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## Editorial

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## 1 Introduction

The subject matter of this special issue of the *International Journal of Automotive Technology and Management* is complex and wide-ranging. Indeed, it considers a number of policy-related themes: changes and developments within the world's auto industry of the kind likely to be of interest to the future evolution of policy at local, national and/or regional levels; existing interactions between state policies and firms in this strategically important industry and the successes or failures – whether partial or complete – of extant policy tacks; and the ways in which different policy makers respond to setbacks or industry shocks. Our concern, therefore, is with different dimensions of how policies, operating on different spatial scales and within different temporal perspectives, pressures and contingencies, have impacted on the industry and how the industry in turn has helped shape policy. In the latter case, we must naturally also be concerned with the processes by which policies are formulated and with institutions, stakeholders and firm responses, as well as with the capabilities and knowledge acquisition required for effective policy formulation. And underpinning all of this is the need to be cognisant of major industry changes underway.

As with previous special issues, the contributions below draw on a rich interdisciplinary expertise to shed valuable new light on the subject matter at hand. In the remainder of this introduction, we first consider some general themes of major policy import before offering a brief overview of individual conceptual and empirical contributions.

## **2 Change and policy responses: issues in the large**

Perhaps the most striking feature currently imposing on the world's auto industry landscape is the great economic and financial crisis which exploded into its first major phase with the bankruptcy in March 2008 of Lehman Brothers, followed by severe difficulties in a host of other financial institutions, and not least in the USA. But as serious commentators are all too aware, it would be an error to view this crisis as one generated purely on the financial heights: there are problems in the basement too. There have been (and continue to be) severe imbalances between the global revenues generated by production and the distribution of incomes required for consumption, as witnessed for example in differences in aggregate net savings behaviour between the USA and China or the contradictory impulses of Britain's economy where 'competitiveness' has been sought through low wage costs and a (now) broadly regressive tax structure, but with no thought as to what this means for the sustainability of household spending (the counsels of Henry Ford and Maynard Keynes having fallen by the wayside). At the same time, the global contexts of the crisis mean that no country has been left unaffected.

Insofar as the world auto industry is concerned, this crisis raises many issues. In the first instance, one feature of what is now being called the 'financialisation' of the Anglo-American economies has been the decision by major corporations active in the old industrial economy to seek profits via newly created financial wings. As has recently been observed by Freyssenet and Jetin (2009, p.9), in addition to 'financed sales and leasing operations' – recall that 1992 saw the launch of the GM-Household Bank credit card, followed shortly by the Ford-Citibank venture – the USA's Big Three have also worked hard to transform a large part of their 'receivables portfolios' into derivative products. The role of these automakers in selling credit, and the difficulties they faced when confronted by simultaneous hits on their industrial and financial wings, are in many ways a microcosm of the USA's macroeconomic problem; and how these structural deficiencies are to be resolved, even over the medium-term, is still unclear. But the always unlikely view that credit lines and financial products could stabilise or even substitute for the earnings of a major manufacturing sector has come unstuck and future auto industry research into these aspects of the crisis will have much to offer. In the second instance, the full effects of the 'vigorous and costly' [Freyssenet and Jetin, (2009), p.9] intervention that many governments have undertaken to sustain their auto industries, not only in the USA and Britain, but also in auto producing regions around the globe, remain to be seen. And a third major issue will be the longer term impact not only upon the organisation of the world auto industry vis-à-vis key corporate players and strategies, but also on the wider economic models and patterns of state intervention within which firms operate.

