars' fuel energy that is lost before it gets to

the wheels.(About 95 per cent of the resulting wheel power hauls the cars itself, so that less than one per cent of the fuel energy actually ends up hauling the driver)."
(***Lovins, A.B. & Lovins, L.H.** *Reinventing the Wheels.* In Atlantic Monthly, Rocky Mountain Instititute, Colorado, http://rmi.org/hypercars, January, 1995)

He declared that a combination of a dedicated attack on vehicle weight coupled with the adoption of 'hybrid' propulsion technology could increase a car's efficiency by dramatic proportions:

"Adding hybrid-electric drive to an ordinary car increases its efficiency by about a third to a half. Making an ordinary car ultralight but not hybrid approximately doubles its efficiency. Doing both can boost a car's efficiency by about tenfold." (op cit 1995)

With the attractions of the hypercar concept so obvious, what is stopping such a dramatic shift in car design happening in the short term? Despite Honda's experimental solar car embracing the principles of the hypercar, there is little external evidence of progress towards a wider adoption of these principles. Whilst the industry at large is unlikely to reveal its longer term strategic hand in the public domain, it must be said that resistance to change the design, engineering and manufacturing habits of the car's lifetime for the cultural and physical reasons discussed above must be a significant barrier - which Lovins has recognised. There are signs out there - Honda's lightweight composite solar-powered car, Volkswagen's hybrid-powered, magnesium '3 Litre Car' challenge, and General Motors Opel 'MAXX' project which takes a lightweight 'city' vehicle frame and hangs on to it different lightweight plastic panels to (re)create its variants - which are testing some, if not all, of the hypercar's individual principles. Is it not 'natural' to expect that the combination of the features would be the inevitable outcome? Possibly. Lovins takes up the Theodore Levitt-inspired, myopic story again:

"The fuel efficiency of cars has been stagnant for the past decade. Yet the seemingly ambitious goal of tripling it in the next decade can be far surpassed. Well before 2003, competition, not government mandates, may bring to market cars efficient enough to

carry a family coast to coast on one tank of fuel, more safely and comfortably than they can travel now, and more cleanly than they would with a battery-electric car plus the power plants needed to recharge it.

"To understand what a profound shift in thinking this represents, imagine that one seventh of America's gross national product is derived from the Big Three typewriter makers (and their suppliers, distributors, dealers, and other attendant businesses). Over decades they've developed from manual to electric to type-ball designs. Now they're developing tiny refinements for the forthcoming Selectric XVII. They profitably sell around 10 million excellent typewriters a year. But a problem emerges: the competition is developing wireless subnotebook computers.

"That's the Big Three auto makers today. With more skill than vision, they've been painstakingly pursuing incremental refinements on the way to an America where foreign cars fueled with foreign oil cross crumbling bridges. Modern cars are an extraordinarily sophisticated engineering achievement - the highest expression of the Iron Age. But they are obsolete, and the time for incrementalism is over.....

"Hypercars, not imported luxury sedans, are the biggest threat to Detroit. But they are also its hope of salvation." (op cit 1995)

But are they? To be fair to Lovins, whilst he foresees a car and motor industry of radically different structure, he does not skate over the underlying problem of personally-directed mobility. Though the hypercar starts to provide the potential for medium term (Generation 5) progress on the fossil fuel reliance front, the problems of sheer weight of traffic and land use remain:

"The ultralight hybrid would sweep the market. What then?

"Then we would discover that hypercars cannot solve the problem of too many people driving too many miles in too many cars; indeed, they could intensify it, by making driving even more attractive, cheaper, and nearly free per extra mile driven. Having

clean, roomy, safe, recyclable, renewably-fueled 300 mpg cars doesn't mean that eight million New Yorkers or a billion still-carless Chinese can drive them. Drivers would no longer run out of oil or air but would surely run out of roads, time and patience? Avoiding the *constraint du jour* requires not only having great cars but also being able to leave them at home most of the time. This, in turn, requires real competition among all modes of access, including those that displace physical mobility, such as telecommunications....

"Happily, emerging policy instruments could foster and monetise fair competition among all modes of access.... Congestion pricing, zoning reforms, parking feebates, pay-at-the-pump car insurance, commuting efficient mortgages, and a host of other innovations beckon state, local, and corporate experimenters. Yet unless basic and comprehensive transport and land use reforms emerge in parallel with hypercars, cars may become apparently benign before we've gotten good enough at not needing them - and thus may derail the reformers." (op cit 1995)

So there we have it, a technical solution which potentially makes the *chronic* symptoms more bearable for longer - the patient is kept comfortable. As welcome as these 'revolutionary' advances may seem in themselves, there are still limits to the car-carrying capacity of the planet in general and individual states in particular. And still the paradox of owning a car and not using it exercises the minds of the industry and regulatory bodies.

The extension of Lovins' 'more for less' principles features in his co-authored report to the Club of Rome (**von Weizsacher, E. Lovins, A.B. & Lovins, L.H.** *Factor Four: Doubling Wealth, Halving Resource Use.* London:Earthscan, 1997) does put the hypercar in its wider economic and environmental landscape, tackling some of the broader issues of transportation at a personal and mass transit level and looking at some of the 'car free' or, at least, 'car restricted' experiments already existent in some major centres such as Berlin (or Edinburgh) with local car pooling arrangements or more integrated transportation systems. However, as we have seen from far-sighted projects such as ARAMIS, establishing and maintaining these networks alongside the

car in city infrastructures which have evolved around the current mix of personal mobility choice is not an easy option. It is to this aspect of choice and service delivery that I now turn.

'Right service, right time, right place v. Motor Myopia' - another 'Lean' Dream

James P Womack and Daniel T Jones are well-established in the field of logistics and well-known within and around the world motor industry. Their research and analysis of the present condition of the industry has developed over Generation 4 from an interest focused on just-in-time and lean manufacturing in the eighties and early nineties (**Altshuler, A. Anderson, M. Jones, D. Roos, D. & Womack, J.** *The Future of the Automobile*. Mass: MIT Press, 1984) to a more wholist industry perspective, i.e. incorporating the marketing, product development, distribution chain elements (**Womack, J. Jones, D. & Roos, D.** *The Machine that changed the World*. New York: Rawson Associates, 1990). Latterly, they have moved on a further stage, applying their logistics-based 'lean thinking' principles both across industries and to the 'personal mobility' industry in particular (**Womack, J. & Jones, D.** *Lean Thinking*. New York: Simon & Shuster, 1996):

"...many different current buyers of what is now a very mature product probably don't want to buy a product at all. What they want is personal mobility, obtained at the lowest cost with the least hassle. A physical product, such as a car, truck, van or sport-utility vehicle, is simply part of the means to this end.

"Looked at this way, the current 'product' is certainly sub-optimal. Buying and selling cars, registering, insuring and repairing them, and taking care of the operational details form fueling to cleaning are mostly a time-consuming hassle conducted with a welter of different firms pursuing their own interests....

"Meanwhile the conventional auto industry has been focusing on (and with considerable success) on applying lean thinking, but only to the design and manufacture of the vehicle itself. It has done little or nothing to rethink the total product - personal mobility - which many of us want." (op cit 1996)

At the core of their proposition lies information - the very currency of the logistician and whilst much of their book goes over familiar ground for Generation 4 relating to time to market, production and customer, demand management, business flexibility and flow based on rapid build to order, it is their dream for a closed loop personal mobility service industry that I wish to explore. Like Theodore Levitt before them, they illustrate the potential dangers of a '(motor) marketing myopia' (**Levitt, T.** *Innovation in Marketing: New Perspectives for Profit & Growth.* US:MacGraw Hill, 1962) - the attachment to a particular internally-focused business formula set within recognised industry boundaries blinding the proponents to development opportunities, if not survival requirements beyond their 'natural' remit.

Their dream for 'short range personal mobility' fits well into a developed automotive world where car 'ownership' is already being supplanted by increasing 'access to use' through long and short term leasing and rental arrangements. Again whilst their vision of a personal mobility provider taking over from the current wheeler-dealer retailing process underwritten by mass production may appear revolutionary to some within the 'traditional' motor industry home, it could still be seen as incremental, if not already business as usual, by those without. Their solution is to suggest a service founded upon a managed network of interested parties:

"Just as long-distance travel needs a team leader to help the participating firms look at the whole, short range personal mobility needs some type of mobility provider to see the complete product. This might be a rental car company, a public utility, one of the new 'mega-dealer' car retailing organisations, or even a reconstituted automobile company. The idea would be to work with the customer to supply precisely the vehicles and services needed with zero hassle and a lower cost....

