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Globalisation and Regional Economies:
Can OECD Regions Complete in Global Industries?

PART II

Chapter 5

Regional Case Studies in the Automotive Sector [1]

This chapter looks at the evolution of the automotive industry and the impacts that changes in the industry are having on four car-producing regions. In each case, the regions are struggling with the impact of restructuring of the global car industry but also striving to build on the technological and innovative capacities that the regions have acquired over time as leaders in a dynamic technology-driven industry.

Global outlook

For decades, the automotive industry has grappled with the task of reconciling the conflicting requirements for economies of scale – and hence standardised output – and growing market demands for product diversity. The challenge facing the industry is that recent attempts to achieve standardisation – such as platforms, modules, and "world" cars – have foundered on the rocks of market demands for difference and mass customisation. In all sorts of ways these pressures for diversity are increasing exponentially.

At the beginning of the 21st century we find a car industry that is in the middle of globalisation and delocalisation into emerging markets such as China, India and smaller motorising markets such as Indonesia not far behind. Patterns of production capacity are somewhat lagging behind this process. The major production locations (Table 5.1) broadly reflect the fundamental changes in automotive markets, with the notable exception of Japan, which has long had a net structural bias whereby production exceeds domestic demand, with the balance accounted for by exports. At the same time, the industry is in the throws of a financial crisis affecting some of its largest, most established players. In addition, the negative environmental and social impact of automobility is increasingly being questioned. As a result, the next few decades could see the emergence of a very different automotive industry with its centre of gravity and its major players moving eastwards to emerging economies and away from the traditional decision-making centres. Toyota has emerged as the world's leading car manufacturer, perhaps to be joined by other Asian players in the foreseeable future. The American model that has dominated mass car production during most of the 20th century could give way to a new Asian model with unpredictable consequences for the global automotive industry.

Car production today is still dominated by the traditional "triad" regions of western Europe, North America and Japan-Korea. Table 5.1 illustrates the recent history of vehicle production in the different producing regions, which clearly shows the Asian Pacific region as that with the strongest growth.

Table 5.1. **Global production by region (In thousands, all vehicles)**

Region	2000	2001	2002	2003	2004
North America	17 658	15 814	16 713	16 215	16 224
Western Europe	17 165	17 797	17 294	17 387	17 722
E & C Europe	2 647	2 658	2 660	2 726	3 146
Asian Pacific	17 945	17 665	20 300	22 299	24 322
Japan	10 140	9 777	10 257	10 286	10 511
China	2 008	2 304	3 251	4 443	5 070
South America	2 010	2 047	1 999	2 036	2 531
Total	57 427	55 963	58 968	60 665	63 948

Source: Ward's Automotive Yearbook, various years.

Over the last ten years or so, a number of trends in vehicle production have become evident. One of these is a general reduction in the capacity of a single assembly plant considered viable for profitable production. This is one attempt to meet the outcome of diversity, through shorter production runs more sharply targeted to market niches. This is reflected in the introduction of more flexible production systems and platform strategies. In addition, we have witnessed the closure of much older capacity in Japan (especially Nissan plants after the link up with Renault), the US, and Europe with some improvement in capacity utilisation as a result. The opening of new high-volume plants in the United States (*e.g.*, Mercedes, BMW) and the European Union (BMW, Toyota, PSA-Toyota) is also significant. The US plants of Mercedes, BMW and Honda have become a significant source of exports from the US to the EU. These new plant locations reflect the general phenomenon of inter-market penetration by rival vehicle manufacturers and the advantages of market proximity being balanced against those of centralised manufacturing.

A number of new or refurbished low-volume and high-value added plants making specialist cars have also appeared in Europe; *e.g.*, Rolls-Royce, Maserati, Aston Martin, Porsche and Bentley. A high proportion of output from these factories is exported, with over half typically going to North America and growing numbers to Asia, although actual volumes are small. In addition, the much-anticipated expansion in new capacity in central and eastern Europe is finally materialising, much of it coming into production over the next few years. Finally, there are large investments in emerging markets in the Asian-Pacific region, in particular China and India.

Car making today: the automotive industry value chain

A modern car plant is typically part of a system that remains wedded to the notion of serial production in high volume of essentially identical or nearly identical vehicles. It consists of a press shop, where sheet steel is pressed into panels, a body shop where these panels are welded into a combined body-chassis unit – the monocoque or unibody – a paint plant, where this unit is painted and protected against corrosion, and a two-stage assembly process, where the painted body receives its mechanical, electric/electronic, glass, and interior trim components. In terms of investment costs, the elements needed to make the all-steel body, together with investments in engine manufacturing – the latter normally in separate dedicated plants – dominate modern car manufacturing. The investment in all-steel body technology and internal combustion engines is very high and much of it needs to be sustained at high levels as the regular model changes introduced by the car industry bring with them high investments in new body-tooling on a regular basis. Engines can be applied more widely across different models and can be specified to last several model cycles, although tightening emissions regulations have meant a shortening of model cycles even in this area.

Actual plant sizes vary widely from the very small (Morgan, Lotus, Ferrari) where per-model output is measured in hundreds or low thousands, through low-volume plants producing variants and derivatives (Karmann, Valmet, Pininfarina, Magna-Steyr) where output may be in the range 30 000 to 100 000 units per annum for a range of models, all the way up to huge plants like Volkswagen's Wolfsburg plant or Hyundai's Ulsan facility, where output can be over 800 000 units per annum. In Europe, if the very small producers and plants with an output under 100 000 units are excluded, production in 2001 amounted to 11.12 million units from 41 plants, with average plant output of 271 000.

As long as markets demanded basic automobility and were prepared to accept limited variety, this mass production system worked well, benefiting from true economies of scale. However, as market saturation set in, car buyers began to demand greater model variety. More recently, regulatory pressures have added to the proliferation of variety, with more fuel and drivetrain types emerging. As a result, per model volumes have been falling and economies of scale are being eroded in many cases. A tension between the demands of the market and the demands of the mass production system has developed, which is still growing today. In Europe it is now estimated that as a result of these trends some 60-70% of models offered in the market are essentially unprofitable. These are cross-subsidised by the remaining models that are made in sufficient volume or can attract a sufficient margin to go beyond break-even and thereby retain some profitability. However, this does allow manufacturers to offer a full model range and thus for their dealers to sell an attractive range of products. It does mean that, even in a good year, the most successful players in the car industry enjoy returns on sales of less than 10%, a figure that would be unacceptable to many other consumer product sectors. Car dealers in developed markets work on even lower margins for new car sales, instead relying on repair, service and parts sales.

The automotive industry value chain is pivoted around the dominating presence of the vehicle manufacturers. Despite rationalisation through mergers and acquisitions, the supply side of materials and components remains much more fragmented. The attempt by Anglo-Indian steelmaker Mittal to acquire the largest European steelmaker, and the political repercussions of this attempt, are a stark reminder of the scope for further consolidation across much of the components and material supply side – as well as the many obstacles in the way of such a process.

The old pattern whereby certain suppliers were closely aligned to specific vehicle manufacturers has been undermined though not entirely disappeared. In Japan, this pattern was often shown in the form of "tiered" *keiretsu* groupings of companies, with the vehicle manufacturer on the top of a pyramid of tier one, two and three suppliers. The Detroit region demonstrates the dense supply linkages that develop with the vehicle manufacturers at the centre of a complex system. Vehicle manufacturers have largely adopted "preferred supplier" strategies that have reduced the number of suppliers with whom they have direct contact. However, the desire for lower managerial costs has been somewhat offset by the desire to retain some control over suppliers. Moreover, globalisation and M&A activity by the vehicle manufacturers create turbulence in the supply base, disrupting old production and location linkages while introducing new ones.

On the other side of this value chain are the independent franchised dealerships, again largely characterised by relatively small companies dominated by the vehicle manufacturers. In comparison with other products such as ICT equipment or pharmaceuticals, distribution of finished vehicles remains relatively slow, unresponsive and expensive. Some 8 to 9 million new and used cars are shipped around the world each year, requiring dedicated vessels and port facilities. Inland car distribution is dominated by the use of trucks, though there are also significant rail facilities particularly in Europe. While some larger retail groups are emerging in the United States, the United Kingdom and parts of Europe, this is another area ripe for further restructuring. Slowly, the industry in established markets is tending towards large, multi-function, franchise and multi-location dealer groups. Industry estimates indicate that only some 3% of the total lifetime profit generated by a vehicle is attributable to manufacturing, with much of the remainder accounted for by items such as insurance, finance, maintenance, repair, and so forth. It is

not widely appreciated that in mature markets the value of used car sales is as large as that for new cars. In mature markets it is often corporate buyers that dominate the market for new cars, with all manner of consequences. In addition, the ownership and use of cars generates a huge economic impact through employment in a wide range of activities.

Markets

As noted above, the major markets have long been North America, Europe and Japan. Regulatory and other differences have tended to restrain the scope for product homogenisation between these regions, or indeed with emerging markets in eastern Europe, South America, Africa, India, China and other Asian countries. While efforts at environmental and economic regulatory harmonisation have made some progress, much still needs to be done until there is a genuine world "single market" for cars.

It is well known that traditionally North Americans have favoured larger cars in relation to other markets. In recent years this been translated into a higher proportion of light trucks, which include SUVs, pick-ups and minivans (often known as people carriers in Europe) that now account for around half of all new private sales. This has restricted US manufacturers' ability to export from North America to other markets. Similarly, Korean and Japanese consumers have strongly favoured locally produced cars, making import penetration difficult. In Australia, a unique full-size segment continues to exist which is served exclusively by two local producers, GM-Holden, and Ford, with its Falcon range. Other features illustrative of difference on a global scale include:

- Diesel engine cars in Europe;
- *Kei*-class ("midget") cars in Japan;
- Near-zero import penetration in South Korea and a mere 5% in Japan;
- Preference for saloon-style small cars in India and many other developing markets;
- Preference for hatchback-style cars in Europe;
- Absence of minicars in China (although there are new government incentives to encourage them);
- Limited market for cars of 2.0-litre engine or more in Italy due to taxation.

Such differences become accentuated when one considers that other emerging markets are adopting motorisation on a large scale, notably India and China, which militates against global car concepts designed to capture ever-greater economies of scale. In addition, more subtle and nebulous differences endure with respect to how vehicles handle on the road, to textures, colours, materials – even with air conditioning. For example, the US market prefers a blast of cold air, while Europe tends to opt for less intrusive "climate control" systems. On the other hand, while leather interiors are valued in the EU and US, they are not appreciated by Japanese buyers.

In addition, fragmentation has been evident as a result of platform strategies whereby each platform yields an increased number of models, body styles and variants. While in the 1960s a company like VW could prosper with a limited number of variants built on a Beetle platform, today all companies need a range of product offerings covering a growing number of segments, sub-segments and niches. During the 1950s and 1960s, people were looking for basic automobility, but from the 1950s onwards in the United States and the 1970s onwards in western Europe, people began to expect more individual differentiation. New segments and niches emerge all the time, while others rise and fall. Even within a

single segment a range of body styles now has to be offered on each platform, even though sales of some of these variants are low.