These questions, all pertaining as much to the auto industry world that will emerge as to the contexts to the current crises of the global sector, overlap with the more slowly emerging – but less potentially transient – crises of energy and environment. The precise

date at which 'peak oil' will pass (or has passed) is as yet a matter of conjecture, while the degree and extent of the myriad problems of global warming are as yet unknown, although the general and pessimistic trends of the scientific evidence are clear. Many writers on the future landscape of the industry see some sources of optimism, with the potential, to borrow again from Freyssenet and Jetin (2009, p.14) for a 'second automobile revolution', deriving from changes in technology and a move towards non-petrol energy sources and new strategic alliances between older and newer players. Again, the potential for auto industry policy research could hardly be richer: on modes of ownership and access distribution; on technologies – electric vehicles, hydrogen fuel cells, hybrids and biodiesel conversion (and the impact on production for food chains); on competing fuel sources – wind, solar, nuclear; and above all, on comparative environmental impacts and ecological sustainability, without fear or favour. This kind of research can engage too with the substantial debate on corporate social responsibility in the auto industry; and also, of course, with appropriate forms of state support, intervention and/or regulation.

Running through these debates are questions also of the changing contours of the world economy at the level of comparative industrial developments and the gradually shifting global status of the 'old' industrial economies of North America and Europe. Amongst the major players now emerging on the world stage are India and China: in the auto industry, the Tata Nano has already captured global headlines, while some at least of China's many auto-firms – state-owned, joint venture or independent – are likely to become equally important on the world stage over coming years. Inevitably, international auto industry research must learn to engage not only with changing relationships between North and South – as, for that matter, West and East – but also with the domestic problems of the home economies of these emerging giants: for example, the industrial politics of Indian land issues, the regional dimensions of Chinese development.

Over all of these questions, controversies over globalisation loom large, the terms of which naturally reflect the different economic structures of national and regional economies, and design, conduct and implementation of state policy, and the trajectories adopted by transnationally mounted carmakers and transnationally mounted suppliers. And if on one side there are concerns within developed automotive regions for the potentials for future processes of industrial 'hollowing out' – and fiercely argued debates as to where this might have already proved an issue: Japan's *kūdōka* being just one major case in point – then on the other, there are hopes in less technically advanced automotive regions that globalisation might bring with it contingent possibilities. But if opportunities do exist for inward foreign direct investment (FDI) to bring with it opportunities for learning, there is also an increasingly heightened awareness that this will only happen if the investments in question can be properly integrated into local economies. Questions of learning, of adaptation and training, of how best to encourage positive spin-offs from large technically proficient and globally mobile producers, and to embed the gains in the fabric of local production networks and cluster, are thus also key.

Against the backdrop of these great questions, in this special policy issue we have the pleasure of presenting a set of individually important and nuanced contributions, each exploring a major issue of auto industry policy research or identifying a major development now underway within the industry of future policy relevance. At every turn, asymmetries in the abilities of different auto industry actors and stakeholders – original equipment manufacturers, suppliers, state agencies and trade unions – are described and

discussed and the tensions of globalisation versus localisation aired. Environmental questions are given due weight in the selection and today's crisis is apparent.

### **3 An overview of contributions**

The first set of contributions is perhaps most naturally organised around themes concerning local innovation and the acquisition of skills and competencies in contexts defined by efforts to develop or upgrade local production networks or clusters.

#### *3.1 Innovation systems, skills, clusters and upgrading*

The first of these papers, by Stewart MacNeill and David Bailey ('Changing policies for the automotive industry in an 'old' industrial region: an open innovation (OI) model for the UK West Midlands?'), looks at the development of policy towards the auto cluster in the West Midlands region of the UK. The authors note that until recently, regional policy towards the British automotive sector was geared to the top-down influences of the prevalent lean manufacturing paradigm and the short-term needs of a small number of large companies. However, recent policy marks a change and seeks to adapt policy to the local demise of volume car production. The Regional Development Agency's support for the 'Niche Vehicle Network' is viewed as shifting policy towards an OI model or at least an innovation system with OI elements. MacNeill and Bailey suggest that such an OI model may be a portent of a more general trend as the industry globally struggles to adapt to the changing political economic circumstances in which existing production paradigms are being questioned by politicians and the public alike. This is not to say that vehicle makers will no longer control the supply matrix through their ownership of brands and direct interaction with vehicle purchasers. The authors note the limits to 'openness' and take the view that conventional production modes will persist for some years to come – because of scale, resources and the 'lock in' of the existing technological paradigm.