"The mobility provider and the customer would work out the type of vehicles and services needed both now and in the future and the mobility provider would 'put them in the driveway'..... The provider would also take care of replacing the vehicle as

appropriate to maintain a constant level of service for the user and bill the user periodically for the services rendered." (op cit 1996)

Womack and Jones then attempt to dispel the predictable customer (and possibly) industry retort that such a product would 'cost a fortune' by pointing to the high potential cost savings of operating the service. One of the key elements in their cost is that such fleets would have the benefit of knowing well in advance their future customer mobility requirements with their contract, its content (what service is required and when) and renewal all furnishing opportunities to plan changes at an individual and aggregated fleet level. In turn, such information, could provide the manufacturer of the vehicles with a higher level of predictability of demand over a greater period of time, enabling waste (inventories of raw materials, components and finished goods) to be eliminated from the supply, manufacturing and distribution chain. They point out:

"Remember that the demand for travel changes only by a small per cent during the business cycle while the sale of new cars in North America, Europe and now, Japan rises and falls by 20 to 40 per cent. This requires the industry to maintain large amounts of excess capacity on average. As the demand stabilises, the supply base can be tightened up and the total lead time for building vehicles can be compressed with dramatic savings in inventories, space and effort." (op cit 1996)

They then make the connection with closed loop principles:

"If the mobility provider retains control over the vehicles and recycles them at the most economic time, and if the new vehicle maker can share the mobility provider's data base on user needs in order to develop vehicle which meet these needs, vehicles should cost less to operate over their lifetimes and last longer.... The mobility provider is in a position to obtain the lowest lifetime costs possible because it is in control of the whole cycle." (op cit 1996)

Womack and Jones admit that their approach would not be easy to introduce and that, in their opinion, 'it is unlikely that conventional car companies will lead the way' (op cit, 1996). However, motor myopia is such that the existing players are already part-engaged (albeit reluctantly) in this game - they cannot avoid it. Alternatives to outright acquisition, as mentioned, above are already a significant source of vehicle demand for the business community and now the 'private' retail customer in the developed markets, where the array of 'flexible' service contracts on offer grows by the day. Spare capacity, especially but not exclusively, with the 'commodity' car suppliers, has meant that these alternative methods of 'financing' - the criticality of which was foreseen by Alfred Sloan's GM in Generation 2 - are now an integral part of automotive business practice. The suppliers of these services, banks, leasing companies, self-drive hire operators and various consolidations of them are already big, if not *dominant*, buyers which have pushed manufacturers into highly discounted vehicle contracts, often with costly buy back clauses. Their influence is growing not shrinking - so much so that manufacturers themselves have increasingly become directly involved in associated, or partnered financing operations to support the business. Not only this, but also we are now seeing the manufacturer drawn into 'cradle to grave' responsibility for their product (including its recycling and scrappage) in some key European markets (for example, Germany). The difference is that manufacturers look on this type of business as an unfortunate by product of stable (if not falling) retail demand and the need to keep their production lines flowing - such 'programme car' business is seen as an excess capacity disposal route (including the resale of used vehicles) rather than an integral part of *their* mobility business.

One could wax lyrical about the new possibilities offered as a spur to such a customer-service-driven business approach - the internet has already started to make itself felt with mobility provider operations who offer a 'hassle-free' service to consumers - but, this is just *another* information medium through which the motor business will be forced to operate regardless of its efforts to sustain its traditional 'exclusive' sales channels. What is interesting is that after years of 'unbundling' of the traditional, franchised motor dealer's business - with significant parts of the whole, being taken up by independent chains selling tyres, batteries, quick service and the

like - a 'virtual' rather than physical re-bundling of the mobility business is now taking place which goes well beyond the boundaries of the original dealership. The personal mobility service of the type envisaged by Womack and Jones is already an inefficient, developing reality rather than their deliberately executed dream. Either the motor manufacturers can seize the opportunity such a dream offers, adjusting their boundaries accordingly, be dragged into it by *force majeure,* or risk potentially serious disadvantage through avoidance.

In 1962, Theodore Levitt introduced the idea of marketing myopia:

"The railroads didn't stop growing because the need for passenger and freight transportation declined. That grew.The railroads are in trouble today not because the need was filled by others (cars, trucks, aeroplanes, even telephones), but because it was filled by the railroads themselves. They let others take customers away from them because they assumed themselves to be in the railroad business rather than the transportation business. The reason they defined their industry incorrectly was because they were railroad-oriented instead of transport-oriented; they were product-oriented instead of customer-oriented."
(op cit 1962)

Caveat vendor.

In the final part of this journey into possible futures, I shall draw together various strands from the views represented above and attempt to put together my particular interpretation of what lies ahead for the car and its industry.

20-20 Vision - the unraveling of the car and its industry - a future personal view

- The structure of the argument

The framework of this paper has been constructed around a cyclical model of history, punctuated by generations of around twenty to twenty five years in length. The model was drawn from Strauss & Howe's book, 'The Fourth Turning' (op cit 1997) which formed a basis for American historical interpretation linked to the rise and fall of

Figure 13 - Motor Industry Network - Pre-generation 1 - 'The horseless carriage' - Daimler, Benz etc

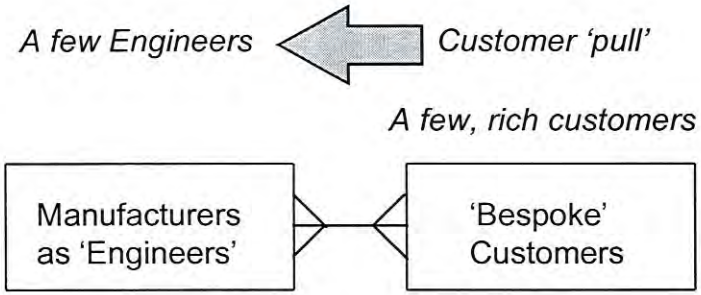
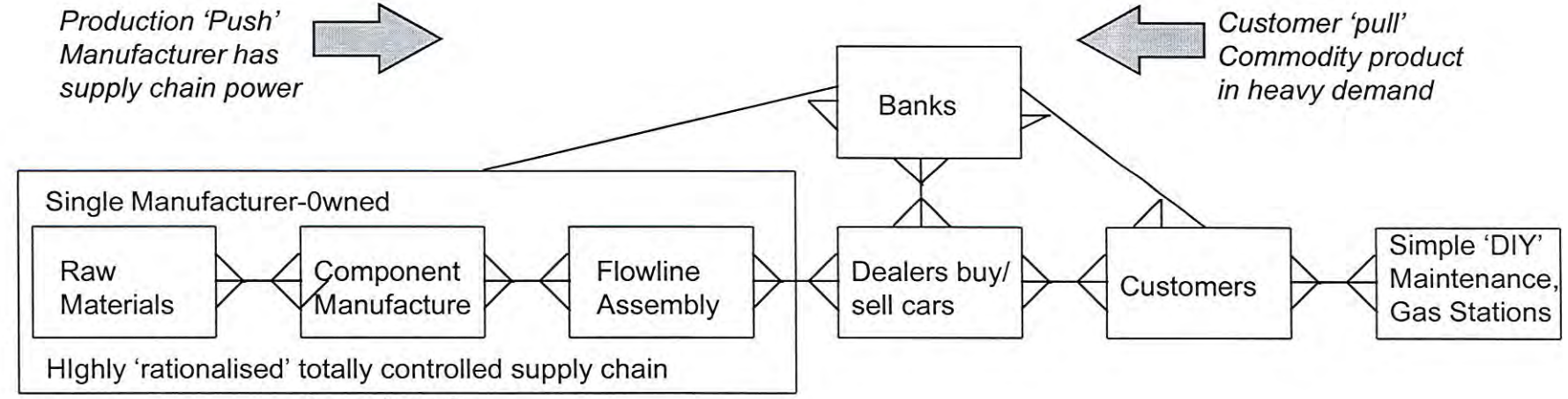


Figure 14 - Motor Industry Network - Generation 1 - Ford's mass production - vertical integration for the 'Model T'



A number of key raw materials providers - iron ore, timber etc

A number of specialised component workshops, power trains, axles, wheels, chassis, bodies