Product life cycles have been diminishing over many years in the industry, for specialist products as well as for high-volume products. Even "best in class" models can expect a period of only two or three years at best to enjoy the leadership position.

Markets are also becoming fragmented as different technologies are deployed, in response mainly to environmental and regulatory pressures. Most notable in this respect is the emergence of the petrol-electric hybrid pioneered by Honda and Toyota, but this in all likelihood is just a glimpse of things to come. In the future there will be an even greater choice of fuels (including bi-fuel and even tri-fuel options), engine type, body technology, and drivetrain. This may or may not include hydrogen-powered and fuel cell vehicles. Flex-fuel vehicles accepting any mix of petrol with ethanol from 0-100% are already sold in Brazil.

A key issue in many emerging markets has become the health impact of vehicles. The World Health Organisation has already drawn attention to the disproportionate negative consequences for death and injury arising from car and other vehicle use in markets that, for various reasons, have not adapted well to motorisation. In Ethiopia, for example, more people are killed by traffic accidents than by war or famine.

At the other end of the scale, there is much debate as to whether there is scope for a "bargain" or "value" brand in established and emerging markets. Tata for example has announced its intention to launch the 1 Lakh car (approximately USD 2 500) in India, to bring mass motorisation to the burgeoning middle class of the country. This is not necessarily the adoption of "motoring-lite" by emerging markets, in the form of cars stripped of content, but the design of products appropriate to those markets. For example, standards of maintenance and aftercare may be lower in many emerging markets, hence the need for cars that are rugged, robust, simple and within the capability of owners to repair and support. This also explains the long persistence of the traditional Lada in Russia.

In addition, some emerging markets already have a strong tradition in types of motorisation that fall outside traditional Western concepts, most notably of course the motorised rickshaw found in many Asian markets. In countries like India and China, unit sales of such vehicles still match those of "normal" cars. Long seen as indicative of technological backwardness, they are now being seen as indicative of "appropriate" and market-balanced technology.

Markets undergoing motorisation are usually thought of in terms of the "S-curve" of development. Car sales start slowly at first, accelerate over a period of time once a threshold level of per capita income is surpassed, and eventually level off. In addition, in many emerging markets the composition of the markets also changes over time. Initially trucks and motorbikes dominate, whereby simple flatbed trucks are used to transport everything from goods to humans. In a next phase a consumer society begins to take off and light commercial vehicles appear to distribute consumer goods. In this phase bus use also increases as consumers now have the wealth to travel and explore their own country. These eventually give way to a higher proportion of sales of passenger cars and the car market takes off, although high population densities have prevented Asian countries – such as Japan or Singapore – from achieving the levels of motorisation of other developed countries.

Brands

During the 1990s, much of the market began to focus on branding of technological differentiation. As a result, new issues have arisen such as brand stretch – either downwards (Mercedes A Class, BMW 1-Series), upwards (VW Phaeton) or sideways (Porsche Cayenne) – and potential confusion created by multi-brand constellations for broader market coverage. As a result, internal cannibalism (one brand taking sales from another held within the same parent group) has become common, as for example between SEAT/Skoda and VW on the one hand and VW and Audi on the other, squeezing the VW brand from both sides.

The market has also been affected by changes in demographics which introduce permanent changes. These include ageing populations in Europe and Japan, rising divorce rates and hence more and smaller households in Europe, Oceania and North America, as well as different market requirements from extended families in Asia to single-child families in China. New brands have been introduced, such as the Scion brand by Toyota or the Saturn brand by GM (both in the United States), in an attempt to capture a larger share of the youth market.

On the other hand, there has also been marked growth in the highest priced market segments catering to the new class of superrich with new brands being launched such as Pagani, Koenigsegg, or Ascari, the revival of previously extinct or moribund brands, such as Maybach, Bugatti or Spyker and the expansion of more established brands such as Rolls-Royce, Bentley or Ferrari.

Recent years have witnessed the emergence of a growing segment of cars costing over USD 200 000. Such cars are bought by a group of people far removed from the ordinary car buyer. Typical buyers in this segment are successful in the real world and arguably less brand-loyal, so it is possible in this segment for new entrants to be successful. While some buyers may just want a Ferrari, many want a particular set of individual product characteristics and if those are delivered more successfully by a Pagani Zonda, they will choose one of these. The fact that other people have not heard of such a new brand is of little relevance to these buyers, and in fact can be an incentive for a car purchase.

The hope for economies of scale comes from market expansion, mostly outside the traditional locations. The pressure for diversity comes from:

- Emergent new technologies and a splintering of regulatory pressures, meaning that "one best way" is unlikely to become dominant in the near future;
- Emergent new markets, with often rather different requirements from the established markets;
- Fragmentation of demand, brand disloyalty, changing demographics, changing status of the car and of motorised personal transportation in the light of market saturation.

The anatomy of the automotive industry

The current structure of the global automotive industry does not provide the conditions for the emergence of a single way of delivering products. Diversity arises from attempts to resolve the basic contradictory pressures the industry faces in terms of scale and diversity. While responses have not been uniform, broad trends are discernible. Vitally, many of the strategic responses outlined below have failed to achieve the results hoped for – thereby providing the basis for the contention that alternative business models and strategies may emerge in the future.

In the face of market fragmentation and stagnation, vehicle manufacturers have adopted a spectrum of responses to cope with, circumvent or deflect the challenges to their core business. The vehicle manufacturers remain locked into the economies of scale resulting from their chosen technologies. At the same time they have sought to reduce capital intensity throughout the business. A growing challenge is how to manage legacy costs in the established production locations: in North America both GM and Ford have struggled with the financial burden of pension and healthcare costs; in Europe companies like VW have met with labour and political resistance to the need to reduce overall employment and close plants.

Over the period since 1990 in particular there have been several interlocked key strategies including:

- Mergers, acquisition and consolidation;
- Multiple brand constellations;
- Platforms and architectures;
- Vertical disintegration and purchasing strategies;
- Technology enhancement.

Manufacturers have to reconcile short-term performance against long-term viability. Suppliers face similar problems, particularly in trying to create robust business portfolios of technical competence and geographic reach – and there have been several high-profile crises as a result.

Mergers, acquisitions and consolidation

In the 1990s, the global automotive industry went through a major round of consolidation under which very large corporate concerns were created. This process has resulted in fewer but larger companies, able to manufacture and sell throughout the world. This consolidation has been caused mainly by the need to reduce costs through economies of scale in all aspects of the business, from R&D and manufacturing, to purchasing and "back-office" rationalisation involving items such as finance, logistics and advertising. Predictions that the global automotive industry at the vehicle manufacturer level would soon be reduced to four or five major "constellations" or multi-brand groupings appear to have been premature. If the well-documented example of DaimlerChrysler is anything to go by, the strategic prescriptions for globalisation through merger and acquisition are easier in theory than they are in practice. As the tectonic plates of the industry shift under the remorseless pressure of market change, new fault lines and discontinuities appear to be as likely as new consolidated blocks.

DaimlerChrysler constructed a global corporation through cross-shareholdings and alliances, notably with Hyundai of South Korea and Mitsubishi of Japan. Yet within the space of a couple of years these were dismantled, leaving their global strategy in tatters. More recently, much of this global realignment has taken the less invasive or intrusive form of joint ventures, most notably in terms of engine R&D and production. These joint ventures are pragmatic, expedient and ultimately add greatly to the complexity of the inter-corporate landscape. The main problem in terms of legacy management is that the real consequences all too often are found at the local level, in individual plants, facilities, and dealer networks. This is particularly true for manufacturing facilities. The following features of incessant global restructuring are typical:

- Large sums of money have to be spent reversing or rescuing previous decisions.

- Some decisions are simply too difficult or expensive to change (engine supply deals are typical) in the short term and so a pragmatic "live with it" attitude is adopted.
- Some investments are effectively wasted: because the duplication of decisions tends to result in overcapacity.
- The actual facilities get scant chance to enjoy a period of long-run stability under which all the key activities such as management, investment, training, etc., can be embedded.
- Facilities and plants can become "victims" of change almost regardless of actual performance; they are simply in the wrong place at the wrong time.

Multiple brand constellations

A key element behind the rationale for consolidation has been the creation of "multi-brand constellations" with apparently different models and variants derived from a small number of core vehicle structures or platforms. Hence the retention of brands has been based (somewhat paradoxically) on the standardisation achieved with platform strategies (see below).

The primary function of multi-branding in the automotive industry is to avoid or reduce the trend towards product commodification by distinguishing the cars of one manufacturer from those of another. With a large vehicle manufacturers each holding a portfolio of brands, the basic intention is to realise economies of scale through standardisation platform strategies while different segments of the market can be reached through the multiple brands available. This has been the case ever since the 1920s when the newly-formed GM "family" of brands was assembled in order to provide a car for every purse and every purpose. There are perhaps four key elements of brand management in the automotive industry:

- Exclusivity and volume;
- Substantive product differentiation;
- Total brand experience;
- Control over brand values.

Platforms and product diversification

The concept of the "platform" was one that was both universally understood and yet without definite meaning. Fundamentally, the platform concept was based on the vehicle body structure that in turn defined the dimensions and positioning of most of the major components. In practice, the extent to which two different models actually shared components seemed to range widely: from 99.9% (only the badge being changed) to the approximately 25% that the Audi TT shared with the VW Golf IV.

What platform strategies showed is that you can't fool all of the people all of the time: or that, in the end, the market catches up. The same truth was evident with the "parts bin" strategies of the 1970s and 1980s: people who bought Range Rovers did not like the door handles to be shared with the widely vilified Morris Marina. For the 1990s, platforms were an effective, but time-limited, means of reconciling the cost-saving benefits of standardisation against the market demands for difference and diversity.

"Architecture" concepts are a more subtle and analytical attempt to achieve the same compromise. The essence of the architecture approach is to treat the vehicle as a three-dimensional jigsaw of nodes joined by lines of varying length. Different combinations of

nodes and lines yield different shapes. In turn, this means that the automotive industry has a new way to achieve those elusive intermediary volumes (between 20 000 and 100 000 units per annum) in an economical manner. Perhaps the clearest real world manifestation of this thinking is shown in the shift in design from the first Audi A8 to the current generation, and in the design of the controversially styled Fiat Multipla. The models are quite different in their execution, using different materials and forming technologies, but both display architecture concepts.

The idea – as typified by Lotus' VVA concept – is that in all cars the architecture can be resolved to four areas of the structure just inside the wheel-arches. Design for the vehicle starts at these corners, and it is here that all the complexity is concentrated. If accommodated at this stage, it is possible to define a large range of vehicle body configurations and engine layouts from the key corner modules: and because the complexity is concentrated at the corners, so is the cost. The corner modules are common to all vehicles derived from the architecture, and so the per unit costs of each module is as low as possible. The incremental cost of the rest of the architecture, differentiated for each model variant, is relatively low because these elements have been greatly simplified. This approach will come to dominate car body design over the next ten years, as it combines relative flexibility with lower cost.