Yet at the same time, the authors suggest that times of economic uncertainty and recession arguably create opportunities for leaps in innovation and technological breakthroughs, as the scramble for survival triggers new ideas and creates new forerunners. If there is to be such a change, the model emerging in the West Midlands of Britain, as in other locations, is worthy of examination, as small companies can often be more innovative than major transnationals. The implications for policy arising from a possible shift towards an OI approach are considered and the authors highlight one key aspect of policy – the need to foster a diverse range of actors with diffused strategic decision-making, in contrast with the 'top-down' and hierarchical nature of the 'old model'.

Conceptual issues are further explored by Johannes Winter ('Upgrading of TNC subsidiaries: the case of the Polish automotive industry') in a paper which considers how the foreign-owned subsidiaries of firms based in more peripheral regions vis-à-vis the established core of advanced car producing economies can upgrade their technical and management competencies. Upgrading in this respect is broached from multiple perspectives: being enabled to introduce more innovative products, or implement changes in production systems, or enhance existing functional roles or develop new divisions within which to organise an expanded activity. And in assessing the paths by which

upgrading is achievable, an original conceptual framework is devised to identify relevant competencies and gauge regional impacts.

This is applied to the particular case of Poland, one of the leading venues amongst Central and Eastern European (CEE) economies for inward FDI, not least in the automotive sector which accounts for around one quarter of the total in manufacturing. After a review of the Polish sector and its main commercial actors, this application is developed via case analyses of the VW Commercial Vehicles Group and Delphi Automotive Systems (the ‘megasupplier’ spin-off from GM), each with affiliates in Poland. A comparison of case experiences illustrates a key premise of this paper, which is that while upgrading processes in producer-driven networks are liable to be initiated as top-down directives by strategic decision-makers operating at the apex of the corporate hierarchy and based in central headquarters outside of (semi-)peripheral regions, these processes can be amplified as a result of local efforts and regional incentives. At the same time, it is easier for new competencies to be acquired on the manufacturing and organisational side than on the side of research and development, or strategy. This prognosis is further supported by the qualitative findings of an impressive set of interviews – conducted over several years and extending to include interviews with participants at 32 automotive plants – with auto industry executives and regional stakeholders in Poland. Accordingly, the paper concludes on a qualified note.

The next paper by Oscar F. Contreras and Paula Isiordia (‘Local institutions, local networks and the upgrading challenge. Mobilising regional assets to supply the global auto industry in Northern Mexico’) focuses on Mexico. It begins with a cogent presentation of the challenges of sustainability for national development strategies based on inward FDI in a regionally integrating auto industry dominated by large assemblers and a ‘privileged group’ of ‘globalised transnational producers’. Identifying Mexico as a key location in the struggle for market share in North America, being attractive for global assemblers as it combines low costs with high productivity, the authors consider the interface between global players and smaller indigenous firms when much FDI in Mexico is organised on the *Maquiladora* model – plants importing components for assembly and re-export abroad, principally to the US. Sharing the view that producer relationships are dominated by a transnational hierarchy, the resulting contribution captures the essential ambiguities of a situation in which processes exist to continually ‘recentralise’ technology intensive activities, but where transnationals are at the same time potential ‘agents of knowledge and technology transfer’.

The core of this paper is a detailed case study of the Ford Motor Company plant at Hermosillo in Northern Mexico, incorporating stamping and assembly processes and a major manufacturing capacity and providing high quality production. After a careful review both of the development of Ford’s Mexican operations and the strategic importance of Mexico to Ford’s competitive plans in the region – ‘the operations in Mexico remain one of Ford’s most viable strengths’ – the authors consider in detail the thorny question of the implications of this for indigenous Mexican businesses. To this end, they report the findings of a truly ambitious research methodology: a substantial set of interviews with Ford managers at the Hermosillo site, with local business suppliers to Ford or to Ford’s transnational suppliers, and with engineers and managers who previously worked at Ford, but who left to create their own companies; a carefully constructed sample survey of micro, small and medium sized businesses in Hermosillo, engaged in areas of activity central to the transnationals’ supply structures; and finally, a

further set of follow-on interviews revisiting earlier participants. The analysis of this detailed interview and survey work identifies three mechanisms by which local firms can be incorporated into the automotive supply chain: via spin-offs by former employees of transnationals, socio-professional networks and conventional market relations. This analysis is located in turn in an assessment of the character of the local economy and its institutional framework – and with due regard to measures taken by Mexican state agencies both to facilitate development, and to engage with and ameliorate the effects of the current global economic and financial crisis.