Large assembly plants and 'transplants' producing 'standard' car

Large number of 'exclusive' dealers, selling and servicing

Large Number of 'willing' customers

'Owner-driven repair & maintenance

Peter Bailey - 1999

Figure 15 - Generation 2 & 3 - GM's 'mass consumption'& Product Divisions

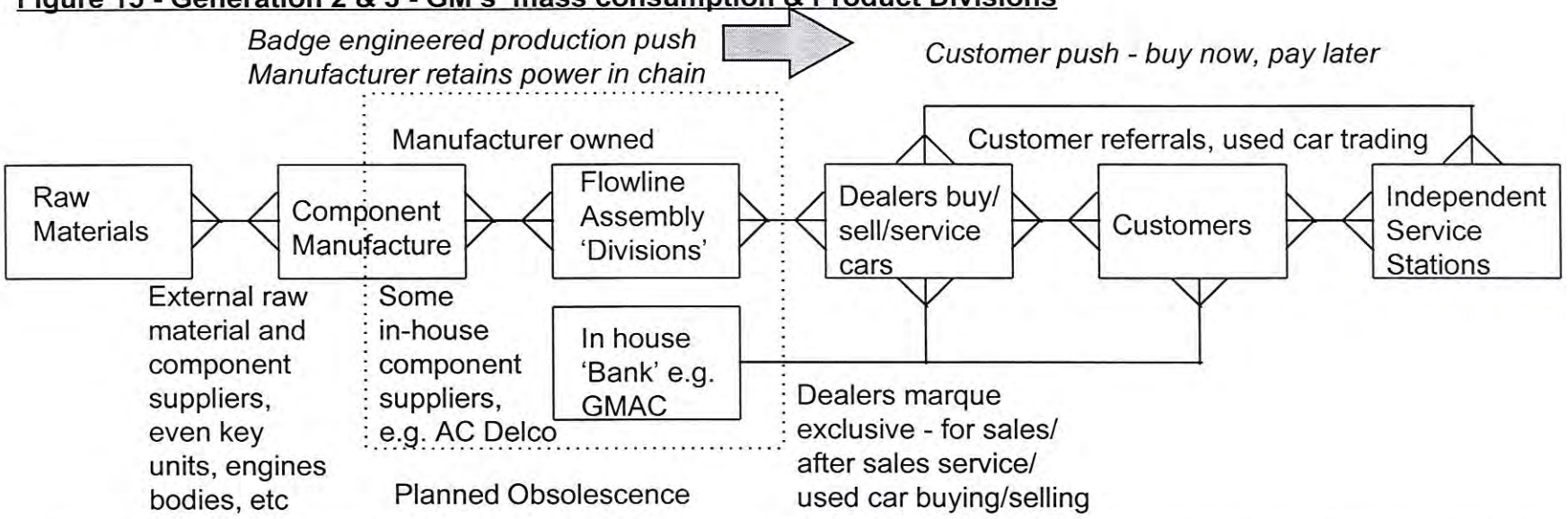
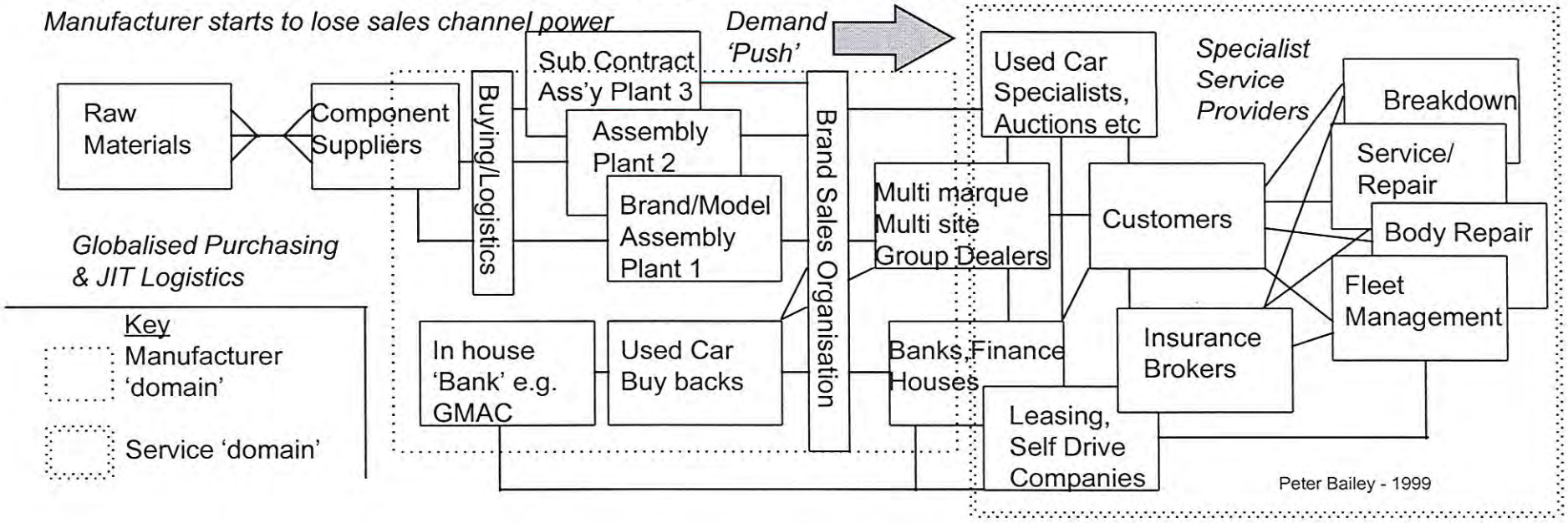


Figure 16 - Generation 4 - Lean Manufacture, cost down, mass customisation, consolidation, brand acquisition



intra-generational influences. They not only saw a developmental link as the balance of influence moved from generation to generation, but also, a more definitive less evolutionary shift in social focus at four turning points linked to a longer centennial cycle of events. This model seemed appropriate for adoption to the history of the car and its industry, which, conveniently fitted both the background centennial prerequisite (the car first saw the light of day as the 19th century drew to a close) and, on examination, the landscape of inter-generational developments, which nominally I set at twenty five year periods - the first generation from 1900 to 1925, the second from 1925 to 1950, the third from 1950 to 1975, and the fourth from 1975 to 2000. In line with the model's construct, I identified what I consider to be the key characteristics of each automotive 'generation', influenced as they were by other social, economic and ecological issues, and plotted the rise and fall of these influences and their shaping of the personal mobility, and thus, motor industry map. As can be seen from the generational motor industry 'network' views (see figures, 13, 14 15 & 16), the fabric of the industry started off at a simple local level (figure 13). As the generations progressed (figures 14,15), it became ever more complicated as its scale developed, with the power of the manufacturer waxing as the dominant force until Generation 4 (though the seeds of its undoing are apparent from as early as Generation 2 when mass consumption and the *'never, never'* took root). In Generation 4 (figure 16), we have seen the power of the manufacturer wane as the relationship with the customer became more and more distant, defying attempts by the manufacturers to maintain their sales channels exclusively. There has been a growing tendency for the network to 'unbundle' and become less manufacturer-manageable.

Having virtually arrived at the centennial 'unraveling' turning point, I have, in this last section of the paper, attempted to build a number of different views, both external and internal of the future of the next automotive generation. I have now arrived at the point where I feel it appropriate to draw from both the views of the previous four generations and the views (albeit they are still my interpretation) of the next, to construct a compounded view which reflects a rather more personal view of the 'road ahead' from the centennial stand-point of 'unraveling' through to a crisis turning point as the fifth generation comes to a close in twenty to twenty five years time. In a

seasonal context, Strauss and Howe would name this next generational period as that of 'winter' - a time when the entropy of Autumn gives way to hibernial destruction though certain elements, apparently 'dormant' and unrecognised by the naked eye herald the renaissance of spring to come. At the core of this final, personal view, lie two linked automobility movements which between them, encapsulate both the most destructive and constructive forces for the future - those of 'scale' and 'ownership' and it is to these elements that I now turn before briefly reflecting on the turning point from which the car overtook the horse as personal mobility provider in order to explore whether any repetitive attributes of the ebbs and flows of this history exist as we enter the next centennial cycle.

- *The unraveling of scale?*

Over the fourth generation, we have seen a gathering of the pace at which the motor industry has consolidated. Even as the final pages of this paper are being typed the frantic 'merger-mania' (which has become a hallmark of the post modernist age in which modernism is trying to defend its mass production and marketing ethos) has hit the motor industry, that fortress of the 'flowline', with the force of a strengthening gale. Not a week (or hardly a day, of late) goes by without a rumour of take over, absorbtion or rationalisation within the industry. In a developing situation not unlike that of Stephen Jay Gould's 'decimation' (op cit 1989), where 'disparity' (or *real* variety) between automotive species is declining at an alarming rate whilst 'diversity' (or *virtual* differentiation) is mushrooming as the ever larger, emergent organisms of the industry strive to survive.

However, behind this apparent consolidation, there are signs, both from within and without of the industry, that there are limits to the scale of operations that can be sustained. Whilst 'efficiency' - 'economy of scale'- is often claimed to be the reason for consolidation, the complexity of operations, the waste they create (especially in mature markets where replacement rather than new demand rules) and the monotony of the products they manufacture are, as a result, increasingly not performing the social, economic or environmental service necessary to support their continued existence in that form. Hence, supplementary rounds of consolidation are deemed

necessary to restore equilibrium. What is becoming ever apparent is that the scale of some of these industrial behemoths is facing a problem of *Jurassic*-age proportions. The laying waste of Detroit and its hinterland in the eighties, and the potential for social and economic destruction in other such structural automotive hubs on similarly shocking scales in Europe - in the West Midlands, for example, is only the product of a 'rationalisation' process which has been in train since the sixties. Notwithstanding the coincidentally virtual destruction of the UK's shipbuilding, steel and mining industries in the same period, we have also witnessed the contraction, on a spectacular scale, of core automotive centres such as Coventry and Oxford. However, in their wake, the establishment of smaller, more flexible, 'state of the art' assembly plants have sprung up on green field sites (Sunderland, Swindon, Derby, for example, and numerous other centres in the USA and Europe) as well as the regeneration of similar, more contained operations both for assembly and component manufacture on brown field sites in Oxford, Birmingham and Liverpool. However, a key feature of new and old is that many less are employed in such operations due to the reorganisation of working customs, practices and technologies.

Whilst this reconstruction movement, on the surface, appears to be fairly radical in its approach and impact, I would suggest that it is only the beginning of a much greater shift. These 'new world' plants - whether for assembly or major component manufacture - are still very much the function of an internal process within the present industrial structure. Developments are in the main sponsored by existing global automotive *commodity* players either clearing the decks for the next round of consolidation or enabling a shift in their geographical influence through establishment in markets where the operational costs are low and where their previous access was limited through lack of a local manufacturing presence. The greater shift in the movement towards smaller, more localised operations will come as a result of the technology of the product itself.