Purchasing

With an average of 70-75% of the value of a new car being contributed by suppliers, the relationship between the vehicle manufacturers and their supply chain is critical for competitive survival. Collectively, vehicle manufacturers spend over USD 1 trillion per annum on materials and components. In recent years, suppliers have been caught between the demand for cost reduction from the vehicle manufacturers and upward pressure on material prices, particularly steel.

Vehicle manufacturers appear undecided on what sort of relationship they want with their suppliers. On the one hand, there is a demand for proximate suppliers that are able to provide just-in-time assembled modules sequenced into the vehicle build process. On the other hand, most leading vehicle manufacturers have declared the intention to switch more of their purchasing budgets to locations such as eastern Europe, India and China. As ever, the attractions of low cost have to be balanced against increased risk of supply disruption from uneven quality, or logistics difficulties, and indeed an insufficient degree of technical competence.

Vehicle manufacturers now rely increasingly on a small select group of suppliers for the majority of components and materials, as well as expecting those suppliers to undertake R&D and manage their own supply base. This will become the established pattern over the next ten years. New technologies, particularly those associated with ICT and electronics, have opened up the automotive market for new suppliers, such as Microsoft.

Still, the vehicle manufacturers are caught between conflicting desires. On the one hand, they want the benefits of close and enduring partnerships, with suppliers undertaking much of the cost and risk associated with developing new components and technologies. On the other hand, the vehicle manufacturers also want lowest possible costs, and this may mean turning to new suppliers in new locations. Many basic "process" activities such as pressing, injection moulding, and casting, as well as labour-intensive

activities such as assembling wiring harnesses, are no longer competitive in high labour cost locations such as western Europe. A real shift eastwards is therefore likely over the next decade or so, both in Europe and globally.

Technology

An emerging, and increasingly important, aspect of the new car market is that of the introduction of new technologies. The vehicle manufacturers of the world face difficult times. Quite apart from the basic issue of trying to make sufficient profit to stay in business, they are facing ever-stricter environmental requirements that cannot be met with current vehicle technologies. At the same time, nobody knows which technologies will emerge victorious in the long term. There are uncertainties over whether the technologies will work in a satisfactory manner, over whether they will meet the demands of government regulators, and whether consumers will accept them.

It is unlikely that, within the next thirty years, any one technology will emerge as dominant in the way that the internal combustion engine and all-steel body have dominated the last 80 years. Rather, there will be a gradual displacement of traditional petrol and diesel engines, traditional manual and automatic gearboxes, and traditional all-steel bodies by a range of alternatives. The immediate conclusions are:

- There will be an ever greater range of real technical choices for consumers.
- These choices will be packaged into a greater variety of vehicle designs and configurations.
- As a result, the market in its widest sense will become much more complicated for all participants.

At the sub-system level, innovation and product development efforts have been impressive, with improvements in emissions technology, safety systems, lights, brakes and traction control, tyres, heating and ventilation systems, noise insulation, materials, and many mechanical components. More recent innovations include advanced telematics systems, enhanced in-car entertainment, and better vehicle security. Much of this is attributable to R&D efforts by leading suppliers. On the other hand, vehicle complexity has grown and, with this, so too has the tendency for things to go wrong or to be considered over-specified to the task. In other words, there is a clear danger of car technology descending into the baroque. Yet most car manufacturers and suppliers would agree we are just at the beginning of this technology explosion.

Key drivers and trends

The world automotive industry is about to embark on a period of significant, possibly dramatic change. There are a number of drivers for this change. Some of these arise out of the external operating environment of the industry, such as globalisation and government regulation. Others arise out of structural problems within the industry, notably its low levels of profitability. The major drivers for change in the industry are thus structural/economic, regulatory, and technological. Combined, they are creating a new era of uncertainty over the future structure of the industry and the prevailing business models throughout the value chain – from materials suppliers via component suppliers through assemblers, and including retail/distribution and end-of-life processing. Main drivers include the – now apparently structural – poor and declining levels of profitability for vehicle manufacturers and suppliers, especially relative to capital invested, but also in

terms of simple operating margins. This is a long-term issue and no obvious short-term solution is in sight. There is limited scope for further rationalisation. Mass car-making in its current form is chronically unprofitable, which gives some scope for innovative new business models to be introduced. The scope for new entrants is limited by the high entry – and exit – costs of the existing business model.

Considerable cost is added by environmental regulation in mature markets – closely followed by newly motorising markets. This covers especially toxic emissions, but also increasingly fuel economy and CO_2 emissions. New regulatory developments take more of a "life cycle" approach with such initiatives as the End of Life Vehicles Directive in the EU. Pressure is also coming from society to enhance corporate social responsibility (CSR) and accountability, including safety, also for pedestrians. New trends, already established in some markets (*e.g.*, Singapore) involve restrictions on car ownership and use. Much of the leadership has historically come from the California Air Resources Board's (CARB) intervention, but it is increasingly losing the initiative to the EU. CARB is still proactive in its ultimate aim for zero emissions from transport, as illustrated by its efforts to develop the hydrogen economy, notably via the California Fuel Cells Partnership.

Cost

Another pressure comes in the area of cost reduction and market deregulation. Competition has increased with the globalisation of the industry. A sector once dominated by US and European interests is now challenged by manufacturers from Japan, with Korea China, India and others not far behind. In their initial development phase each of these countries has been able to compete on price, at least temporarily. Japan has also been able to compete in manufacturing efficiency, thus transforming practices throughout the industry. In this globalisation process markets have been opened up presenting significant challenges for established local players.

Over the past 40 years, the European Commission's policy emphasis has gradually shifted from industry protection to consumer protection, as exemplified by the Block Exemption for car retailing. This has highlighted price as an issue within the EU and considerable price reduction pressure has been evident throughout the EU in recent years. In North America too, discounting has become endemic, a trend only recently addressed by US car manufacturers. Other pressures come from the World Trade Organisation (WTO) regime, which, though welcomed by the car industry, also increases competition by reducing protectionism. Other cost pressures involve capacity against market growth and the capital cost of new production plants.

Costs also increase as a result of multiple emergent technologies, each of which needs management and engineering input. These include hybrids, fuel cells, latest generation petrol and diesel, aluminium and carbon fibre structures, new powertrain and transmission, electronics in vehicles, intelligent vehicles and highways (telematics), pedestrian protection. As making money on basic cars is no longer possible for many players, attempts are made to sell features, leading to "feature" proliferation, with resulting complexity issues and warranty and reliability problems (*e.g.*, DaimlerChrysler announced in 2004 it was reducing the number of electronic functions in its cars to improve reliability). Nevertheless, the electronics and ICT content of cars will continue to increase, leading ultimately to cars which are essentially electrically/electronically powered and controlled, even if the primary power input still comes from an internal

combustion engine. However this will make the transition to technologies such as fuel cells easier if or when it comes.

Intensified competition has put pressure on manufacturers to improve their manufacturing and supply chain processes in order to reduce costs. This has led to the widespread adoption of lean production systems – based on the Toyota Production System – and of attempts to recapture economies of scale by globalisation. Lean production allows maximum efficiency at any given scale. This means that firms should aim to minimise inputs and maximise outputs – reduce waste. On the other hand, there is the move to increased scale effects as these will still give cost reductions. These are achieved by:

- Buying in more materials, components and services, but reducing in-house production.
- Industrial rationalisation through mergers, liquidations and joint ventures.
- Global integration; produce for a world market, both in terms of cars and components.
- Achieve production synergies through commonality and back office reorganisation.
- Cost pressures are likely to continue, and reinforce the drift of production capacity away from the established regions and into eastern Europe, Latin America and Asia.

Changing supply base

Because of generally lower capital investments compared with the vehicle manufacturers, suppliers are often moving more and faster than vehicle manufacturers themselves. This includes the potential for sourcing from low labour cost locations to assembly facilities in high labour cost locations; although this is still less common in automotive than in some other sectors, it will change over the next ten years. One major struggle involves the reallocation of responsibilities in product development, design and manufacturing. This process of vertical disintegration and redefinition of core competence amounts to a battle between vehicle manufacturers and first tier or "tier 0.5" suppliers – themselves capable of developing and building whole vehicles. Though instigated by some manufacturers as part of a rationalisation and overhead reduction process, others have resisted from the start, while others are now having second thoughts. In the wake of consolidation among vehicle producers has come a wave of consolidation among suppliers. Suppliers are becoming more powerful as a result of these developments and could potentially turn the tables on their customers; a situation which to some extent already exists in the truck industry, where vehicle producers are generally smaller. Ten years from now, some of these super-suppliers will be less disadvantaged *vis-à-vis* the car assemblers.

The cost pressure on suppliers has begun to take its toll, with two major US suppliers filing for Chapter 11 bankruptcy. To some extent this represents the failure of what we may call the American Model where the focus is on low cost, tactical decisions and short-term financial objectives maximising what is perceived as shareholder value. Part of this model also involves small government, which puts a considerable social burden on companies – hence Delphi, Ford and GM's responsibility for the healthcare and pensions of legions of both current and former employees. In Japan, although suppliers have to some extent suffered the gradual collapse of the *keiretsu* structures and many smaller suppliers have been lost, relatively close relationships with manufacturers have remained, enabling both suppliers and manufacturers to plan for the longer term and thus benefit financially. With the widespread collapse of major suppliers in North America and their restructuring into

their EU and Asian divisions, the super-suppliers are therefore likely to emerge in EU or Asia.

In Europe, many suppliers have deliberately embarked on a lifesaving strategy that involves developing intellectual property that can be sold at a fair margin, at least for sufficient time to benefit both supplier and customer. On the other hand, they have started to become more selective about who they do business with – "preferred" customers. Many key European suppliers have been able to benefit from the higher margins engendered by the cost-recovery approach used by Europe's specialist volume producers. Rather than build cars down to a price – cost reduction – as true mass volume producers have to do, these firms, notably BMW and the Mercedes-Benz brand of DaimlerChrysler, can leverage the value of their brand into a premium pricing approach.

Suppliers have benefited from new technologies used by the vehicle manufacturers in market competition, such as satellite navigation and – perhaps surprisingly – airbags, which are still not compulsory but now expected by customers and essential in meeting the semi-official crash standards that have been developed by EuroNCAP in Europe. They have also benefited from new regulations requiring such technologies as on-board diagnostics (OBD) and pedestrian protection systems. The speed with which such new technologies have to be introduced stretches the product design and development capability of many car manufacturers, thus providing opportunities for suppliers with product development capability – such as Bosch or Autoliv – as well as specialist design engineering consultancies such as Ricardo of the UK and AVL of Austria. With the EU currently leading such developments, these suppliers then have products they can sell world wide as other jurisdictions catch up with EU regulation. The key issue for the future is whether high-cost locations and leading companies can retain their status in the face of competitive threats from emerging locations. In practice many of these EU and US businesses are relocating many of their activities – including R&D – to such emerging locations.