Following this, Dessy Irawati and David Charles investigate the changing contours of government policy towards inward FDI in the Indonesian automotive industry ('The involvement of Japanese MNEs in the Indonesian automotive cluster') and its successes in achieving knowledge transfer. A particular focus is on the Indonesian stance today favouring a cluster policy based on developing the dynamic capabilities of the industry via indigenous learning from transnationally mounted firms and with particular regard to the role now being played by Japanese transnationals. This is pursued via case studies of Toyota and Honda and their impacts on Indonesia.

As with the preceding studies, a starting point here is that Indonesia has, like other countries, developed its infrastructure to attract foreign owned firms, abandoning an earlier policy stance oriented towards import substitution in favour of drawing in global capital. In assessing the impact of Japanese transnationals on the Indonesian sector, Irawati and Charles also consider obstacles to success vis-à-vis the feedthrough of positive spillover effects to domestically owned firms and businesses operating in more localised circumstances; and they ask whether hoped for gains from Japanese producers in engineering and in process and product management have been realised. In addition, they examine what the answer to this question reveals about the difficulties of transferring knowledge, when much of this knowledge may not be readily codifiable, and locally owned producers start at a disadvantage. These last problems are – in the view of this study – exacerbated by the fact that the technology gap separating Japanese from Indonesian firms is made all the harder to close because even while local firms try to learn from the transnationals, new technological advances are still being made. Their contribution recommends that Indonesia take further concrete policy steps to facilitate development, including measures to encourage 'innovative collaboration' between Indonesian and foreign 'knowledge centres', as well as 'local technological transfer sectors', with government support to sponsor and promote effective upgrading.

In each of these papers, commonalities of purpose and perception are evident: there is an acute awareness of the dominance within the international automotive arena of global hierarchies and the extent of their control over the technologies which shape the largest part of world production; and there are nuanced assessments of policy efforts to develop more locally rooted industries and development initiatives. And in this regard, each contribution is acutely aware of questions of knowledge and learning.

It is therefore of interest to consider the next contribution by Keith Bevis and Fiorenza Paoletti, who consider the role of social dialogues in developing skills initiatives ('The role of social dialogue in skills initiatives: a case study approach'). The authors use four West European case studies to explore diverse applications of training in situations of profound change, looking at vehicle manufacturers and Tier 1 and 2 suppliers. In so doing, the authors identify challenges and lessons, including the need for speed,

communication, and above all, cooperation. In particular, they find that policy makers can and must react quickly to changing circumstances and that training strategies need to adapt to the life cycle of companies. In addition, the authors stress that cooperation between companies in the supply chain promotes the migration of skills through the chain and increased performance. The juxtaposition of different case studies in the paper helps to stress the complicated nature of training and training policy and hence the role of social dialogue in supporting the development of that policy.

Two of the case studies indicate that governments, employers and unions can unwittingly be trapped into preserving a failing enterprise. This carries the risk of reducing the resources available for reskilling or upskilling the workforce when change becomes inevitable. The authors suggest that training needs vary dramatically through the life cycle of an enterprise, with attention required in terms of training across life skills, operational and technical skills, and leadership skills. Two case studies illustrate the migration of skills from the automotive manufacturer down through the supply chain. Training here is seen as more than just a remedy for skills, rather relating as well to industrial relations and employment policy. The authors suggest that given the continuing upheaval in the industry, human relations interactions need to be agile and to provide upskilling, and that key for survival in the European industry is the diversification of the supply base.

