THE CHOICES WE HAVE MADE OVER THE past 200 years about modes and technologies of transportation have brought us unprecedented global interaction and, in many respects, increased personal freedom. However, all this mobility has come at a cost to society, to the economy, and to the environment. The industry has largely ignored these challenges, and has continued to produce heavier cars and SUVs with more electrical gadgets and which consume more rather than less fuel. It is often not appreciated to what extent our modern culture is integrated with the car and its systems: we have literally built our world around the car in its current form, and this inevitably shapes the scope for constructing sustainable mobility. We therefore need to tackle any change to the current automobility paradigm on a very broad front and we need to be prepared for the possibly dramatic social and economic changes we may bring about by changing just some elements. This special issue of Greener Management International attempts to inform the broad and systemic change required in the wider concept of automobility by exploring the role of the regulator, in particular in the context of more recent co-operative and partnership approaches with private-sector stakeholders, particularly the automotive industry.

The need to regulate the car

This special issue explores some of the new regulatory relationships developing between government and industry. It puts those developments within the context of technological change in the automotive sector, specifically the change towards new powertrain solutions, such as hybrid internal combustion-electric and fuel cell systems. The papers presented in this special issue find their origin in a dedicated sustainable mobility stream at the 2003 conference of the International Greening of Industry Network (GIN), which was held in San Francisco, California. GIN has been
working for over ten years to bring together practitioners, theorists, policymakers and activists from business, academia, government and NGOs. Its main aim was and is to deal with issues of how to build a more sustainable industrial culture by combining the conceptual with the practical.

In many parts of the world, there is a crisis of mobility. The choices we have made over the past 200 years about modes and technologies of transportation have brought us unprecedented global interaction and, in many respects, increased personal freedom. However, all this mobility has come at a cost to society, to the economy, and to the environment. Mobility is in crisis, but few seem aware of the full extent of it. Though most people will be aware of congestion, accidents—although this last aspect is often overlooked—parking restrictions or fuel prices, few will have considered the effects of the dramatic increase in mobility expected in China, India and elsewhere. Nor do many people in their daily lives consider the impact of climate change on our environment and the contribution our cars make to it. It is often thought that technology alone can solve this problem. For some observers, salvation could be achieved by means of hydrogen fuel cells, by hybrid-electric cars, or by increased fuel efficiency, or even by telematics to reduce congestion. The papers in this special issue attempt to show that ‘technology’ may well not be enough in itself and that for a genuinely sustainable transport future a complex support network involving technology, industry and government is needed.

Few cultural artefacts of the modern era reflect the dilemma of sustainability as clearly as the car. At the social level, many people have been excluded from the advances offered by the car, and many have become its victims—in many of the poorest countries more people are killed or injured by cars and trucks than by war or famine. At the economic level, congestion, resource depletion and pollution bring significant though largely uncertain costs. While at the environmental level some areas of concern, notably toxic emissions, are understood, the impact of others such as carbon dioxide emissions on climate change will increase beyond imagination. As other causes of climate change will be addressed effectively in the near future, car transportation will stand out as the single cause that is most difficult to address.

Even to those of us who do benefit from the advances in personal and collective mobility, the costs are undeniable. More US citizens have been killed on US roads than have been killed in all the wars the US has been involved in, including terrorist acts (Williams 1991). Road building has reconfigured urban and suburban areas creating social exclusion for many while enhancing the means of social interaction for others. Urban centres around the world have become congested with barely moving metal, while air quality has deteriorated. Urban sprawl, spreading out suburbs far into the countryside, is considerably predicated upon individual car ownership and use; sprawl also makes it difficult to conceptualise a transportation alternative without the individually owned car—thus creating a situation of technological ‘lock-in’. Indeed, the environmental and social burdens generated by car ownership are diverse, pervasive and complex (Nielsen et al. 1996; Sydbom et al. 2001).

Over time the regulators’ areas of interest in the motor car have broadened from the initial narrow focus on crankcase emissions to gradually encapsulate more and more of the full sustainability agenda, while also increasingly taking a life-cycle approach (see Fig. 1). The European End-of-Life Vehicles Directive is a good example of the latter. The recognition that we need to do something about these interconnected problems came initially with the realisation that deteriorating urban air quality in—in particular—Southern California was car-related (Brilliant 1989; Mondt 2000). This prompted a wave of toxic emissions regulation aimed at controlling the harmful side-effects of the
internal combustion engine, which has extended into more and more aspects of the car, its production and its use. Regulation now extends to safety, noise, end-of-life vehicles, materials use and fuel efficiency and is likely to take an increasingly holistic, or life-cycle perspective. In future, restrictions on use are also likely to increase with precedents already set by Singapore, and London with its congestion charge. Many cities already use tolling for cars entering their city centres—Oslo is an example—while several Italian cities use a permit system to restrict access for cars to their central areas.