Environmental pressures

The recognition that we need to do something about the environmental impact of the car came initially with the realisation that deteriorating urban air quality – initially primarily in southern California – was car-related. This prompted a wave of toxic emissions regulation from the 1960s onwards aimed at controlling the harmful side-effects of automobility, which has extended into more and more aspects of the car, its production, and its use. Regulation now extends to safety, noise, and fuel efficiency and is likely to take an increasingly holistic or life-cycle perspective. 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 30 years ago. By 2008, EU trucks will have improved such that it will need ten trucks to produce the same emissions as were produced by a truck built in the late 1980s. While individual vehicles have become cleaner, quieter, more durable, more able to be recycled, and in some respects more efficient, various 'rebound' factors have combined to undermine these achievements.

First, there is the fact that vehicle numbers have increased considerably, the distances driven have increased and growing congestion has resulted in longer periods where stationary cars continue to consume fuel and produce emissions. 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 minivans or people carriers for personal transport. 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 EU, North America and Japan within the next 20 or 30 years, thus doubling the global burden of motorisation. The key issue here is whether harmonisation of global environmental standards can be achieved, and at what cost.

Climate change and oil

The looming issue of global warming and the link to petroleum consumption is particularly challenging, and one that may be expected to take centre stage in the future as toxic emissions *per se* are dealt with. The science behind climate change while still debated in some areas is now widely accepted by policy makers around the world. What is still unclear, though, is the extent to which we humans contribute to climate change. On the other hand, we are rarely 100% certain about any risk, yet most of us take out insurance against various risks and pay the premiums in the hope we never need to claim. This is the basis of the precautionary principle that guides much of our current political response to climate change. Some credit should go to the European car manufacturers – and to some extent also their Japanese competitors – for what they have already achieved. The number of cars now available that do meet the 140 g/km agreed with the Commission has increased significantly since the agreement was implemented; and people are buying them. In fact, there are several cars available in EU and Asian markets that already meet the 120 g/km proposed for 2012 by the Commission.

What have been lagging behind, are any true incentives for buyers of cars to choose these lower CO_2-emitting vehicles. Some countries have made moves to adjust their regulation – the UK's CO_2-based company car tax regime is an example – and many countries have traditionally favoured smaller, less powerful or more fuel-efficient cars in their taxation regimes. China has recently introduced measures favouring smaller cars and diesel cars, but others are well behind. Consumers themselves have therefore not been party to the agreement between ACEA (European Automobile Manufacturers Association) and the Commission. This would need to be remedied. One possible solution may come from rising oil prices. The effects of this are already visible in the United States, where a lower proportion of the price of fuel is represented by taxes and where oil-price increases translate into pump-price increases much faster than in Europe. This has prompted the introduction of tighter light truck fuel economy standards under the CAFE regime (Corporate Average Fuel Economy).

The price of oil has already risen to unprecedented levels. As the point of "peak oil" is reached, perhaps as early as 2010, price pressure will grow. Rapidly increasing demand from newly industrialising – and motorising – nations will speed up the decline in the availability of cheap oil and of many raw materials needed for car making, such as precious metals for catalysts. In addition, dependence on Middle East oil has now become a political issue, especially in the United States. Concern for dwindling supplies and political dependence may galvanise governments into action faster than issues related to global warming. There could be profound consequences for the industry, and indeed the global economy. Overall sales volume growth may not be achieved, putting further

pressure on the industry. Additionally, major shifts in vehicle design and the segment split of sales are likely, greatly increasing risks and uncertainty for the vehicle manufacturers.

Environmental regulation

Environmental regulation has traditionally been regarded in the automotive sector as something that holds the industry back, a cost without any business benefits. The industry has therefore rarely been proactive in environmental technology. Car manufacturers, particularly in the United States, but also – albeit to a lesser extent – in Europe, have spent considerable efforts and resources over the past few decades attempting to stop the introduction of new environmental rules and regulations. However, this view is beginning to be challenged by some of the biggest players in the industry. Toyota has made it quite clear it intends to use its technological advantage in hybrid and fuel cell technology as a competitive tool in the market. In fact, it intends to use its considerable financial and technological leverage to move the whole industry in that same direction. Having established the direction for the whole sector, it can profile itself as the leader and its competitors as followers, benefiting immediately from a first-comer advantage. Toyota is not alone. PSA Peugeot-Citroën caught its German competitors off-guard in their own German home market by offering particulate filters as standard on its new Hdi diesel engines.

It has become quite clear that environmental technologies are beginning to be used as a competitive tool. Toyota has laid down the gauntlet, but PSA has also taken the initiative in the German market. If others wake up to the possibilities offered by the CO_2 reduction agenda and the California-inspired Japanese drive into hybrid and fuel cell technologies, our environment can only benefit. At the same time this new approach could change the industrial landscape and the way the car industry interfaces with government and regulators. This is an example of an external driver being internalised by the industry and being turned into a competitive tool. In the long term such a scenario will of course make the industry more sustainable, both from an economic and an environmental viewpoint. By implication, in the future individual vehicle manufacturers, their technology partner suppliers, and/or particular locations will be looking more aggressively to establish market technology leadership. In this sense, the Toyota case could for example accelerate the deployment of fuel cell vehicles.

Västra Götaland Region, Sweden

Introduction and basic data about the region

The industrial geography of Sweden, as in other member-states of the OECD, can be understood in terms of regions and clusters which concentrate different types of industrial expertise and know-how. Sweden has, since the 1990s, experienced a process of decentralisation and growing autonomy of its regions, although it remains a unitary state. Sweden's regions and the companies they host have done relatively well, by international standards, in terms of economic performance and competitiveness.

Swedish regions nonetheless confront significant challenges of adjustment to changes associated with globalisation, the emerging knowledge-based economy, and broader industrial transformations, similar to those in other European Union (EU) states. These challenges are nowhere more clearly identifiable than in the manufacturing base of the

country's economy, especially in the automotive sector which accounts for a major part of the country's economic activity in terms of employment and exports.

Specific regions, specialising in different phases of the automotive production process, comprise the Swedish automotive sector. The region of Västra Götaland in the south-west part of the country is the centre of the sector: a large county with 49 municipalities and a metropolitan area that is home to more than half of the region's total population of 1.5 million. The region is referred to as the "second region" – the first being that surrounding Stockholm – with a geographical area of 24 000 km^2. However, it constitutes a leading manufacturing and trading hub. Gothenburg is the centre of a travel-to-work area with approximately 940 000 inhabitants.

The Regional Council and Local Authorities make up the administrative structure of the region. *Region Västra Götaland* (*www.vgregion.se*), the Regional Council, is the central political decision-making body in the region. With regional development tasks including support for infrastructure development such as transportation and communications, business development, knowledge and skills development, international co-operation, analysis and assessment of economic trends, and the management of programmes for development and social cohesion funded by the EU, it is also responsible for creating conditions favourable to economic development and the promotion of trade. The *Region Västra Götaland* is also responsible, beyond these functions, for healthcare, which is its primary responsibility, the promotion of culture, tourism, and environmental protection issues, thus exercising a wider influence on the region's welfare.

The municipalities of the Västra Götaland region, the so-called Local Authorities, constitute the support infrastructure for all public services provided at municipal level. Collaborating with *Region Västra Götaland* on matters of regional economic development, they are organised into four associations. The Local Authorities have, like the *Region*, the power to raise taxes from their constituencies in order to finance their activities.

Despite the fact that it is a unitary state, Sweden has a public administrative structure where the interpretation and implementation of national policy take place at national and regional levels. Regions and municipalities have relative autonomy on how to interpret and apply national laws, raise income tax, and implement various policy objectives set at national level through the use of subsidies, while legislation and fiscal policy are the responsibility of the national level.

The general trend in Sweden, as in other EU member-states is toward devolution of policy-making authority to the regions. On 1 January 1999, as part of this trend, Västra Götaland became a self-governing region with directly-elected representatives assuming responsibility for regional development.

The co-ordinating work of the Drafting Committee for Regional Development ensures commitment and co-operation among the region's stakeholders and municipalities around the objectives of regional development. Political representatives from *Region Västra Götaland* and the Local Authorities make up the Committee. A strategic framework for the region is its focus, built around a regional vision and growth programme, infrastructure planning, and EU cohesion policy. Formed at regional and sub-regional levels, partnerships among key stakeholders such as companies, unions, universities and other applied science organisations of civil society, carry out these lines of activity.

The Västra Götaland region is supported by an extensive education and research infrastructure, given its centrality as a manufacturing and trade centre. Three universities

with specialisations in the fields of technology, natural sciences and architecture, but also disciplines such as economics, law, medicine and information technologies form part of this infrastructure. In addition, there are three University colleges which, apart from classical studies, also offer programmes such as computer sciences and engineering.

Gothenburg is a vital part of Swedish industry, business, shipping, education and culture. The city was founded in 1621, and grew to be an important centre of trade and industry. Among the first important industries to be developed in the city were shipping and trading, shipbuilding and engineering; full industrialisation arrived during the 19th century. The industrial history of the region was dominated by the same industries for much of the 20th century, even though during the last quarter of the century several of them, such as shipbuilding, suffered delocalisation or closure.

The industrial structure today is diversified across sectors such as automotive, petrochemicals, information technologies, aerospace and textiles. The region is also an attraction pole, given its accumulated expertise, for a large number of international companies which have located operations in and around Gothenburg. The presence of the automotive industry, led by Volvo and Saab, is one important element of attraction, as well as several major chemical companies such as Akzo Nobel and Eka Chemicals. International companies of high specialisation are attracted by the advanced research and production activities carried out by these companies, with a positive cumulative effect for the entire regional economy. The Gothenburg region is one of the fastest-growing regions of northern Europe as a result.

Per capita gross regional product (GRP) for Västra Götaland was 5% above the EU15 average in 2003. Services such as healthcare, education and public services, provide the majority of the jobs, in terms of employment composition across different sectors, with the remainder being in manufacturing. Unemployment levels, however, have been comparable to those at the national level despite a generally high level of education. What is more, levels of unemployment tend to vary across different areas of the region, which indicates the absence of a common labour market, with remote areas not being fully integrated into the economic dynamics of the Västra Götaland region. Transportation infrastructure investment, as a result, is a public priority in order to reduce the vulnerability of remote areas of the region.

The economy of Västra Götaland displays a well-balanced distribution between small and medium-size enterprises (SMEs) and large firms, in terms of its firm structure. Firms with 1-9 employees, for instance, represent 17% of the total, while firms with 10-49 employees represent 29%, firms with 50-250 employees represent 29%, and firms with more than 250 employees 25%. Within a well-diversified economic base spanning textiles, petrochemicals, automotive and fishing and aquaculture among others, these companies exhibit high degrees of specialisation.