The skills issue is also taken up by Bart Kamp and Reha Tözün ('Automotive industry and blurring systemic borders: the role of regional policy measures') who consider the changing nature of the automotive value base as environmental pressures from regulators and consumers, plus demands for higher levels of gadgetry from car buyers, result in the incorporation of new electronic and software technologies. The authors observe that this transition brings a new knowledge base and new actors into value chains from the traditional firms in the mechanical components sector. Managing the interfaces with new sectors presents the industry with a particular challenge which they analyse in terms of different aspects of market failure, for example, technological, financial or network management that can prevent smooth progress of the transition.

They also note the challenge for regional authorities trying to support 'local' automotive sectors given that new players may be located outside the traditional regions and that the local skills base may not be adequate to adapt to the new technologies. Two case studies are presented where contrasting approaches have sought to assist this ecological and technological evolution. The first of these, the publically funded CARS-IT initiative in Stuttgart, seeks to avoid the cognitive and organisational 'lock in' that led to previous crises and to stimulate the development of SMEs in the new technical areas. In addition, the initiative seeks to encourage the interflow of information and good practice and also to create new training opportunities to address skills shortages. While CARS-IT is oriented around loose networks, the second initiative, Mov'eo in Northern France is, by contrast, organised around specific research-oriented projects. Unlike CARS-IT, it operates on a membership basis with 50% private sector funding. It seeks to raise the technological level of SMEs by integrating them within research projects in new technologies. In their concluding section, the authors observe that, while the two initiatives take different approaches, both are important examples of how public support can help the industry by building bridges between different industrial specialisations.

### *3.2 Closures, reorganisations and rationalisations*

With the fact of change and often challenging upheaval thus identified, the second set of contributions then broach questions of plant closure, industrial reorganisation and network rationalisation, each being indicative of the potential disruptions of such processes and each casting more light on developments around the world.

In the first of these papers, Gill Bentley, David Bailey and Alex de Ruyter ('The MG Rover closure and policy response: an evaluation of the Task Force model in the UK') note that after several recent auto plant closures in the UK, the policy response has included setting up task forces to deal with the impacts of closure. Such task forces can be seen as requiring multilevel working across territorial boundaries and tiers of government in order to devise an effective policy response tailored to people's needs and to ensuring success in dealing with the immediate impacts of a closure. This suggests that leadership and vision, partnership working and community engagement, as well as the delivery of high quality services, are all important. The study by Bentley et al. looks at the specific case of the MG Rover closure in 2005, to examine the extent to which the policy response at national, regional and local levels dealt effectively with the immediate impacts of the closure, and the lessons that can be learned from the experience.

The authors suggest that the MG Rover Task Force was largely successful in displaying effective governance and that there was clear evidence of multi-agency and multilevel working. The approach was not necessarily inclusive; but while community groups were not part of the Task Force, it did draw on their expertise and took advice from them. Responsibility was devolved to the Task Force, leadership being taken by the Regional Development Agency and various other agencies were pulled in to deal with the impact of the closure. Deliberations in the Task Force saw innovative policy solutions being tailored to help both firms in the supply chain and those made redundant. However, the authors believe that the Task Force failed in one important respect. Despite the wide range of help available, take up was variable; more significantly, few ex-workers felt adequately supported by the government. From this point of view, the Task Force perhaps failed to gain legitimacy for its role and the recognition for the real work that it actually undertook. The authors conclude by highlighting the transformative nature of partnership working embodied in a task force approach and the need for this to be remembered. Task forces provide a mechanism for bringing agencies and groups together to synergise and produce innovative policy solutions. In this sense, it would be appropriate for task forces to look at ways of tackling the issue of making people aware of what is being done and for appropriate messages to be transmitted.