In past generations, the complexity of the product, not only in terms of its componentry but more importantly its assembly, meant that the automotive industry tended to establish itself in localities where the whole product was manufactured and

assembled. Thus, proximity of location was a key feature of the industry's historical development - hence Detroit, Dagenham, *'the Austin'*, Toyota City and the like. Ford demonstrated with his Model T that the product and its assembly could be simple and *transportable.* For many years, the motor industry in its Western and then Eastern format, expanded into less developed overseas markets through local assembly from CKD ('Completely Knocked Down') kits. However, this was not a 'natural' industrial outcome, it was rather more a product of local market protectionism which sought first to both protect the employment of local labour and second the market position of the assembler (and its sponsoring supplier). As markets matured and became less protected, production and assembly re-centralised around home 'base camp' and the importance of the exportation of built-up vehicles was gradually restored. These movements in critical mass happened mainly in the second and third generations of the car.

As demonstrated earlier, in the fourth generation, globalisation became a significant motivational factor for the industry, and the transplant (born of Henry Ford much earlier still) took on a whole new meaning especially for the Japanese who had never given up on worldwide CKD operations and then went the extra mile taking 'local content' to previously unheard of levels, manufacturing core components such as engines and transmissions locally as well as establishing component supplier networks on or near the site of manufacture or assembly. From transplant philosophy emerged the smaller, more flexible plants which are now very much the bottom line of motor industry 'best practice.' It is from this movement and the changing world of product engineering and retailing that the next level of localisation will develop.

For many years, the specialist automotive operation (whether it be a Rolls Royce, a 'kit car' or a more humble commercial vehicle supplier) has been able to create on a small scale products which are highly tailored to the individual customer's requirement. Though often hardly the height of economic efficiency (for which they compensated through their pricing mechanism), these manufacturers accepted that they were not in total charge of their product's development and manufacture. Many bought major components from a host of other automotive suppliers (engines,

transmissions, even bodies) and often even sent partially-complete products to other specialist operations for addition or completion - the function of Rolls' Mulliner Park Ward coachwork associate furnishes a good example of this. Such manufacturers became experts in running organic networks of suppliers all of which drew together to give the customer what they wanted. This feature, whether the exemplar is Rolls Royce, TVR or Land Rover offers the first glimmer of light for generation 5.

The next line of automotive pointer worthy of consideration for the future of 'scale' has sprung from the need to eliminate waste through *'recycling'*. Driven increasingly in generation 4 through external environmental lobbying followed by regulation, this whole system-based feature started to impact first on materials and reclamation - whether it be the reprocessing of scrap metals, recovery of precious or scarce metals or latterly, plastics, the latter spurred on by the perception that no landfill would ever be capable of absorbing such intractable waste and that a formula for recycling it has had to be pursued. Whilst Henry Ford, from Generation 1, led the internal industry crusade against waste from a cost avoidance perspective in his manufacturing process to keep the prices of his Model T commodity down, the effects of waste post production were not his primary focus, though simplicity of assembly and more significantly 'repair' in service (viz. his vision above in Generation 1) formed a *relevant* part of his agenda to which I will presently return. Though this approach was subsequently negatively obscured by Sloan's GM refocusing on the 'planned obsolescence' philosophy of Generations 2 and 3, it has subsequently become a key feature of the Deming-inspired and Japanese-promoted total quality and lean manufacturing movements. In order to meet the demands of regulation, especially in Germany, where 'cradle to grave' product responsibility has been thrust on the car manufacturers, there has been an increasing recognition by the industry that complexity in manufacturing and particularly assembly (driven in part by the need to protect the 'copyright' of the manufacturer) paradoxically inhibit 'disassembly' which, in turn, must be a pre-requisite for effective (if not economically efficient) recycling operations. Thus, design for disassembly without loss of quality in assembly became a criteria for car designer, product and production engineer. In turn, a further outcome of this development must be that if the product is easy to disassemble

without loss of original production quality, then conversely, assembly could be simple enough to be operated beyond the traditional factory gate - a 'secret' previously known to Japanese manufacturers such as Toyota, which has been subcontracting assembly worldwide on a massive scale for years and has not suffered poor quality as a result.

Thus, if the product can be assembled (and disassembled) locally beyond the context of the scale production plant, could not this develop into *very* local assembly to meet customer demands as they occur? Is this not the inevitable result of Henry Ford's insight of simplicity in production and service? Certain products, GM's MAXX for example, have already been designed with an inbuilt capacity to be part-adapted and re-adapted in the field. Why could not this drive local assembly in the future? Such 'modular' operations, as mentioned above, are already a feature of the specialist motor industry (though thought to be a cost-*driver* not *saver* if judged purely on traditional scale motor industry accounting principles). Such networked operations are already commonplace - for example, the 'kitchen' industry allows the 'retailer' (which may be supplier-owned) to order and assemble standardised components in multitudinous configurations around a semi-standard frame to suit the customer. In such industries, some 'driving parts' are bought in, sometimes 'privately labelled' from other suppliers, cooker hobs and the like. Could not car products be designed, assembled, adapted and reused, disassembled and recycled in such a way drive local rather than regional or even national economies? Could such a development mean that the days of the large motor assembly plant which depends on its ability to recover high capital investment cost through long runs of similar high volume products are coming to an end?

Such a product proposition would entirely reconfigure the present fabric of the mass motor industry. Power in such a supply chain would shift away from the current centralised 'assembler' to the designer, the supplier of key components and their production technology and the service networker who draws the order information package together for the customer, and makes the appropriate connections to ensure its supply. Could this be the vehicle which enables Lovin's hypercar technology to see

the light of day, where radically different methods of energy creation and use for propulsion can be mixed and matched into a lightweight adaptable frame equipped to the specific needs of the customer? The assembler and disassembler in such a network form part of the extended service network. Would such a formula not be capable of moving the centre of gravity of personal mobility much closer to the point of use, thus potentially supporting an incremental set of social requirements? Though such a development could be seen as consolidation into an entirely different form of network, could this be the ultimate unraveling of automotive scale of operations - upsetting the presently fiercely-contended equilibrium?

- *The unraveling of ownership?*

But the 'unraveling of scale' is only one of the two factors I have chosen to explore which, I believe, may have some influence on the personal mobility outcome. The ebb tide of the element of scale, or at least of some of its component parts, inter-acting with the shifting flows of 'ownership' could further exacerbate the motor industry's plight in Generation 5. The subject of ownership, like that of scale, is a matter of some contention from both within and without of the industry. External influencers, as we have seen, seek on the one, regulatory, hand to increase car ownership whilst attempting to limit use - somewhat conflicting objectives to say the least. Those of the environmentalist see the reduction in ownership as an integral part of the solution to the automotive problem. What is missed is that, in the automotively-crowded, developed markets at least, private ownership is in dramatic (terminal?) decline. If anything, the responsibility for ownership is increasingly lying *directly* with some form of 'hiring agency' if not the manufacturers themselves.

From Generation 2, with mass consumption underwriting its mass production capability, GM and subsequently all other motor manufacturers (even a bitterly resentful Henry Ford) openly facilitated the acquisition of their products through credit, often through wholly-owned subsidiaries which offered the associated financial product to their aspiring customers. However, from Generation 4, the pressing need to absorb factory mass production overheads coupled with increasing over capacity saw the motor manufacturer trigger a shift in car ownership away from the private buyer to

that of the corporate fleet 'owner', with the car becoming a substitute for or complement to employee remuneration, a corporately-funded personal status symbol rather than business necessity. In such an automotive world, access to and possession of such personal transportation rather than outright ownership became a growing trend which kept the lines running. This indirect form of automotive perk had all the advantages of ownership without its significant downside costs of acquisition, servicing, depreciation and disposal from which the possessor of such a car would normally be protected in whole or in part.

At the same time, so far, no matter how hard the taxman has tried to transfer an assessment of the real cost of motoring to the company car driver in an attempt to rebalance the business towards private ownership, the strength of this desire to be able to attain and maintain the privilege of company car possession has not diminished. Indeed, even if the taxman eventually weans 'Mondeo man' off the company car perk (in exchange for a cash buy-out or salary increase), such an educated car user population is far more likely to opt for a personal leasing package with the built-in flexibility of tailored contract at a flat monthly 'rental' conveniently including items such as insurance, maintenance, breakdown cover and change-over conditions. Thus the unpredictable risks of true ownership - the negotiation of the 'deal', in service costs, of the residual value of the used car when the time to change comes round again - have become ever more present in the minds of the user to a level where access to a car (and not even necessarily one *particular* car) through some form of leasing contract is threatening to become the norm rather than the exception for both corporate *and* private customers. The growth in such contracting has been meteoric in most of the developed markets - the US, UK, and mainland Europe. Despite the preference of manufacturers to sell their products *outright* to the 'retail punter', in Generation 4, they have been forced into a position where the overriding business impulse to keep the lines running has meant that they have been progressively drawn into a (downward?) spiral which has seen:

- first, the discounted sale in bulk to fleet buyers (who both owned and managed their corporate fleet assets)

- second, the discounted sale in bulk to a leasing intermediary which, in turn, financed car access to the corporate buyer wishing to avoid the expense of purchase, maintenance and disposal and to the user (who was increasingly given the choice of a car up to an agreed value or a sum of money to 'spend')
- third, the sale in bulk to a leasing intermediary which started to offer such leasing contracts to the industry's target 'private customers'
- fourth, the 'sale' to a hire or leasing intermediary with a 'buy back' arrangement which exposed the motor manufacturer to the full risk of used car disposal on a massive, and previously unheard of scale.