The automotive sector in Västra Götaland

Historically, vehicle manufacturing has been the core business of the Swedish automotive sector. The motor of the industry is constituted by the major vehicle manufactures (AB Volvo, Volvo Car Corporation and Saab Automobile) and their suppliers (such as SKF, Autoliv, Haldex and Opcon). These companies conduct automotive R&D through universities and research institutes, and play a significant role in the development of Sweden's automotive sector. The industry is structured, beyond these

major firms, around approximately 200 SMEs that act as suppliers of components and services.

The automotive industry, taken as a whole, employs over 50 000 people, which represents a major part of employment in the manufacturing base of the region. Beyond its significance for employment, however, the automotive industry acts as a driver of technological R&D as it accounts for a significant share of Swedish exports; it also functions as an engine of growth for other industrial sectors (Ministry of Industry, Employment and Communications, 2005).

The industry confirmed its position as an engine of growth for Västra Götaland and Sweden in general in 2004, after reaching record production levels of passenger vehicles and heavy duty trucks, The combined strengths of the industry are reflected in its performance, with production of Volvo Cars and Saab Automobile increasing by 7%, reaching a total of 587 000 units, half of them being produced in Sweden. An increase of 24% from 2003, totalling 150 000 Volvo and Scania truck sales world wide, was also experienced in heavy duty truck production. Approximately 85% of the production of passenger cars and 95% of trucks and buses were sold outside Sweden.

Sweden's growing dependence on exports is also highlighted by this performance. In 1968, for instance, exports accounted for about 20% of the country's GDP; in 1998, consolidating the industry's position as the country's largest exporter, the figure had risen to 42%, with the automotive industry being responsible for a major portion of this increase. In addition, the automotive industry accounts for approximately 25% of Sweden's total investment in industrial R&D and 20% of its investment in machinery and equipment. In 2003, according to Statistics Sweden, the manufacture of transport equipment accounted for 27% of total industrial R&D investment and for 30% of all employees in the industrial R&D sector as a whole (Ministry of Industry, Employment and Communications, 2005).

Despite the historic strengths of the Swedish automotive sector, Västra Götaland faces challenges associated with transformations in global production systems and the emerging economies. The automotive industry today is a global competition arena where business rules and conditions often are defined by larger groups. The very core of the industry, moreover, Volvo Cars and Saab, is owned by foreign groups Ford and GM respectively. It must adapt, therefore, to the strategies pursued by the owner groups which are defined on a global, rather than a regional, basis.

The challenge for the automotive manufacturers and suppliers is one of adjusting to realities while seizing market opportunities that might arise. It is a matter for the national and regional governments of creating conditions that enable the industry to defend and enhance its position and create growth. The region is uncertain about its future in the long run, as this depends largely on decisions taken elsewhere and according to criteria that might not correspond to the priorities of the region.

Västra Götaland is confronted by another important transformation: mounting competitive pressure from emerging economies and the changing global geographical distribution of the automotive production process. Europe headed global vehicle manufacturing in terms of number of vehicles produced until the end of the 1990s, followed by North America and Asia. Asia is the dominant producer today, with 36% of world production, with Europe and North America following, with 33% and 30%, respectively.

Low-cost countries with substantially lower wage costs are Västra Götaland's main rivals. In some parts of Asia and eastern Europe, labour costs are often less than 10% of average labour costs in OECD countries. This reality has profoundly affected the industry, and its consequences for manufacturers and component suppliers are unclear (Ministry of Industry, Employment and Communications, 2005).

The disaggregating of the automotive value chain and the location of different phases of the production process in different regions according to optimum production and profitability criteria are also a reflection of these differentials. Swedish major manufacturers, nonetheless, undertake the entire process, from product development to the manufacture of finished cars. A seamless working infrastructure, including an efficient supplier network, is a requisite for this process. Cost effectiveness, which is increasingly defined on a global scale, is another major factor, which makes manufacturers and suppliers vulnerable to cost pressures.

Manufacturers, at the same time, are following the tendency in the value chain to place increasing value on the immaterial aspects of automobile production, namely design and other advanced engineering functions as opposed to vehicle manufacturing. Although automotive manufacturing continues to be among the most capital-intensive industrial activities, manufacturers tend increasingly to focus on other areas to boost profitability, reduce risk and access wider market targets, including brand values and branding, marketing, maintenance, financing and insurance. The relationship between manufacturers and suppliers is changing in the process. Increasingly, suppliers are expanding their operations in manufacturing and product development; and now constitute the bulk of the automotive industry in terms of value added. They are under pressure, as a result, from more cost-effective locations and manufacturers to find ways to increase their cost-effectiveness while increasing investment in R&D. The relationships between manufacturers and suppliers have changed as a result, with the burden of adjustment being shouldered increasingly by the latter. According to interviews conducted for this study, suppliers have, in fact, become the shock absorbers for the automotive industry's fluctuations.

Increasingly, competitiveness in the automotive industry is based on high levels of expertise, R&D, and cost-effective production. A paradigm change that requires the integration of new technologies and the development of new technological solutions has shaken the industry. Fuel, safety, accessibility and the environment are just some of the key areas requiring new technological solutions. Interviews conducted for this report point out that such integration will take time, possibly 10 to 20 years; moreover, success will depend largely on R&D.

The automotive industry is an important sector in Västra Götaland and the importance of the industry in recent decades as an employment-provider has increased even further as manufacturers and suppliers have not relocated their operations to other locations or reduced their workforce in Sweden. General employment in the sector, however, has fallen by 20-30 000 since the early 1990s. The geographical concentration of the industry across a broad corridor between Västra Götaland and Södertjälje/Stockholm has, moreover, increased the importance of the industry from the standpoint of regional policy; the various companies across the region being the dominant employers in the localities in which they operate (Ministry of Industry, Employment and Communications, 2005). However, it should also be underlined that

the regional economy in Västra Götaland has become increasingly diversified during the latest years.

Regional governance and strategies

Different levels of government have introduced initiatives, against this background, to boost the innovative and adaptive capacities of the country and the regions. The national government published a report in June 2004 outlining its innovation strategy, *Innovative Sweden: A Strategy for Growth through Renewal* (see *www.sweden.gov.se/sb/d/2026/a/32551*). A framework for enhancing Sweden's position as a knowledge economy is outlined in this strategy. Changes in the structural conditions of policy intervention are reflected in this approach: having moved from generic intervention, to industrial sector targeting, to industrial structure ("parametric" policies).

The national framework for innovation policy and initiatives is set by *Innovative Sweden; Vision Västra Götaland – A Good Life* lays out the vision of the region (see *www.vgregion.se/upload/Regionkanslierna/regionutveckling/RUSEN/PP-pres%20eng.ppt*). Jointly formulated by *Region Västra Götaland* and the four regional associations of local authorities, the vision is a product of a collaboration of a number of parties representing trade and industry, universities and colleges, and other organisations. On 5 April 2005, it was adopted by the Regional Council.

As a framework to organise regional actions in order to enhance the region's appeal as a place in which to live and work, *Vision Västra Götaland* specifies long-term objectives. Health, work and education opportunities, safety, community spirit and social inclusion, a good environment protecting renewable systems, addressing the needs of the young, sustained growth and promoting cultural life are the core of the vision. Sustainable development is required, based on mutually reinforcing relationships between and across economic, social and environmental conditions.

The *Vision* has five focus areas in terms of economic policy intervention: support for sustainable trade and industry, support for a leading position in competence and knowledge development, support for the development of infrastructure and high standard communications, support for the cultural life of the region, and support for health. Through an approach which centres on social cohesion, equality, integration and internationalisation, these are thought to be achievable.

The *Regional Growth Program* is another initiative co-ordinated by the regional government. Designed to mobilise system-oriented change activities focused on the region's trade and industrial requirements, the main objective of this plan is to concentrate national and regional funds for sustainable regional development through regional and local partnerships. Regional government agencies responsible for innovation, education, labour market regulation, transport and cultural policy are its main stakeholders. For the implementation of the *Regional Growth Program,* the key institutional instrumentality responsible is *Region Västra Götaland*.

The strategy to address the challenges of the automotive sector has been formulated within the general economic strategy of the region, based on the view that Västra Götaland must compete not on low wages but rather on the strength of its expertise and potential for innovation. It aims to enable the industry to maintain its position in the global automotive value chain through the development and introduction of advanced technology solutions in international markets. The vision of the role of government policy in the strategy is to

create conditions that will enable the industry to maintain world-class institutions of R&D within a stable macroeconomic environment, and a dynamic business climate supported by efficient innovation systems.

A study commissioned to the Center for Market Analysis (CMA) in 2003 identified several positive elements in the current state of the industry, such as the structure of the industry which encourages collaboration, the ability to develop quality products to meet emerging demands, the cost-effectiveness of engineering across the sector, and the existence of high skills areas that will be critical to future competitiveness such as environment, telematics, and new materials. The study zeroed in on certain competitive disadvantages, on the other hand, including difficulties to adapt to rapid changes in the international business environment, low productivity, high dependence of the sector on Swedish manufacturers, and hence their foreign owners, limited and mostly regional networks, a relative disconnect between academic institutions and industry, and infrastructure.

These findings prompted the formation of *Automotive Sweden* in 2004, confirming the commitment of public authorities at different levels of government to the sector in the region (see *www.automotivesweden.se*). Established by the public sector, *Automotive Sweden* is a network to help promote the development of the automotive sector. The network's strategic objective, in co-operation with industry and academia, is to help foster a favourable business environment for the industry, support R&D and the long-term development of skills in emerging critical areas. The focuses of its business development programme include: 1) business intelligence (to increase knowledge and awareness); 2) co-operation (to support existing and new players); and 3) marketing (to attract new companies and skills).

The historic sources of the Swedish automotive industry's strengths, which cross different sectors and domains of expertise, are the framework for *Automotive Sweden*; these include environment, safety, telematics, design and engineering, and winter testing. These competencies are the focus of the industry in its quest for international competitiveness.

Other priorities in the Swedish government's initiatives to support the sector are automotive safety and the elimination of vehicle accident-related casualties. "Vision Zero", for instance, is a government-sponsored programme, supporting the development of advanced safety features and systems. The Intelligent Vehicles Safety Systems (IVSS) programme designed to help introduce new safety solutions in vehicle and roadside systems are another government-sponsored initiative. This programme is regarded, additionally, as a driver for the development of skills that will be critical for research and education as well as a platform for the development and application of advanced information technologies in the automotive production process.