In the second paper, Dan Coffey and Carole Thornley ('Swing plants and punishments: a study of a Ford closure decision') appraise another British plant closure event in order to further develop another substantive area of policy research. In this study, the authors explore plant location decisions from the viewpoint of tacit bargaining games enacted between transnational producers and their more nationally rooted employees, under conditions simultaneously structured by global demand conditions. By this means, the study assesses a Ford motor company explanation of a major plant closure – the closure of its car assembly plant at the historic Ford Dagenham site in the southeast of England – based on an appeal to weak global demand and a reduction of plant numbers to economise on fixed costs at a regional (European) level; it compares this position with a quite different view put forward at the time, pointing to workplace tensions. In this regard, the authors show how (in some circumstances) demand-side and employment-

side explanations of closure events can be understood not as necessarily competing, but rather as mutually conditioning concerns, each potentially applying together. From this analysis, generalisable conclusions are drawn regarding the rationalities informing plant network organisation in the car assembly sector and key policy issues are discussed.

At the same time, this paper identifies and explores a number of other substantive issues emerging from close scrutiny of this (and other) closure events. An appeal amongst some car assemblers to the economies to be had from favouring the development of 'swing plant' or 'flex plant' facilities – factory sites doubling up on the number of product lines produced so as to be able to switch resources from one to the other in response to changes in the composition of demand – is identified and formally considered in the particular context of the Ford car assembly plant closure. The lean production vogue is also touched upon, and again, in connection with this event. Against each of these issues, the responses of the British state are considered, of comparative as well as national interest given current controversies over varieties of capitalism.

A major new study, by Ulrike Schaede ('Globalisation and the reorganisation of Japan's auto parts industry'), next sets out the evidence that will overturn many of the conventional wisdoms about the organisation of the subcontracting structures of Japanese automotive producers. Schaede shows how the logic of traditional Japanese subcontracting arrangements has changed since the mid-1990s, with twin processes of globalisation of production and modularisation of subassemblies combining to vitiate the standard image of a pyramid-shaped subcontractor *keiretsu* and impacting most severely on smaller Japanese firms that are the third and fourth tier suppliers – namely those most likely to be lacking in 'proprietary capabilities critical to the final product'. While relations with a falling number of hi-tech first tier suppliers are shown to have become more exclusive, the bottom end of the hierarchy has become more replaceable, competing on a lowest cost basis within a now more arms length (global) market system.

This important study amply demonstrates the value of an original sector analysis that can successfully integrate history with empirics and combine both with a cogent understanding of the frequently complex contexts that define corporate strategy. Successive phases in the history of Japan's auto industry globalisation are carefully identified: the importance of changing Japan-USA relations and the organisation of production for the US market (and for Europe) in the 1970s and 1980s; the move to Asia in the mid-1990s; and the 'China Boom' of the early 21st century. There are nicely balanced discussions of the latest data pertaining to trends in outsourcing, production, investment and employment for Japanese manufacture and automotive, and as too of the impact of strategic alliances abroad and of Renault-Nissan at home. And quite fundamentally, the Schaede study demonstrates the need to rethink assumptions that have developed from the 1970s emphasising inter-firm reciprocities and complementarities as forces conducive to a long-term structural stability, as globalisation enacts 'irreversible effects' on the subcontracting logic of Japan's industrial architecture.

If we pause again at this point, the questions of closures and industrial reorganisation broached in this second set of papers highlight the significance of the debates addressed in the first, concerning issues of support and viability for local networks of firms.

There is also much speculation running across both sets about the current economic crisis: if it is perhaps obvious that this is liable to lead to closures and rationalisation, the terms of the state response and also of the evolution of extant forms of organisation become concerns which are more rather than less pressing. This is also true of corporate

strategy – the Schaeede paper, for example, speculates that as a consequence of their rationalisation of their supply chains, Japan’s carmakers are better placed than most. At the same time, and as the Irawati and Charles contribution also reminds us in connection with the earlier Southeast Asian Crisis, this most recent global shock is not the first.

### *3.3 Growth, sustainability and new industrial models*

The final thematic grouping develops a further set of key policy issues, this time, turning to questions of future industrial growth, sustainability and new industrial models, and in each case, inviting us to consider wider political and social economies.