Within the industry and also among those who regulate it, the emerging regulatory regimes have created a culture that can best be likened to a cat-and-mouse game whereby legislators acting on the basis of political imperatives try to tighten regulation, industry claims dire consequences if the regulation goes ahead and some kind of compromise position is reached. Not all of this regulation has been concerned with control in the traditional sense: indeed it was in recognition of the limitations of such regulation that initiatives such as the US Partnership for a New Generation of Vehicles were originally conceived (Wells 1996; Nieuwenhuis and Wells 1997: 54-62). More recently, CARS21 was established as a European attempt to harmonise regulatory and industry objectives (Wells 2005).

Better cars, but better environment?

Still, the regulatory approach, with successive generations of emissions standards, has created vehicles that are much improved in many respects. A modern car, driven under the right conditions, can be up to 95–99% ‘cleaner’ in terms of toxic emissions than its equivalent of 40 years ago (Mondt 2000: 213). By 2008, EU trucks will have improved to such an extent that it will need ten trucks to produce the same emissions that were produced by a truck built in the late 1980s (ACEA 2000). So have we solved the problem of sustainability for the automotive industry and its products? It would appear not. While individual vehicles have become cleaner, quieter, more durable, more able to be recycled, and in some respects more efficient, various factors have combined to undermine these achievements.

First there is the fact that their numbers have increased, the distances driven have increased and growing congestion has resulted in longer periods where stationary cars continue to consume fuel. In addition, cars themselves have become heavier, more complex with many more comfort and safety features, while there has been a move—led by the US—from cars into generally heavier sports utility vehicles (SUVs), pick-up trucks and mini-vans or people carriers for personal trans-
port. These are all factors that have more than compensated for some of these undoubted improvements. Just as importantly, the newly motorising economies of China, India, Indonesia, Russia or Brazil are potentially markets of such magnitude that collectively they can easily outgrow the established ‘triad’ markets of the EU, North America and Japan within the next 20 or 30 years, thus doubling the global burden of motorisation in many respects.

Clearly we need to think of more radical solutions than have been implemented so far. It was the ‘factor x’ debate that first highlighted the need to improve resource efficiency by an order of magnitude if the peoples of the emerging economies are to enjoy an equivalent standard of material welfare to those in the established economies (Vergragt and Grootveld 1994; Ryan 1998; von Weizsäcker et al. 1997). As the single largest manufacturing sector in the world, the automotive industry is strongly implicated in this debate.

On the one hand, the industry has largely ignored the fundamental challenges described above, and has continued to produce heavier cars and SUVs with more electrical gadgets and which consume more instead of less fuel, because of the profit margins on such vehicles. On the other hand, however, the large car companies have also engaged in R&D into alternative fuels and powertrain, recognising the challenges and seeing the profitable opportunities that environmentalism can present; and radical alternative technologies are under development by many of the world’s largest car- and truck-making concerns and their suppliers. Nonetheless, moving these from the R&D division to the market is a bigger step than is often appreciated, especially in an industry which at its core is extremely conservative and staffed by people who are normally recruited not on the basis of their revolutionary tendencies but on their ability to slot into these conservative cultures. The industry appears almost paralysed by its own structural condition: high capital intensity alongside low returns to that capital (Nieuwenhuis and Wells 1997, 2003; Maxton and Wormald 2004). More profoundly, it is simply not possible for there to be a ‘magic bullet’ solution in the form of a new car technology that can render the industry entirely sustainable. Although theoretically imaginable, the practical barriers are such as to make it impossible to recognise a better, more sustainable automotive future from our current automobility perspective.

**Issues addressed**

Much of the effort reflected in the papers in this special journal issue is concerned with going beyond the ‘technofix’ of new cars, to confront the more difficult challenges of institutional, cultural and social change within and beyond the industry that have to be resolved in the transition towards sustainability. It therefore seeks to break through the conventional boundary between engineering and the social sciences. The central problem addressed is the private car: how better to power it, how to build it better and how to deliver it to customers in a more sustainable future. Next is the question of what role government can play in guiding this process. We start in the first three papers with ideas of radical innovation in the propulsion system of the car, notably the hydrogen fuel cell and how the moves on this technological path have been guided by the regulator, particularly in California. The competition for credibility between fuel cell cars and hybrid electric cars is explored by Hekkert and van den Hoed, while Vergragt explores the gradual rise of fuel cell technology to a more institutionalised status.