As Generation 4 comes to a close, sales to these automotive service providers, often subsidiaries or associates of a bank, operating their own multi-marque dealerships or 'buying' direct from the manufacturer or importer has become an established, though internally reviled, mainstay of the motor business absorbing production capacity and generating a 'marginal contribution to overheads' albeit that such sales were at a substantial discount which undermined the 'retail' value of the product. These developments have further eroded the fragile fabric of the 'private' automotive owner body. The diminishing numbers of retail buyers have been either switching to either corporately-subsidised or personally contracted 'access' schemes or becoming used car buyers as the costs of buying a single new vehicle outright rose while those of the bulk fleet purchaser fell as a result of their power to extract a discount from the supplier.

More recently, in an effort to bolster 'retail' replacement demand, manufacturers have become even more directly involved with the stimulation of this type of 'unowned by driver' demand following the trend into leasing rather than selling to private customers. Many of these manufacturer-offered personal financial arrangements now include a dimension of a wholly different order, the guaranteed 'buy back' of the used product and its replacement if required. This has now exposed many mass manufacturers directly to the risks of trading in their used car products on repurchase - indeed, these low mileage, 'discounted' used cars are in turn attracting the new car retail customers who were (and still nominally are) the much sought-after prize of the

industry. This absurd commodity-led treadmill, set up, aided and abetted by an industry eager to maintain its market share-driven production volumes, has now degenerated into the registration of new cars and their *subsequent* offer for sale to private buyers as used 'factory mileage demonstrators'. Whilst continuing to place their faith in trade-based wholesale campaigns to shift unwanted stock, resisting overt retail price reductions which might smack of 'distress trading', at the time of writing, even this bastion of automotive culture is being removed with heavy consumer discounts being explicitly advertised by manufacturers 'up front.'

In such an environment, it is hardly surprising that buyers, dealers and governments are confused about, if not actively averse to car buying. At the same time, the evidence is growing that many car users are actually coming to like the freedom that release from ownership offers, not just for the reasons of tax efficiency or the management of risk, but as a result of the increased flexibility that access to rather than ownership of a car bestows on them. Recognising that Womack & Jones' 'lean dream' (op cit 1996) of the 'personal mobility provider' which already exists in the form of an increasing variety of automotive service contracting discussed above, there are other signs of growth in the diversity of both arrangements and arrangers of more transient personal mobility requirements provided through a variety of media - whether it be the expansion of short term car hire, or car pooling and sharing formulae which offer the right form of vehicular transportation when and where it is required. Such 'metered' services can give the customer a city runabout hired from a station or airport, a 'people carrier' for a family weekend trip or holiday, or a fly-drive or rail-drive package expressly tailored to suit highly individual needs. The user is free of the domestic responsibility of the car once its metered use is over - that befalls the provisioning agency and its supplying network, which plans its fleet and vehicle utilisation to meet demand as it occurs. As Womack & Jones suggested (op cit 1996), such planned demand may be much more stable than the vagaries of that of the so-called retail customer and that therefore the satisfaction of such demand, looked on traditionally by the industry as a marginal contributor, may indeed be more profitable over the longer term, if the motor business reorganised its custom and practice in recognition of this.

There is another, complementary side of this coin, however, which offers a different perpective for the future - especially if the my vision of the unraveling of scale comes off. The argument goes like this - presently manufacturers have been dragged into managing their products from cradle to grave - first, as we have seen above, through market pressure with many consumers of the car openly resisting ownership, leaving manufacturers increasingly responsible for their used as well as new cars and second, through the increasing regulatory pressure to recycle.

In such an automotive world, the used car should no longer be looked on by the manufacturer as solely the unfortunate by-product, if not waste, of a failed sales transaction. The completion of the new to used sales cycle has for years been a recognised 'critical success factor' of motor retailing - an integral part of the dealer's but not the manufacturer's business. However, the manufacturer can no longer avoid direct involvement in the management of its new and used product. I agree with Womack & Jones (op cit 1996), that reorganisation along different lines may offer up an entirely different motor industry proposition where the service is the product not the car. However, in their personal mobility dream, I would suggest that the role of the mobility provider in managing the fleet is crucial. In my dream, I would go one stage further in defining such a possibility. In Generation 5, the industry (or, at least, the wiser players in it) should recognise that the ownership of *their* car fleet may be far too precious an asset to gratefully hand over to the care of the consumer or dealer and that it could be a *fixed* rather than current asset of *their* business.

Over the years the motor industry has progressively lost its grip on its customers. Despite all its efforts to preserve the exclusivity of this important relationship, the very ossification of the industry's modus operandi, especially out in the market place where it has attempted at all odds to, at least, outwardly control the car sales and after sales process through its dealer networks, has been its undoing. As the car has become more of an over-supplied commodity, customer loyalty to a marque and marque loyalty to the customer has waned - after sales service was increasingly seen as a *cost* of sale. Whilst the outward character of the motor market place trundled on regardless,

newcomers cherry-picked the more desirable fruits of the automotive tree. The conceptual 'one-stop shop' of the dealership, an extraordinarily complicated retail business combining service, fast moving parts and durable (the car itself) consumer goods started to unbundle from early Genearation 4 with the loss of petrol forecourts leading the bleeding. Even as the car became a more technologically complicated product, the unraveling of after sales service operations ensued with basic lubrication, tyres, batteries, exhausts, electrics, tuning and quick service (as well as finance, insurance, breakdown recovery and more lately, body repair) being lost to so-called 'specialists' who raided the store, took the quick and easy gems and left the more risky, complicated and less profitable marque-related work (warranty and the like) under the roof of the traditional dealership. And all this notwithstanding the stalwart efforts of the manufacturers to resist this external developmental pressure with all sorts of programmes designed to re-capture the oligopolistic past. *Canute vivat!*

As we have seen above, the fledgling organic *reality* rather than virtuality of the networked, service-driven, dream of Womack and Jones (op cit, 1996), held together with the glue of a communications framework designed to provide the right mobility at the right time and place is self-evident from the growing interests of the finance and fleet management providers - with these two linch-pins often acting in formal unison. The following headlines demonstrate the point:

- *'Bring your company cars to Barclays for a full service'* (headline from Barclays Vehicle Management Services advertisement, The Times, 26th November 1995)

- *'Halifax acquires stake in Lex in bid'* (headline, Wall Street Journal, 7th December 1998 describing the Halifax's acquisition of 50% share of Lex Service, one of the largest automotive contracting and service providers)

The increasing capability of electronic forms of communication and the consequent impact on real time transacting has facilitated the expansion of service-based networks across previously well-defined commercial boundaries, shifting the balance of power between the participating parties and putting the network rather than the

product provider in an increasingly influential, customer proximate position. Manufacturers and now, even retailers, are losing their traditionally influential position in the chain as they become more distant 'suppliers' to an increasingly fragmented, distant market. As this electronic revolution gains pace, this same development now threatens to further unravel the industry. Generation 5 may well see the unbundling movement now well established in the retailing end of the business breach the defences of the manufacturing industry itself.