The first of these looks at the sustainability of industrial growth and development in the Chinese automotive industry and in a comparative perspective. In this assessment, Tom Donnelly, Clive Collis and Jason Begley (‘Towards sustainable growth in the Chinese automotive industry: internal and external obstacles and comparative lessons’) focus on China today as a ‘developmental state’, one which has demarcated its automotive sector a ‘pillar industry’ for growth. However, a series of deficiencies are observed in China’s indigenous sector, especially in a global context and given aspirations of competing on the world stage as a major player. These comprise: problems with safety and quality; little external brand recognition; a weak design and technology base; and an over-dependency upon foreign firms for technologically advanced components. A pressing case is also observed for a reduction in the number of competing Chinese enterprises if currently realisable economies of scale and scope are to be achieved. But while the authors view the Chinese Government as being cognisant of the difficulties and seeking to pursue ‘fairly all-embracing’ policy goals in these respects, they also identify severe obstacles to progress at the level of China’s political economy as a whole.

A main contribution of the paper is to not only consider these further social and political obstacles, but to assess the resulting weaknesses of China’s developmental state when placed in a comparative context, vis-à-vis (qualified) ‘success’ stories elsewhere. Via a careful analysis first of China’s Cold War inheritance and then of later economic and political reforms favouring decentralisation in the 1980s and 1990s, the authors trace the evolution of China’s provincially fragmented automotive base, developing en route the hypothesis that a key problem today is a weak central state struggling to enact structural reforms when these are resisted by regions each seeking to localise development. This situation is contrasted with the Japanese and Korean developmental experiences and with regard to a number of key decision-making parameters and policy objectives. At the same time, it provides a nuanced and textured context in which to consider the role of inward FDI for sustainable growth in the automotive industry. Commencing with China’s ‘parallel growth’ strategy for indigenous firms and foreign joint ventures, and concluding with the difficulties facing the national government in encouraging foreign carmakers to help develop not only Chinese manufacturing management skills, but also research competencies for future indigenously sponsored growth, this skilful appraisal covers all of the main players: centre, periphery, state-owned enterprises (the Big Three and Little Three), foreign firms, joint ventures and Chinese independents.

In our penultimate paper, Peter Wells (‘Sustainability and diversity in the global automotive industry’) takes up a different theme. While warning against any overstatement of existing uniformities, this provocative paper envisages an era which has

been characterised by a technological monoculture, vis-à-vis the industrial structures, business models and operational practices currently in evidence, giving way to technological diversity. While taking the view that no ‘one best model’ is likely to emerge, with the once assured dominance of the all-steel body and internal combustion engine yielding to potentially new and diverse technological forms, there is now the potential at least for a decisive break from the existing path dependency of the global industry, towards more sustainable forms of diversity: in particular, there is new potential for a revived localism, ‘under the rubric of cluster initiatives and similar policies’.

In the course of developing this prognosis, a number of highly pertinent sub-themes are touched upon and explored. Insofar as an ‘industrial ecology’ perspective – an approach to understanding industrial systems by means of (qualified) analogy with the ecosystems of natural science – is advocated, Wells favours an extended metaphor, one which can provide policy makers with ‘inspiration’ as well as ‘insight’, to supplement the development under this rubric of two main lines of inquiry: life cycle analysis, the tracking of material requirements from a product’s ‘birth’ to disposal, and eco-industrialism, concerned with physical interlinkages between sectors and activities. Using multiple microcase studies and illustrated with examples from around the world, the case for the emergence of diversity in the future automotive world – ‘healthy and beneficial’, and representative of a ‘more precise fit to local circumstances’ – is explored in rich detail, and represents a provocative and timely survey of transformative potentials.

Comparing these studies, both with each other and with some of the earlier contributions to this special issue, we can see the importance of a broader perspective. On the one hand, there is the case not only for local networks but also for a local ‘revivalism’, based on new technological possibilities – pointing to the ‘second automobile revolution’. But on the other, and within the existing technological forms, there is a corrective warning as to the tensions which localism can itself engender, even in a national context.