The convergence between automotive and information technologies is another object of *Automotive Sweden*'s concerns; this convergence is regarded as a key competence in the industry's positioning as a leader in telematics, given the country's industrial experience in both sectors (Volvo Cars, Volvo Trucks, Saab and Scania in automotive; Ericsson in information technology). "Telematics Valley" is result of this convergence, an automotive telematics cluster around Västra Götaland. As a centre of innovation hosting developers and producers of hardware, software, and services, as well as telecommunications vendors and operators, it is also home to leading international automotive manufacturers and suppliers.

Another area of strategic action of *Automotive Sweden* is the combination of Sweden's experience in design and engineering with the dynamics of automotive production; the objective here is to combine skills that cross these domains and lead to the development of world-class products that confirm Swedish production values such as excellence in industrial design, product durability, road-holding ability and style.

A number of areas have been identified where co-operation in the automotive sector can be further improved and where initiatives can be implemented to reinforce the position of strength enjoyed by the automotive industry. The initiatives are grouped into the following areas: measures to promote closer interplay between the government and the business sector; measures to improve know-how and expertise and raise the level of technology in strategic areas; measures to ensure skills provision and access to labour; measures to facilitate pilot projects and the demonstration of new technologies and systems; and measures to develop the potential of Swedish suppliers to the automotive industry (Ministry of Industry, Employment and Communications, 2005).

The *Regional Growth Program's* main objective is to promote an innovative economy across the Västra Götaland region. For achieving this goal, clusters are seen as key vehicles, along with the promotion of entrepreneurship and initiatives targeted to support SMEs. Nine clusters have been prioritised by the *Regional Growth Program* as well as cross-cluster initiatives which seek to create synergies across them. These are life sciences and healthcare, automotive, ICT, food, petrochemicals, textiles, wood and creative industries. Also in the programme are measures to further promote design, logistics and financial services.

Intended to position the region as a pole of attraction of investment and competence, this multifaceted approach views cluster support not as an objective in itself but rather an integral component of the regional strategy for economic development. It is to be developed through continuous dialogue with key regional stakeholders, the role of public agencies differing according to their functional responsibilities. *Business Region Gothenburg* thus targets its activities to the support of start-ups and organisation of cluster initiatives, providing, for example, project managers and networking opportunities; *Västra Götaland Region's* role, on the other hand, is to co-finance cluster development and help stimulate cross-sector initiatives.

The development of cluster initiatives or networks, based on co-operation between industry, academia and the public sector on local, regional and national levels is the key instrument used to achieve the *Regional Growth Program's* objectives. Initiatives on a cluster level are defined and objectives prioritised through such partnerships. Co-operation across research, business and competence development, and internationalisation are some of the concrete actions involved. One of the key instruments to support innovative clusters is horizontal action focused on the priorities of industry and the targets of regional economic development. Another prioritised instrument are centres of excellence, or arenas for co-operation. Designed to stimulate synergies across the competences of different stakeholders by facilitating co-operation between companies in different sectors and academia in ways that foster innovation but also attract competencies and investment in the region, these centres can be located in a science park, a university or research institute which provide the facilities of incubators (including test and demonstration facilities, managerial advice, and networking) for the promotion of start-up companies.

The innovation strategy for the automotive sector that was presented by the Swedish government in 2005 reflects this approach. Based on a model of co-operation across industry, regional government, and academic and research institutions, key actions were identified. A number of actions, such as the promotion of "Test Site Sweden" and the establishment of a "think tank" for policy measures in the automotive sector, are to be the responsibility of the different stakeholders across these communities. The more detailed phases of implementation involve more specialised institutions, even though *Region Västra Götaland* and *Business Region Gothenburg* (see *www.businessregion.se*) have overall responsibility for the development of these centres, The *Lindholmen Science Park* (see *www.lindholmen.se*) in Gothenburg thus plays a key role in the development of "Test Site Sweden" while the *Chalmers School of Technology* (see *www.chalmers.se*), *Gothenburg University* and *Automotive Sweden* are important stakeholders in the development of the "think tank".

Besides the above initiatives, the Swedish Government in 2004 initiated two special programmes to strengthen the international competitiveness of Swedish car manufactures. The two programmes were directed at developing production technology and telematics and vehicle electronics. The total budget for the programmes is roughly SEK 1 billion or about USD 110 million. The programmes are conducted in co-operation with the Swedish car manufacturers, the Swedish Agency for Innovation Systems (Vinnova), the Swedish Agency for Economic and Regional Growth (Nutek), the region of Västra Götaland and the Scandinavian Automotive Suppliers.

General conclusion

The Västra Götaland region and the automotive cluster around Gothenburg, in comparison to other EU regions, have performed relatively well over the past several years. Like other regions across the EU, however, they face strategic challenges associated with changes in the global automotive industry which could have a dramatic impact on the economy of the region. Several key points presented here are highlighted:

- The experience of the Västra Götaland automotive cluster points out the importance of government support, at both national and regional levels, especially in the provision of an "enabling framework" to assist the industry in defending and promoting its position in international markets. The collaboration between government institutions with industry but also collaboration across different levels of government is one particularly critical component.
- In the context of the strategic orientation to compete on the historic strengths of the industry instead of low cost, this framework is particularly important. In the development of a long-term approach to critical skills development and putting into place infrastructures that will play a key role in the future of the industry, it is a critical factor.
- The Västra Götaland case, however, also highlights the challenges associated with corporate control. With foreign control of the very core of the Swedish automotive industry, it could be harder to influence critical investment decisions and strategic direction, apart from providing the conditions necessary for global competitiveness, which, when considered in the context of wider global strategies, might or might not address the concerns of those who are ultimately in corporate control of the industry.

The following tentative suggestions for policy may be advanced based on the foregoing analysis:

- A "total" approach to the design and production of automobiles continues to mark the Swedish automotive industry. Given the global dynamics which affect the industry, however, as well as the significant cost differentials across different regions, this orientation might no longer be tenable.
- In the Västra Götaland region, the automotive cluster concentrates significant competencies that will play a major role in automotive production competitiveness in the future. In collaboration with the stakeholders in the industry, the government needs to develop a strategic approach that focuses on the segmentation of the global automotive production value chain and concentrate on its high-value components, as opposed to seeking to address the whole production process.
- This approach must be flanked, in parallel, by programmes and measures that assist the regional SMEs either to internationalise their activities (*e.g.*, enter into highly specialised subcontracting arrangements with international automobile manufacturers and/or diversify their activities into other industrial sectors).
- Such an approach would reduce the dependence of the Västra Götaland region on exports of automobiles while it would provide a more diversified economic base for the region's development which would also reduce its dependence on the fluctuations of the automotive industry. Not the least benefit would be reducing the uncertainties linked to the foreign control of the very heart of the automotive industry regional and national governments seek to support.

Turin, Italy

Introduction and basic data about the region

Piedmont is a region of north-west Italy with the city of Turin at its centre. Piedmont has historically been a core of the industrial and economic fabric of the Italian economy, concentrating major industrial activities ranging from automobile production to telecommunications and information and communications technologies (ICT). The region of Piedmont and the city of Turin constitute a major industrial centre, known particularly as home to the headquarters of Fiat. Turin is also the birthplace of major pillars of the Italian economy, like telecommunications (Telecom Italia), television (Rai, National TV channel) and cinema. Most of these industries have over the years migrated to other parts of Italy, but Turin is still a major hub of industrial activities which span several sectors.

Given its industrial history and accumulated competencies, the region concentrates key elements of a vibrant "enabling framework" that are usually encountered in dynamic clusters. Some of these include the following:

- Universities and research centres of high-quality research capabilities in leading technological fields.
- A research community which among other types of expertise includes almost 20% of Italy's researchers in ICT.
- World-class companies in sectors such as automotive, telecommunications, ICT, and aeronautics.
- A diversified base of SMEs which intervene at different sectors and levels of expertise in production processes with large firms within but also outside the regional economy.

- Availability of public and private funding to support both research activities and the creation of new entrepreneurial initiatives (Piedmont invests 2.5% of its GDP in innovation and attracts a quarter of all Italian private investment in R&D).
- A regional government engaged in nurturing favourable environmental and infrastructural conditions for new enterprises.

The automotive sector in Turin

The automotive sector in Turin has historically been structured around Fiat which was established in the city in 1899 and has dominated automotive production in the region ever since. For more than 100 years, Fiat has developed multiple activities at an international level in the motor industry. Besides its automobile core business, with brands like Fiat, Lancia, Alfa Romeo, Ferrari and Maserati, Fiat produces trucks and commercial vehicles, under the brand of Iveco, and agricultural and construction equipment, under the brands of Case and New Holland.

The automotive sector has been central to the region's welfare in terms of employment and forward and backward linkages to other sectors in the regional economy. The automotive cluster has developed largely due to a growing supply chain around Fiat, without an identifiable government strategy. Indeed, according to interviews conducted for this report the automotive sector, given its maturity as an industry in Turin, seems less in need of a formal cluster policy programme. Yet, despite the absence of a formal definition of the automotive sector as a cluster, the sector has had a decisive influence, in the case of Fiat, on regional politics and the relationship of the region to the national government since the 1950s.

However, for reasons related to processes such as European integration and the introduction of the euro, globalisation, and the emergence of new economic powers and reasons specific to the operations of Fiat, the automotive sector in and around Turin has undergone significant changes over the past 10 years. Moreover, these changes have been related to heightened competitive pressures and missed market targets by Fiat which played a major role in its near collapse in 2003.

The combined effect of these changes has been a reconfiguration of the basic economic relationships that structure the automotive sector. Though delocalisation and outsourcing have played an important role in this, it is a reinforced focus of automobile manufacturers on core business and high productivity that has been the key factor in the transformation of the automotive sector. One major aspect of this has been a dramatic reduction of employment. Until the mid-1990s the sector employed 80 000 people; today it employs approximately 25 000.

Another major impact of the change has been the emergence of new relationships between Fiat and its supplier base in the region. Fiat has historically had a broad supply base composed of a large number of SMEs located in and around Turin and throughout the province. The number of these enterprises grew substantially after World War II. This growth was largely the effect of labour "spillover" from Fiat whereby specialised workers set up their own businesses to act as suppliers to it. The relationships among these SMEs and Fiat were based on a variety of models. However, the "one-to-one" model of vertical integration, involving exclusive relationships of specialised SMEs to Fiat, was pre-eminent.

Over the past 10 years the relationships between these firms and Fiat have been disrupted by changes associated with Fiat's mounting crisis, which peaked in 2003. The

crisis has had different implications for the SMEs and has generated different responses. There are three discernible patterns of response: 1) a number of SMEs have closed as a result of their inability to diversify their business activities, either toward other international automotive manufacturers or other industrial sectors; 2) a significant number of SMEs have, by default, reinforced their "one-to-one" relationship with Fiat; 3) another part has diversified their activities internationally becoming specialised component suppliers to European car manufacturers such as Volkswagen, Daimler-Chrysler, BMW, and others.