- *Generation 5, an unraveled automobility network?*

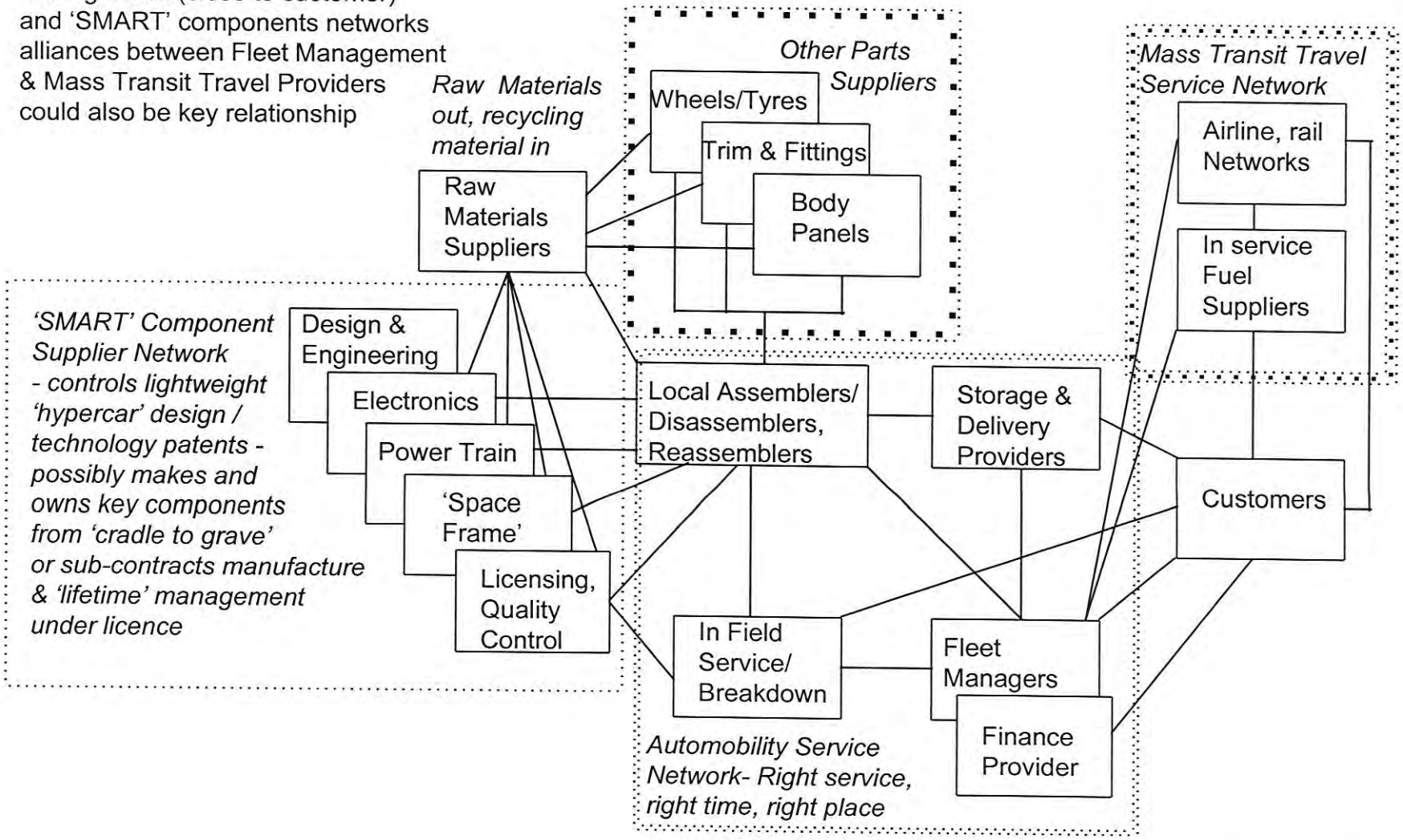
How could this be? As we have seen above, vehicle design and engineering, especially in the field of assembly and disassembly have great potential for simplification. Over the years, it has been proved that vehicles do not need to be the exclusive product of a massive, far-away manufacturing plant delivering their exported product fully built-up to the retailer. Quality vehicles can be assembled in smaller quantities locally in smaller assembly plants - this has long been the tradition in developing markets where whilst more complicated components may have been imported, simpler parts could be substituted with local supply. This, however, has always been looked upon by the industry as a market entry tool, where incremental production and assembly cost has been accepted to offset the higher cost of exclusion. Latterly, developments to make vehicles easier to recycle, i.e. disassemble, coupled with the potential adoption of lightweight 'spaceframe', if not 'hypercar', technologies could see assembly to meet a particular customer vehicle configuration (or, importantly, *re-configuration*) literally being in 'a batch of one', completed at or very near to the point of consumption. Such 'production' activity could be undertaken by local 'body shops' - after all, these *specialist* operations, often inexclusive to marque and insurance company-tied, are becoming very experienced in this field. Just for a minute, suppose that such operations were the configurators, assemblers, disassemblers, and re-configurators of the future, where would that leave the traditional mass production, flowline-based, manufacturer-owned motor assembly plant - high and dry?

More to the point, what role could the manufacturer adopt to protect itself? It could continue to try and maintain its hold on the currently established vehicular supply chain, in which it continues to attempt to control the market for its products - undoubtedly, there will be many manufacturers whose investment levels in current mass production technology remain a barrier to exit. However, there remains an opportunity for any of them, especially the 'specialist' manufacturer or, indeed, 'outsiders' to dramatically shift the industry's centre of gravity in their favour through the wholehearted pursuit of a less travelled, more personalised, road. In such an unravelled marketing and production world, what could the role of the manufacturer look like? Perhaps manufacturer is the wrong word. With it comes the suggestion of the current 'made' product that continues to be bought and sold by outsiders - perhaps a return to Henry Ford's laudable fixation with public service becomes a pre-requisite? There would be a role for at least the control of design and engineering, product licensing if not manufacturing, especially of 'smart' automotive components - the power train for instance, the electronics which would control not only the key functional attributes of the vehicle but also its *tuning* if not *character*, and any 'spaceframe' technology upon which other customised components, body panels, 'trim' items and accessories could be 'hung', *unhung, and re-hung,* - the items which instil the vehicle's very marque character. Retention of ownership of these critical 'smart' components, both in terms of patents, quality control, manufacture, re-use and recycling, without necessarily absolute control of their assembly or disassembly, could be a desirable core feature of the industry, though individual operational parts may be subject of licensing or sub-contract arrangements. Hence my remark above that the car *fleet*, albeit a disaggregated number of pieces of the automotive jig-saw, could be viewed as a 'fixed' rather than 'current' asset of the industry of the future.

After that, the network of various service suppliers, as envisaged in Womack and Jones' 'lean dream' (op cit 1996) would come into play to configure the automobility service to meet the individual customer need as and when required. Even here, given the central role of the 'manufacturer', or *owner* of the characteristics of the marque being supplied, in the provision of the key components of the mobility package, there is still the opportunity for the new age supplier to take the initiative in the

Figure 17 - Generation 5 - An 'Unraveled' Automobility Network?

In this 20-20 vision scenario, the influential areas are in Fleet Management (close to customer) and 'SMART' components networks alliances between Fleet Management & Mass Transit Travel Providers could also be key relationship



Peter Bailey - 1999

establishment or re-working of any existing network - though, I suspect that the provision of the spine of such a network has already become a highly-protected function of the financial services community. It would not stop, however, those financial institutions which are already motor-manufacturer related developing a network specific to the needs of their marque-differentiated customer body - indeed, the marque could really become a *service* product rather than just the car itself (Thinks....is not the name 'Rover' particularly evocative in this context?).

In the Generation 5 network diagram - 'An Unraveled Automobility Network' (see figure 17), I have attempted to set some boundaries around the different industry 'domains - that of the 'smart component' supplier network (rather than manufacturer), the 'automobility service network', 'other part suppliers', raw materials and connections with the 'mass transit travel service network'. The checks and balances of control in such a network are by no means a certainty - they remain an opportunity for the 'manufacturer', though the management of their service network has all but disappeared from their control and reassertion of their will, in general, is no certainty though the more specialist product provider stands a better chance of retaining an influence in customer service provision.

The industry is aware of all these product and service realities and possibilities but has often lacked a determined policy to face up to the threats they represent, with any reaction tending to be defensive at best or acquiescent at worst. As Charles Handy puts it:

"If you put a frog in water and slowly heat it, the frog will eventually be boiled to death.

"We, too, will not survive if we don't respond to the radical way in which the world is changing."
(**Handy, C.** *The age of unreason*. London: Random House UK, 1989)

It seems the industry has already moved from the comfortable world of the 'frog in warm water' into one where the discomfort of 'coming to the boil' is generating some resistant activity - though there is still the feeling that the changes will never last, growth will resume and 'normality' will be restored. I am not reassured by the warmth of the water, which is trying to tell me that there will continue to be a long term place for the present automotive formula. But do my 20-20 visionary jottings in this paper remove entirely the external threat of extinction of the automotive world as we know it in Generation 5?

I do not think so, the writing which warns of impending doom remains on the wall, especially but not exclusively, in the developed markets where the conflict between the increasing number of cars and ever-scarcer road or parking space will continue to exist. The pressure on the commodity, mass manufacturer players to converge and reap further economies of scale will continue, both in reality and virtuality with mergers, acquisitions (especially of marques which are believed to offer the possibility of differentiated exclusivity), share exchanges and looser but nevertheless contractual automotive alliances continuing to dominate the evolution of the industry in its current form. These 'quick fixes', however, will not, in the long run, solve the global problem of automotive over-capacity which assumes regionally-centralised mass production and extensive exporting of finished products from existing facilities in the developed world - the developing markets will demand products which are appropriate to their market and will want them to be manufactured locally not brought in at great cost to their own economy and society. At the same time, the globalised players will continue to roam the world looking for ever cheaper production bases from which components and products can be made and exported regardless of whether local demand can sustain the capacity developed or the effect on their existing production bases. Such developments set in store more potential cases of Stephen Jay Gould's 'punctutated equilibrium' (op cit 1989), which will disrupt economies as the new winners turn into losers as their forebears did - and that's progress?

On the other hand, the emission-related problems of current automotive propulsion technologies remain a threat also, though, as pointed out above, possibilities already

exist to reduce their effect if not, over time, restore the sensitive environmental balance upset specifically by the car in use. If some changes are not forthcoming, the current reliance on fossil-based fuels is set to become (if it is not already) a growing *political* as well as environmental problem as the demand for cars as symbols of economic success in the developing world increases. Hence the attraction of Amory Lovins' 'hypercar' approach which seeks to not only minimise the use of oil through the adoption of replenishable fuels but also, most importantly, radically reduce fuel consumption through dramatically reducing vehicular weight, and, in so doing, reducing the potential of growing competition for and conflict over fuel. The greater imbalance caused by the overall use of this 'toxic' energy, both domestic and industrial (in that I must include the energy consumption of the motor industry itself), and the dangerous competition in protecting its supply, cannot be wiped from the slate so easily. However, it could be argued that the sort of motor industrial restructuring discussed would offer by its very nature, 'leaner' and, therefore, less wasteful contribution from what is presently a key economic driving force. The shift to a more localised product assembly structure (of the type envisaged by John Whitelegg in 'Critical Mass', 1997) designed to tap demand very close to the point of consumption would naturally disperse jobs into local rather than centralised communities, which, in turn, could start to re-engineer urban life - regenerating a more sustainable variety of productive occupations closer to home. That is not to say that the adoption of such a restructuring would not involve social disruption and industrial discontinuity on a major scale. However, as demonstrated in the paper, the current motor industry ratchet is already showing signs of great strain - economic, social, and political - and entrenched resistance to the inevitable does not diminish the risk of decimation of the increasingly centralised but at the same time paradoxically fragmented automotive species.