In a fitting conclusion to a special issue developing themes of policy relevance for the worldwide automotive industry, Fabrizio Ceschin and Carlo Vezzoli (‘The role of public policy in stimulating radical environmental impact reduction in the automotive sector: the need to focus on product-service system innovation’) consider concrete proposals for reducing environmental impacts of the automotive sector, this time from a product-service system (PSS) perspective. At the outset, two contrary pressures for the sector are noted: the tensions arising from a steadily improving environmental performance of products coincident with rising consumption levels which actively undermine the impact of advances made and the divergence between the economic interests of manufacturers in accelerating this rising consumption and the requirements of environmental sustainability through impact reduction. To tackle this twin dilemma, a systemic approach based on PSS is recommended – to move the traditional ‘industrial economy’ towards a ‘functional’ model oriented to the delivery by firms of access to product-functions for consumers, rather than the transfer of ownership titles in product-commodities as such: selling not cars, but ‘mobility’.

With this theme to the fore, policy instruments are presented and classified. Deploying a rich mix of examples to illustrate, PSS schemes past and present are considered. A careful distinction is drawn between simple product sales enhanced by additional subsequent services and more radical types of departure from the traditional model: use-oriented (as, for example, car leasing, sharing or pooling) and (pay for)

results-oriented services provision, each of which entails abandonment of private car ownership. A shift from an 'industrial economy' product-commodity model must necessarily involve changes too both in the identity of recipients of income generated by the sector and in the experiences of other parties necessarily impacted – both state and commercial. After discussing implications for fuel-use and energy consumption, the lifespans of vehicles and materials, and the reuse and remanufacture of componentry, the authors consider barriers to implementation and diffusion and relevant policy steps. Distinguishing between policy measures that indirectly address and policy measures more specifically oriented towards PSS, Ceschin and Vezzoli consider various possibilities. Underpinning this review – including general measures like extended producer responsibility (EPR) programmes and tailored measures including public procurement policies – is an express assumption that traditional environmental policy measures, aimed at internalising the environmental externalities of production and consumption within a traditional industrial economy model, will not suffice to move towards the new functional economy. While a number of producer-led pilot initiatives from Honda, Volvo and Renault are noted, the case is thus made for the integration of general government policy measures with PSS and with (further) active involvement from universities and research centres.

And on this note, the pressing need for engagement that makes full social use of the research potentials of auto industry specialists both in universities and elsewhere – repeating again a point made repeatedly in other contributions – we end.

#### **4 Summing up**

These contributions, taken both individually and as a whole, confirm the economic and social relevance of the larger policy debates pertaining to the world's auto industries today, and the value of detailed studies honing in on particular aspects. A reader of these papers in full will also be made fully aware of the internationalisation of debate, not only as regards contributors, but also the countries, regions or areas under scrutiny. Organised by theme, one is also struck not only by individual contrasts in treatments and perspectives – essential from the viewpoint of developing serious and textured policy analysis – but also the commonalities to emerge in the concerns different contributors identify. Papers are readily grouped: on innovation systems, skills, clusters and upgrading, in a world industry where a feedthrough to local development concerns is essential to both economy and society; on closures, reorganisations and rationalisations, in an industry where events are often sharp; and on the range of questions raised concerning future growth, sustainability and new industrial models. At the same time, chords are struck which appear and reappear in different contexts: on whether the future lies in sharp departures or in shaken down versions of the present, or on how less technically advanced regions of the world are likely to fare in that future. Both individually and as a whole, the papers in this volume will contribute to the worldwide debates, illuminating the issues for states, stakeholders and relevant policy makers.

And present in many of the studies, there is the shadow of the current global economic crisis. While any commentary at this stage on how the auto industry world will look when the dust finally begins to settle – which may take some time – must necessarily be speculative, readers of this special issue will be informed of the many ways in which this crisis now intrudes: as a major development expressly addressed; as a

potential point of reference for future study drawing on particular policy insights; and as field of context against which corporate strategies in the auto industry must now be considered.

### **References**

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