Against this background, the restructuring of the automotive sector presents a big challenge for policy makers in Turin. According to interviews conducted for this report, Fiat is "top heavy" and too "old economy" with little commitment to the region, which makes it part of the problem the regional economy faces, not part of the solution. However, given the economic centrality of the sector and the widespread automotive culture in the region, it is still regarded as a key sector not so much with respect to employment or strategic economic importance but in terms of introducing and testing new technologies ranging from ecological engines to greater ICT use in the production and use of automobiles, R&D and design, and the development of advanced transportation and logistics infrastructures.

On the other hand, several policy makers and industry leaders stress that the Turin automotive cluster is keenly aware of the changes in the global automotive value chain. These changes involve a shift in the automotive production and consumption cycle where a higher value added is increasingly placed on the components of automobile design and innovations in engineering, and less on the actual manufacturing of automobiles. As a result, given the region's internationally recognised position as a world-class centre of automotive design, the emphasis of the cluster is increasingly on the global positioning of Turin as a "one stop" international centre of excellence in design and innovation in global automotive markets, not exclusively or primarily linked to Fiat.

Indeed, according to interviews, many consider that the crisis of Fiat and the ensuing restructuring of the Turin automotive cluster has forced the key players, especially among SMEs, to focus on core business and has resulted in a more robust, competitive and internationally oriented economic position, both in the traditional relationships between Fiat and its regional supplier base and in terms of dynamic companies specialising in automotive design and engineering. This robustness prepares them for accessing global production and design circuits and provides a solid capability in Turin's global orientation.

Regional governance and strategies

In light of the changes affecting the automotive sector the regional authorities have made great efforts to assist the process of restructuring and adjustment, not only of the sector itself but of the regional economy as a whole. Such efforts have focused on labour market policies with a focus on training, especially in leading technologies such as ICT, but increasingly also on innovation and R&D with an emphasis on technological districts and greater involvement of universities and public institutions in different programmes involving the economic base of the region.

Efforts to develop a comprehensive strategy to address the problems the region faces have been complicated by changes in regional governments and occasional shifting of priorities related to regional political pressures.

The case of Turin highlights the dual nature of institutions, formal and informal. Formal codified strategies with clearly specified roles and responsibilities are more characteristic of countries such as France, Germany and the Scandinavian countries. In contrast, Turin's relatively loosely organised approach reflects the informal nature of institutions predominant in southern European countries.

Italy has no national industrial policy that specifically addresses clusters, though there is a tradition of support programmes and legal frameworks that allow public funding to be directed at groups of firms (specifically those located in designated industrial districts). Clusters come under the framework of National Economic Policy which emphasises decentralisation and regional autonomy in matters of economic development. In Piedmont, the approach to cluster support is "parametric" in that it seeks to create an environment that facilitates economic adjustment through the migration of companies to higher value added, technology- and knowledge-based economic activities.

In the last 10 years, more focus has been put on innovation and R&D and there is a general policy and institutional framework that is recognised as a regional economic strategy even though it would be simplistic to suggest clear-cut structures of leadership and co-operation mechanisms. Instead it would be more realistic to understand such a strategic framework as a product of loosely co-ordinated actions of key agencies responsible for regional economic development, since there is no overall strategy for these development projects.

In terms of its institutional instrumentalities the strategy has been carried out through four loosely interconnected "platforms", as they are known in the region. Their objective is to contribute to the economic transformation of the region and facilitate the passage of regional companies to higher technological- and knowledge-intensive forms of economic activity such as health sciences and healthcare, aeronautics, ICT and logistics. For instance, SMEs with high levels of specialisation in the automotive sector could, with appropriate reconfiguration of their business competencies and skills composition, diversify their activities toward the aeronautics industry. A diversified economic base of the region of Turin is regarded by regional policy makers as an enabling condition that can enhance the dynamism and economic transformation of the region.

The "platforms" are concentrated in the automotive, ICT, aeronautics and transportation sectors.

The *automotive cluster*, largely structured around the *Fiat Research Center* (CRF) (see *www.crf.it*), has a mission to develop and transfer innovative products, processes and methods to the automotive and other industrial operating units of the Fiat Group. CRF is deemed to have the potential to enhance the competitiveness not only of the Fiat Group, but also that of its supplier SMEs.

The *ICT cluster* is centred on the *Torino Wireless Foundation* (see *www.torinowireless.it*), founded in 2002. It brings together the key ICT stakeholders in the Piedmont region in a common framework of strategies, and actions in order to increase the competitiveness of the region through the integration of R&D, entrepreneurship and venture capital.

The *aeronautics cluster* is built around *Alenia Aeronautica* which was established in 2000 as the new corporate entity that replaced Finmeccanica (see *www.alenia-aeronautica.it*). *Alenia* is well-known in the field of aeronautics with a tradition of autonomous development in specialised competences in several fields spanning R&D, integration of systems, production and commercialisation.

The *transportation cluster* is constructed around *T5*, a private-public entity dedicated to the promotion of R&D in advanced transportation and logistics systems in the Piedmont region and the city of Turin.

However, the "platform" approach to economic adjustment and innovation has been criticised as being out of touch with the structural realities of the economy of the region and lacking an overall strategic framework. The diversification into different new sectors is done in an autonomous way with no governance framework.

Regulatory policy has over past administrations been inspired by, and largely implemented through, a linear approach to innovation policy which usually took the form of generic and mostly financial support to specific sectors. This approach worked well in an industrial past that was based on more or less predictable patterns of market demand and economic change; it does not work as well in an era marked by unpredictability where competitiveness depends on the ability to innovate. For instance, as other leading industrial regions across the EU, Piedmont created seven science parks, the highest number in Italy, three of which to this day have active business incubators. However, the results in terms of innovation have fallen below expectations. These problems have been compounded by the fact that innovation policy has lacked mechanisms of policy evaluation and accountability of investment decisions.

The lack of proper evaluation of structural problems has been related to complications from changes in regional governments and occasional shifting of priorities related to regional political pressures. As a result past administrations and regional government institutions have found it difficult to communicate to the wider political and business communities that the economic problems of the automotive sector are not cyclical, and able to be addressed through minor and traditional interventions, but rather structural, which require a more thoroughgoing process of reform and the reconfiguration of traditional business relationships.

Debate has raged over whether the region should place strategic emphasis on new or traditional sectors. The emphasis on new sectors originally stressed the importance of ICT, and more recently other leading economic sectors such as health sciences. It was in this context that the *Torino Wireless* initiative was launched. The key objective was to increase ICT intensity in the traditional sectors of the regional economy while fostering entrepreneurship in new ones. However, the initiative has not been supported by other measures to enhance innovation capacity in traditional sectors or measures to include key stakeholders and especially the SMEs. As a result, the initiative has met with criticism that it was "too late".

These shortcomings in the regulatory framework have become reform priorities for the new regional government that came into office in May 2005. The government has introduced a new Regional Law on Research and Innovation as a means to confront the structural problems of the economy. The Law, identifying policy intervention areas for innovation covering the period 2006-2006, is based on a non-linear, ecosystemic understanding of innovation which relies on dynamic relationships between and across businesses, academic and research institutions, and agencies of the public sector as the key to restructuring and innovation.

Though the Law identifies specific sectors for strategic support, it does not provide financial support to the automotive and ICT sectors. More specifically, the Law introduces revisions with respect to the criteria of financing public interventions, specifically seeking to overhaul the previous practice of generic support funds for different sectors with an emphasis on "technology pull" focusing on market and industrial demand for technology

solutions. Financing is now coupled to technology foresight and encouraging framework conditions favouring deeper collaboration between regional enterprises and the university and research institutions of the region. Most R&D investment will not finance traditional sectors but new "frontier" sectors and different domains such as nanotechnology, innovation in healthcare, etc., and specific competitive technology platforms, ranging from hydrogen energy to intelligent systems, in short, sectors that are likely to be critical for competitiveness in the next ten years.

The central idea that lies behind the four "platforms" and the "frontier" sectors identified by the new Regional Law on Research and Innovation is to increase the innovation potential of regional companies, especially SMEs, by enabling them to reconfigure their competencies and enter new and more technology-intensive sectors and to enable the "migration" of regional firms to higher value added activities, be they in the automotive sector or in other sectors such as transportation and aeronautics. This is an effort to better synchronise the education capabilities of the region with the economic transformations it confronts.

This is the case with the agreement concluded in 2005 among key stakeholders in the automotive cluster to assist SMEs in the sector to diversify their activities toward the more globally oriented aeronautics sector.

However, this "migration" toward higher value added segments of a global value chain depends on good governance. Several key stakeholders interviewed for this report stressed that reform of the governance structure accompanied by education of the stakeholders, especially among the SMEs, are critical to the success of the automotive cluster and the economic future of the region because it plays a decisive role in the implementation of innovation strategy. The regional administration structures continue to be relatively fragmented, largely catering to particular interests, preventing the emergence of a strategic framework that could generate synergies and accelerate adjustment. The region of Piedmont and the city of Turin have been good at generating plans for industrial restructuring, innovation and competitiveness; however, these plans tend to become demobilised due to regional and local political concerns and social networks – which expand across all the levels of the cluster – geared to the preservation of established and vested interests. As one interviewee put it, in the historical context of Piedmont and its institutional and cultural specificities, the key policy issue for governance is to create an environment where each of the key stakeholders maintains autonomy while the *sum total* of their actions contributes to the general strategic development of the region.

However, the new strategic orientation faces significant obstacles of both a structural and socio-political nature. For instance, Italy's spending on R&D is 1.1% of GDP, which is the lowest in comparison with other advanced economies of the EU. In addition, in Piedmont the balance between private and public investment on R&D is heavily tilted toward the latter. In addition, the new priorities and the financial instruments earmarked to support them face opposition from the automotive and aeronautics sectors.

Despite the shift away from generic support to the automotive sector, the regional government has actively intervened to assist the process of adjustment and innovation. For instance, *Finpiemonte* has bought 1 million m^2 of the 3 million m^2 of the old Fiat factory in Turin, on condition that the new Fiat popular model Punto would be built in the city. The new venture will be based on a new approach – a new model involving research, suppliers and public institutions – geared to innovation. The overriding policy direction of the government in this respect is to build synergies between designers and new production

methods. This orientation reflects a wider understanding that the region faces a structural problem which needs long-term solutions.

General conclusion

The Piedmont region and the automotive cluster in and around Turin have faced great disruption over the past 10 years and continue to face strategic challenges with a potentially decisive impact on the entire economy of the region. The case presented here highlights several key points.