What seems certain, however, is that man's wanderlust is set to continue for the foreseeable (albeit short-sighted) future - after all, most of history even before the enlightenment seems inextricably connected if not devoted to traveller's tales, or at least milestone events which have come about through man's tribal or individual mobility. With travel on foot being expensive in terms of time, it is easy to see how

speed became an integral part of movement. Thus any machine (or animal) which delivered man or product quicker to his or its destination would underwrite 'progress', whether it be the horse, iron horse or horseless carriage. As Robert Louis Stevenson put it:

"For my part, I travel not to go anywhere, but to go. I travel for travel's sake. The great affair is to move."
(**Stevenson R L** , in 'Travels with a Donkey', 1879)

It is difficult to see the elimination of this human urge to roam in the twenty-first century, given that it is through this process that we have arrived where we are and are likely to continue to move further - though it may be at a slower speed. The car, as a provider of independent mobility, is not quite dead yet. However, it can be envisaged that its ownership and use, far from being the deliverer of a utilitarian benefit for all as Henry Ford foresaw it, is developing into an increasingly expensive, time-wasting inconvenient conveyance for the many for most journeys, and is likely to (re?)mutate into a device which gives exclusive mobility pleasure to those who can afford to maintain access to though not necessarily ownership of it. In such a automotive world, the purveyor of fine (i.e. expensive) cars may well still play a part but the role played by mass production for commodity suppliers looks set to change - for the worst for some in the shorter term and for a different kind of mobility future for those which survive.

Maybe Henry Rolls and Charles Royce had it right after all? At least, the pleasure given to the many by the car in its first four generations could have been worth the trip though out of it, in the fifth generation, perhaps the goal of universal automotive travel will be taken less for granted as an essential part of everyday life and its pleasures restored and reserved for the special occasion?

" 'Glorious, stirring sight!', murmured Toad, never offering to move. 'The poetry of motion! The *real* way to travel! The *only* way to travel! Here to-day - in next week

tomorrow! Villages skipped, towns and cities jumped - always somebody else's horizon! O bliss! O poop-poop! O my! O my!"

(**Grahame, K.** *The Wind in the Willows* (1908). UK:Purnell Books Edition, 1982)

In retrospect

The paper has taken me on a journey of discovery, very much from a historical perspective, through the first century of the car. As the paper and the century draws to a close, the prospects for the future of the car and its industry and the mounting conflicts as their impact on economics, the environment and society shifts to the negative are ever more in the spotlight. From an assembled landscape of economic, environmental, political and social snapshots, I have tried to identify signs amongst the increasingly complex, developing network of factors which may give an insight into where automotion may go next.

The title, 'Freeway, Crossroads or Cul-de-sac ? - the Crisis of Personal Mobility' may, with the benefits of hindsight, have been incorrect or at least incomplete. The age of the automotive freeway is coming to an end, and maybe we are standing at an important crossroads where choices of route still exist. I do not think that all will enter a cul-de-sac from which there is no exit - but some players very soon could be in such a position. Perhaps what may be a more appropriate symbol for the car and its industry's present position is that of *'road narrows'* with the distinct possibility of a 'one way street' for some products and participants ahead if significant avoiding action is not taken. The steering wheel took over from the tiller at an early stage in the automobile's life because it increased manoeuvrability at speed - its principle use, with both *hands on*, needs to be applied to the industry if it is to brake and negotiate a turn away from the 'shadow of obsolescence' defined by Theodore Levitt in 1962:

"It is impossible to mention a single major industry that did not at one time qualify for the magic apellation of 'growth industry'. In each case the its assumed strength lay in

the apparently unchallenged superiority of its product. There appeared to be no effective substitute for it. It was itself a runaway substitute for the product it so triumphantly replaced. Yet one after another of these celebrated industries has come under a shadow [of obsolescence]." (op cit 1962)

This shadow created by the car defeated horse-drawn transport and almost put pay to the iron horse (though the latter or similar may enjoy a renaissance as a result of the urban and inter-urban failure of the car). Now, as the impossibility of keeping its promise of personal mobility for all becomes evident, that shadow threatens the car itself. The underlying cyclical, seasonal theme of this paper, provided by Strauss and Howe (op cit, 1997) saw the pattern established, in Generation 1, with Henry Ford's mass produced car and its production method setting the path to destruction for horse-drawn transportation. The car's promise of clean, manageable and convenient transportation for every individual which shone brightly in the early days of the automotive spring and glowed well into the summer and early autumn of Generations 2,3, and 4 has now been revealed to be an illusion. Moreover, as the numbers of products and the scale of the industry grew, there appeared to be an ever-increasing diversity of automotive life - though beneath the surface, real diversity, or to use Stephen Jay Gould's definition of 'disparity' (op cit, 1989) started to fall quite rapidly from quite early on in the generational process with functional standardisation linked to nominal differentiation of product 'species' from the formation of the multi-marque General Motors Corporation under Alfred P Sloan early in Generation 2.

This propensity to aggregate into ever greater organisational organisms has continued to this very day - though all the time whilst virtual variety has grown, real choice has dramatically diminished as great automotive names have become absorbed into the direct influence of the behemoths, which, in turn, have become less responsive to the external stimuli beyond their protected cellular walls. Despite some elegant and well-conceived evolutionary developments of the breed, many of which (Deming's total quality management movement, Ohno's Toyota Production System, just in time, lean manufacture, batch of one, 'sell one, make one' and the like) have tried to return to or further sophisticate Ford's original flowline, the process and product has remained

basically the same. However, perhaps in this - the relentless pursuit of scale production and consumption, everlasting growth with little reference to sustainability - lies the car and its industry's fundamental weakness. This ever-increasing motor industry complexity (demonstrated by the first four automotive generational 'networks') is maybe due for a simpler approach in Generation 5, with scale operations, especially in the assembly function becoming far more localised - almost within the domain of the local *garagiste*, or specialised body repair and dissassembly operation - such a model has some affinity to that of Generation 1, though its operation is running on a much more universal level.

Like the horse before it, at the end of the fourth generation, the car stands threatened by its very success - the promise of the freedom of the open road stands increasingly unmet, an advertising illusion, for the many who struggle to support the expense of ownership. At the same time, its congestion has created an unhealthy havoc for those without and within its shell - again, not unlike that of the horse before it. This did not mean that travel by horse was dead - it continues to enjoy pride of place in the *leisure* time activity of a much smaller, *exclusive* band of supporters. Maybe, it is in this context that the seeds of a car's more limited future lie - a future in which new or at least different things will have to be done. Time will tell. At the dawn of the fifth generation, perhaps it is time to re-engineer another quotation of Robert Louis Stevenson who said:

"To travel hopefully is a better thing than to arrive"
(**Stevenson, R L** , in Virginibus Puerisque, 1881, 'El Dorado')

into *'To arrive is a better thing than to travel hopefully'* ?

Peter Bailey
Swinford,
7th March 1999

Fere post scriptum

As if by coincidence, as I completed my dissertation, during the final few weeks of preparation, the Sunday Times published its 'Chronicle of the Future' (in five weekly instalments from 21st February 1999), in which it presented its vision of the future. Whilst I had not taken into account its views of the automotive world during my investigation, I thought it might be appropriate to recognise the tenor of its story as it has unfolded with the following extracts. The view of four articles caught my eye - it is perhaps hardly surprising that certain elements will appear similar to some mentioned in my paper, in as much as the authors have presumably accessed the same sources and, thus, formed some of the same insights.

1) From Week 1 - 21st February 1999

1st January 2011
"Big Five steer clear at top
"The Fiat-Ford merger means that there are now only five large car producers worldwide. This puts Europe firmly in the driving seat, leaving General Motors as the sole independent American manufacturer and Toyota-Nissan still struggling in Asia.

"This is the latest in a long line of takeovers and mergers since the 1998 takeover of the Chrysler Corporation by Daimler Benz. Described at the time as a marriage of equals, the fact that the resulting company, DaimlerChrysler AG, was based in Germany not Detroit and was 57%-owned by Mercedes shareholders left little doubt as to who was in real control.

"Such mergers have been fuelled by global over-capacity, which as early as 2002 saw annual car production hit 79 million. The so-called super grouping of VW and BMW two years ago was followed by Toyota's deal with the French government to acquire Renault, Peugeot and Citroen, completed shortly before General Motors bought Volvo into its own Saab subsidiary."
(Source: The Sunday Times, *Chronicle of the Future* London: (various, February-March 1999)

- Comment

Is industry consolidation not going at a brisker pace than this? - incidentally, March 1999 saw Ford take over Volvo and the rumoured Daimler-Chrysler negotiations to take a c30% stake in Nissan make the press, though the latter is now denied and Renault have stepped into the frame. One thing seems certain, that consolidation will continue until a new modus operandi arrives.