The issue of transition has been given considerable theoretical and empirical treatment by those concerned with sustainability, particularly academics and policy-makers. Techniques and approaches have been developed. Backcasting (Quist and Vergragt 2004), for example, sets a final target or state, and then looks backward from that point to ask which steps
have to be taken in order to reach that point from the position we are in today. An alternative approach much favoured by those charged with disbursing public R&D funds, and with companies, is the technology roadmap. This is somewhat akin to critical path analysis (and hence popular with those from an engineering and science tradition), and seeks to identify the necessary features or steps that need to be in place in order that some future scenario should come to pass.

The papers by White, and Brown and Carbone offer a US perspective. It is here that new regulatory formats involving more of a dialogue were first explored, particularly in the context of the California Zero Emissions Vehicle mandate. These issues are to some extent covered by the earlier papers, so in these papers we expose some aspects of new regulatory regimes that are less well known, particularly outside the US. Thus Brown and Carbone explore the potential of bounded socio-technical experiments (BSTE), partnerships of various private- and public-sector actors intended to bring about technological change. The authors explore the potential of such an approach in the context of two US battery-electric vehicles available in the market, but restricted by existing systems that favour conventional vehicles. The authors argue that these products are also limited by the purely entrepreneurial nature of the firms involved. Although it is clear from past marketing efforts that their originators are aware of the higher-order learning potential embedded in their products and the way they can be used, their incorporation as partners into a BSTE could significantly improve their chances of success.

White reports on efforts in the US towards public–private partnerships. He has selected for his analysis two programmes chartered by the US Department of Energy with the purpose of stimulating alternative, more energy-efficient technology and associated infrastructure: the Clean Cities programme and the Building America programme. White’s conclusions from studying these cases suggest that obstacles to achievement of sustainable mobility and housing through technology change programmes should not be underestimated. Alternative technologies such as Alternative Fuel Vehicles are not fully mature and require further innovations to enable their widespread adoption. However, the experiences of Clean Cities and Building America reinforce the perception that voluntary partnership can contribute to technological transitions.

In general, regulators often still focus too much on ‘end-of-pipe’ issues, particularly emissions. However, a transition to a truly sustainable automobility system would also require the emergence of new business models. We explore this in the final paper by Wells and Nieuwenhuis. New business models are needed, as well as users and consumers adopting new forms of behaviour. Disruptive technological innovation may well contribute, but needs to be induced by a combination of market forces and government regulation. Such new business models can often be hindered by existing inflexible regulation and, in future, more visionary and proactive regulatory approaches may be needed to allow such alternative, more sustainable business models to develop. Powertrain improvements alone cannot solve the problem of sustainable mobility; the authors therefore turn to business models that could be used to deliver automobility in a more sustainable manner. In line with the thesis that we cannot change one element of the system without considering the impact on the whole, this paper looks beyond the car at how it is made and used, and how we could change those aspects in our quest for sustainable mobility.

Changing the cultures of automobility is by no means easy, so embedded is the car with notions of status and aesthetic pleasure, but it must be seriously doubted whether automobility will ever be sustainable under the current philosophy of ‘fire and forget’ production. That is, new business models that allow ‘product service system’ concepts to become reality also offer an escape from relentless over-pro-
duction, a means of realising the potential of product stewardship, while enhancing customer care and profitability in the process. The authors argue that a future development phase could see a return from uncritical globalisation to a trend towards relocating certain types of economic activity. The paper presents the Microfactory Retailing concept in more detail and highlights some of its social and economic advantages, particularly within the context of a re-localisation of economic activity, thus linking in with a debate that is gaining increasing currency in academic and environmental debates, but still rarely addressed in the context of the automotive manufacturing sector.

Conclusions

We must accept that personal, and in particular private motorised transport—the car—is one of the greatest problems in our slow progress towards sustainability. Uninventing the car or returning to human and animal power alone is no longer a viable option if we want to retain the complex economies we have created. For this reason, much of this special issue is focused on ways of improving the automobility system in terms of sustainability. Tackling the car in isolation may seem easier to many commentators; however, it is important to recognise the car as part of a system we have created over the past hundred years or so. This system, which we have called the ‘automobility paradigm’ (Nieuwenhuis and Wells 1997, 2003), includes the car, truck and bus production system and its complete supply chain from mineral extraction onwards. It includes the car itself, how it is used and the social and cultural changes it has brought with it. It also includes the infrastructures created for it and the fuels that motivate our vehicles, and their supply chains.

It is often not appreciated to what extent our modern culture is integrated with the car and its systems: we have literally built our world around the car in its current form, and this inevitably shapes the scope for constructing sustainable mobility. Similarly, our regulatory regimes for the car have also in many respects fixed it in its present form, leaving limited scope for genuine innovation. We therefore need to tackle any change to the current automobility paradigm on a very broad front and we need to be prepared for the possibly dramatic social and economic changes we may bring about by changing just some elements.

References


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