2) From Week 2 - 14th February 1999

6th October 2007
"Here come the hybrids
Cambridge City council, tired of waiting for Westminster to resolve the problems of traffic pollution and congestion, has introduced a unilateral traffic ban.

"Having seen similar steps taken in Tokyo two years ago, motor industry insiders say they are not surprised at the move.

"One insider, who wished not to be identified, said that car companies have been waiting for such local initiatives to boost sales of hybrids.

"Toyota has been selling small numbers of hybrids like these since the launch of its Prius in 1998; now its time has come.....

"Environmentalists argue that hybrids are a halfway solution, merely exporting pollution to the power stations where the electricity is generated. Friends of the Earth favours more expensive fuel cells, which generate hydrogen from biomass or domestic waste.

"According to Mercedes Benz, which expects to build 100,000 fuel cell cars this year, sales are booming. And if the hybrids are as eco-friendly as the company claims, they could reduce landfill problems too."
(Source: The Sunday Times, *Chronicle of the Future* London: (various, February-March 1999)

- Comment
If it takes until 2007 for these hybrids to take off (they will be old rather than new by then), then much expensive R & D will have been wasted and little progress will have been made with the car's emissions of greenhouse gases. Most of the direction here is recorded in the Toyota 'Care for the Earth' publication and the Daimler Benz 1997 Environmental Report in print a decade before the forecast reality.

3) From Week 3 - 28th February 1999

1st November 2020
"The last chance saloon runs dry
"The motor industry was in mourning yesterday when the death of the family saloon was announced - following a long illness.
"Increasing charges for private ownership, stringent new taxes on company cars and car parks and other legislative and fiscal changes have recently caused many to question the private car's survival.
"Recent data from the Society of Motor Manufacturers and Traders suggest we are following the example of Japan, where many motorists have been weaned off the notion of cars as a status symbol.
"The vast majority of European motorists now opt for leasing or short term rental instead of buying. Of these, by far the most popular has been the Card-Car, a petrol-electric hybrid. The system enables travellers to use smart cards to access micro-compact, computer controlled city cars - effectively a halfway between private cars and conventional public transport. Information contained on the magnetic 'swipe' strip on the driver's card means he or she is simply billed each month for the mileage travelled.
"The success of such programmes means that only the very rich seem likely to retain their own vehicles and, as such, the automobile looks set to become, once again, a mark of great wealth and privilege, just as it was 100 years ago.
"There was some good news for the rest of us, however, with EntsCo confirming it had signed it had signed a deal with the EU to acquire a long lease on a site in Luxembourg.
"EntsCo wants to create Autoworld, the world's first motoring theme park, a 2000 sq km holiday playground where motor enthusiasts can pay to rent anything from sports cars to off-roaders.
"Lobby groups are already forecasting a rise in pollution and fatalities."
(Source: The Sunday Times, *Chronicle of the Future* London: (various, February-March 1999)

- Comment
The concept of CardCar is once again discussed in the Daimler Benz Environmental Report (op cit 1997) and is close to reality with its plans for SMART city hire car availability at central Deutsche Budesbahn stations.
For further information on car theme park concept, see The Bulcroft Report, 'Johnny Dollar', December 1994 and Frankfurter Allgemeine Zeitung, page 16, 9th August 1997 describing Volkswagen's planned 35,000 square metre 'new car city' near Wolfsburg.

4) From Week 4 - 7th March 1999

20th July 2030
"Riots on the road to hell

"Worldwide traffic chaos gridlocked every major city today as the Global Integrated Traffic Guidance System (GIGTS) collapsed. Irate motorists were forced to abandon state-controlled transport and walk.

"Riots broke out in urban centres. Unmanned aerial vehicles (UAVs) were able to pinpoint areas of civil unrest but ground-based police failed to gain access to quell the looting.

"State monitoring of the use and manufacture of all vehicles has long been held as the only practical means of managing worsening traffic congestion. Successive governments have sought to persuade individuals out of their cars by removing pride of ownership from the equation. But even though modern cars are no more than uniform transport modules - all functions and no style - there is still a reluctance to abandon the personal environment and perceived freedom of an individual transport pod for the convenience of the shared mass-transit system.

"But far from giving freedom, today's compact hydrogen powered transport modules, which are hired by the hour or kilometre when needed are accessed using a retinal ID systems, actually represent the removal of the freedom that made motor cars so attractive.

"Minutely controlled by a system of global satellite integrated autopilot programs, they navigate themselves and require no input from a 'driver'.

"Development of the sort of dynamic route guidance technology first pioneered by Debis Systemhaus in Tokyo in 1997 allows the traveller simply to enter his or her destination by voice command, leaving the system to plan the best route and monitor progress.

"The system prevents bunching on highways, helps travellers avoid the worst inner-city congestion and reduces fatal accidents by eradicating driver error.
"When introduced, GITGS promised a ride to enjoy. But the collapse of the core computer has revealed the system's inherent vulnerability. Some blame a new computer virus for the catastrophic global lockout; others prefer terrorist conspiracy theories.

"Either way, with a transport system entirely dependent on an apparently defunct external guidance and control mechanism, and with no conceivable manual override option available, a workable solution does not seem close to hand.

(Source: The Sunday Times, *Chronicle of the Future* London: (various, February-March 1999)

- Comment

Sounds familiar, for the chaos of computerised gridlock see 'The Italian Job', (**Martin, T.K. & Wlaschin, K.** *The Italian Job.* UK: Sphere Books, 1969), otherwise see 'ARAMIS or the Love of Technology' (**Latour, B.** *ARAMIS, or the Love of Technology.* Translated, Porter, C. Harvard: Harvard University Press, 1996) for a detailed *history* of PRT (Personal Rapid Transit) systems and 'Two Transport Visions' (**MacKenzie, J.J.** *Two Transport Visions.* In The Annals of the American Academy of Political & Social Science, Ed. Long, S.G. London: Sage, Sep 1997 Vol.553, 192-198).

In addition to the above automotive forecasts, John Hagel III & Marc Singer in their very recent Harvard Business Review article emphasise the importance of the 'infomediary' - the sort of relationship networker to which I refer in my view of Generation 5.

"As electronic commerce spreads out into other, more traditional industries, they too will begin to fracture. Take the automotive business, for example. Small entrepreneurial companies like Auto-by-Tel and Autoweb.com have recently emerged on the web and are already beginning to gain control over customer relationships. The companies' sites provide car buyers with a broad range of information about current models and pricing. The sites then collect detailed data about the customers and their preferences and use that information to refer customers to the appropriate automobile dealers. In 1997, Web site referrals accounted for about 2% of all non-fleet new-car sales. Although 2% is a small percentage, it represents 300,000 cars, of $6 billion in revenue - and those numbers are growing explosively. J D Power & Associates predicts that one-third of all new car buyers will buy cars using the Web by the year 2000.

"As the infomediaries gain more control over customer purchases and , even more important, over customer information, car companies will have to rethink the role of the traditional automobile dealer. Dealers may give up their customer relationship business entirely and focus narrowly on the infrastructure business - managing showrooms, for example. The independent, on-line infomediaries would take over the role of acquiring and managing customer relationships. As they develop a deeper understanding of each customer, the infomediaries could play an ever more central role in determining which make and model a customer buys. In fact they could come to fulfil virtually all of a customer's car-related needs:

- *selecting the auto loan with the best terms*
- *selecting the insurance package with the best rate and the most cost-effective trade off between premiums and deductables*

- *providing a list of qualified repair and maintenance shops and towing companies*
- *recommending car phone companies and phone service packages*
- *providing reminders of required servicing and then recording maintenance information for the customer's records*

"Auto manufacturers would love to access all this valuable information, but they could never collect it as efficiently or effectively as the infomediaries. A car maker might be able to gather data on the people who bought its own models, but it would be hard-pressed to assemble information on people who bought competitor models. Instead, car manufacturers may decide - or be forced - to unbundle their businesses, outsourcing the customer-relationship management role to the infomediary and focusing on product innovation. Who knows? Automobile manufacturers already outsource a significant portion of sub-assembly manufacturing - perhaps, some day, they might outsource all their manufacturing operations to infrastructure management businesses."

(**Hagel III J. & Singer, M.** *Unbundling the Corporation*. Harvard Business Review, March-April 1999

- Comment

Their revelations about potential infomediary activity are already largely existent. Their observations about the problems for the manufacturer in creating and maintaining such relationships, the difficulties of the dealership in becoming little more than a fleet supplier and the possibilities for *deliberate* rather than involuntary outsourcing of both customer relationship management and manufacture are interesting - though the examples of what an infomediary could do are still very well within the boundaries of the traditional automobile sales and service business as we presently know it. Such a breed of networker could go much further (as Womack & Jones show in their 'Lean Thinking' book (op cit 1996 and I have developed further in my paper), with the result more fundamentally *re-structuring* mobility and its provision beyond unbundling of the present automotive infrastructure.

PB
7th March 1999

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Peter Bailey,
Swinford,
April 1999

Declaration

I declare that this M Phil dissertation, entitled 'Freeway, Crossroads or Cul-de-sac - The Crisis of Personal Mobility', is a product of my own work with the exception of any cited material therein.



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Peter J C Bailey
12th April 1999