- The region and the automotive cluster are keenly aware of the changes associated with European integration and the euro, globalisation and the heightened competitive pressures stemming from the emergence of new economic powers.
- The regional players are also aware of the challenges and the potential for Turin associated with the transition from production to services and specifically in the automotive sector the transition of value added to the design and advanced engineering phases of automobile production.
- Though at first sight the strategy of the Piedmont region appears fragmented and loosely-structured there is a certain logic that connects its different components. The central idea that lies behind the four "platforms" and the "frontier" sectors identified by the new Regional Law on Research and Innovation is to increase the innovation potential of regional companies, especially SMEs, by enabling them to reconfigure their competencies and enter new and more technology-intensive sectors. Indeed, this is the case with the Agreement concluded in 2005 among key stakeholders in the automotive cluster to assist SMEs in the sector to diversify their activities toward the more globally oriented aeronautics sector.
- Today, car design is one of the "frontier" sectors within the automotive industry in Turin and not only linked to Fiat. There is a general tendency for going into more high value added production and services such as design and info-automotive among SMEs within the region. In the past, the prevailing relationships between Fiat and its component supplier SMEs, based as they were on a one-to-one basis, left SMEs concentrating in low value added activities which resulted in few possibilities for internationalisation. The new approach seeks to reverse this by increasing technological sophistication and innovation, and hence the international potential, of SMEs.
- However, a key condition for the development of successful adjustment and innovation strategy is the accurate assessment of the structural realities of the region.
- The new Regional Law on Research and Innovation addresses some of the critical shortcomings of the previous innovation policy regime, especially through a new understanding of innovation dynamics it introduces, along with a rigorous methodology and assessment criteria for public interventions, technology foresight for emerging sectors.
- However, though the region has been good at developing advanced plans for innovation and competitiveness it confronts major challenges in terms of implementation. A critical issue concerns reform of the governance system which tends to undermine planned actions and objectives due to regional and local political considerations.
- A crucial issue for regional government authorities in the region remains the communication of the "structural" nature of the economic problems of the region and

the construction of a more inclusive governance structure that includes SMEs in both leading research projects and access to financing through greater transparency and symmetry of information between venture capital and SMEs.

- At first sight the strategic response of Turin to the challenges of the automotive sector appears loosely organised, lacking an overall cohesive framework. However, it is arguable that this looseness is also a factor of strength as it contributes to flexibility. The historical context of the region and its institutional and political make-up have contributed to a framework response that connects the different stakeholders of the cluster through tentative agreements of collaboration and to the extent that they contribute to the promotion of particular interests. However, the relative fragmentation of the policy responses has inhibited the development of a widely accepted and coherent strategic response. The policy challenge from a regional policy perspective is how to allow for independence of action among the different stakeholders (the politically acceptable) while positioning such independence to contribute to the development of the region (the politically necessary).

Detroit/south-east Michigan, USA

Introduction and basic data about the region

Perhaps no other region in the industrial world has been identified more closely with automotive production during the 20th century than south-east Michigan, and more specifically the area surrounding the city of Detroit. It was here that the methods that dominated automotive production for much of the 20th century, above all Fordism, were invented and deployed to unprecedented scale and impact. It is also here that the historic challenges that confront the automotive industry in the opening decades of the 21st century can be observed in their most acute form.

Michigan is part of the Great Lakes Region of the United States. The region is an economic, social and cultural area comprising 12 states, including the western portions of New York, Pennsylvania, and West Virginia, northern Kentucky, all of Ohio, Indiana, Michigan, Illinois, and Wisconsin, and eastern Minnesota, Iowa and Missouri. It is one of the largest industrial production centres and marketplaces in the world. It is also a vital centre of economic activity and growth in the industrial heartland of the United States.

South-east Michigan has a population of 4.9 million people. However, the economic footprint of the automotive industry of the region extends beyond the geographical perimeter of south-east Michigan and the city of Detroit. Automobile production, including automotive components production, extends into a larger area, involving people and communities across the state but also surrounding states and southern Ontario. The region is also a central hub for international trade as 42% of US-Canada trade passes through the Detroit/Windsor and Flint/Sarnia corridors.

Being part of the US federal system, the administrative structure of Michigan is organised at state and county levels. The region's administration includes several counties which connect local government units and state-level governance structures and processes. Given its centrality in automotive production, the region has a rich history of industrial organisation and syndicalism, closely associated with the history of the United Auto Workers (UAW) and Democratic party-political affiliations. This socio-political and institutional compact has been the foundation of the economic dynamism of the region

and the historic compromises between automobile manufacturers and organised labour that defined automobile production in the United States for most of the 20th century.

Yet, despite its illustrious economic history and dynamism of the past, the region is today facing an uncertain future. Globalisation and transformations in the automotive production process, coupled to intense competition from other states within the United States and emerging economies, have diminished the region's economic primacy, leaving its economy and communities struggling to redefine their competitive niche. With one foot in a declining economic base, and the other in the emerging global knowledge economy, the region is facing two scenarios: a future marked by growth and innovation, and one that conforms to the prospect of long-term industrial decline and relegation to a "Rust Belt" of the industrial past (The Brooking Institution Metropolitan Program, 2006).

South-east Michigan today confronts challenges which in some ways are historical reversals of the amalgam of the social, economic and political conditions that underpinned its ascendance as a pre-eminent automobile production location. The region is heavily reliant on mature industries and product lines, an ageing population that lacks the education and skills required to generate new economy activities, and a political and institutional/administrative structure that is not equipped to address the challenges the region faces.

In contrast to the historical experience of much of the last century, the region's metropolitan areas are economically stagnant, engaged mostly in traditional economic activities that face serious competition from other states in the United States and emerging economies. It also lags in entrepreneurial spirit, which is undermining its ability to generate new firms and employment in high-value knowledge-intensive industries. These conditions are compounded by a historical legacy of employee benefits, job and income security programmes, negotiated during earlier decades of growth, which have become a burden, putting the region's firms at a disadvantage in the global economy.

To gain perspective of the scale of transformation across the region it is worth noting that from 1995 to 2000 Michigan lost over 16 000 of its young, talented workers, while its workforce is growing older. One of the main reasons for this is that the region has not created enough jobs in knowledge-intensive, high value added services industries to offset declines in industrial jobs, while it has struggled to commercialise the outcomes of its research and innovations. As a result the region must continue to make rapid productivity gains in manufacturing while at the same time developing new products from its industrial base, and new knowledge-based products and services.

Yet, the measures necessary for improving the region's economic prospects are conditioned by the structures of its industrial past. The region's economy is dominated by the automotive industry which has provided a century of prosperity, punctuated by occasional periods of economic downturn. The domestic manufacturer presence, despite decades of downsizing, still makes Michigan the most concentrated automobile manufacturing state in the United States. Automobiles and light trucks manufactured by Ford, GM, and Daimler-Chrysler are critical to the region's economy. However, the "Big 3" manufacturers have been losing market share for years. This loss is related to an increasingly competitive international environment with global automobile manufacturers striving for market share and profitability.

Unlike past downturns, which were often followed by upswings for the domestic automotive industry, and hence good times for south-east Michigan, the prospect of a turnaround today hinges in a fundamental sense on the sector's ability to halt and reverse the loss in market share by the domestic manufacturers. Interviews conducted for this study indicate that there is no confidence in the prospect of a quick turnaround.

The loss in market share is not a cyclical phenomenon. The automotive industry is facing a structural change. According to seasoned estimates the industry is not likely to regain the position it held during the 1950-60s. The region has been recovering from the recession of the 1980-90s. However, during these downturns it was mainly domestic US automotive manufacturers that lost market share to foreign manufacturers. Indeed, the domestic downturn in 2001 was due to changing market preferences, the cost of production, and investment decisions in new manufacturing locations in other states.

According to official statistics the two sectors with the largest losses of employment are automobile and automotive components manufacturing. Old-style retail sub-sectors also figure prominently in the statistics regarding loss of employment, perhaps reflecting multiplier effects. Another sector that has been affected by the structural change of the automotive sector is public services, generally inclusive of federal, state, and local governments. The loss of industrial capacity in the manufacturing sector has constrained public budgets across Michigan resulting in public sector layoffs. This is the core of the problem for the regional economy: its major industry is not in a transitional recession, it is in a fight for survival, while its regional policy framework is not equipped to provide it with the necessary support mechanisms.

Despite the enormous impact of the changes affecting the automotive industry, the economy of south-east Michigan is also experiencing growth in a number of sectors considered to be part of an emerging new economy. The automotive industry is undergoing dramatic restructuring and continues to shed factory employment. Yet, the region is emerging as a global automotive design and research centre. While some new foreign transplant manufacturers are locating production facilities in southern states of the United States, some highly competitive automobile manufacturers, such as Toyota and Honda, are investing in new facilities and R&D centres in south-east Michigan, but also in states like Indiana and Ohio.

The region is also hosting significant R&D activities in the field of biotechnology. The Great Lakes Region is home to some of the United States' leading centres of medical research, teaching, and treatment, with a number of highly-ranked hospitals in multiple disciplines. In addition, metropolitan areas like Detroit/Ann Arbor, Chicago, and St Louis, are among the top-ranked biotechnology research centres in the country. However, these are sectors that require generally higher levels of education than those typically required for automotive manufacturing.

South-east Michigan's economy is undergoing a historic transformation that has undermined the competitiveness of its major companies. The region cannot regain its dynamism until one or both of two conditions are met: these companies return to prominence and drive the region's economy, or, they at least reach a state of equilibrium that halts the loss of market share. Such equilibrium will arrest the loss of industrial capacity and facilitate growth in the emerging new economy sectors to create employment growth in the total economy of the state (The Brooking Institution Metropolitan Program, 2006).

The automotive sector in Detroit/south-east Michigan

The state of the US automotive industry today is marked by contradictory tendencies. A set of positive trends is making the overall industry appear robust. At the same time, some negative trends reflect serious weaknesses. Growth in light vehicle sales has been on a downward trend for the last 25 years, and fell below 1.5% per year in 2000. The continuing losses of market share by GM and Ford have been reflected in gains by their foreign competitors. According to some, the US light vehicle market was an oligopoly prior to the late 1990s, which meant that US manufacturers could earn above-normal returns. The market now seems to be directed toward a more competitive position with manufacturers roughly equal in size. It is a distinct possibility that the EU's market composition, where the largest player commands less than 20% share, may be the prospect that the US automotive industry is facing.

Some of the contradictory tendencies in the US automotive industry are outlined below:

- The volume of light vehicles sold annually is impressive by historical standards. Unit sales have not been less than 16 million since 1998; they have not been less than 15 million since 1993. Yet, this volume has been sustained through substantial price reductions.
- The competitive structure of the industry is changing, and appears to be heading toward a situation where six or seven more roughly-equal manufacturers struggle for market share.
- After two decades of historically low oil prices, expectations now are of rising prices for the next two decades.
- GM, Ford and Daimler-Chrysler have relied on truck-based SUVs for much of their profits for many years. They now face serious risks as higher oil prices and environmental awareness drive consumers away from SUVs and toward crossovers and cars.
- GM, Ford and Daimler-Chrysler have a significant cost disadvantage, most of which can be attributed to legacy issues (union agreements and pension liabilities, coupled to a large retiree population);
- GM and Daimler-Chrysler have been reluctant to embrace hybrid technologies, while Toyota, Honda and Ford have commercialised them. As the market moves toward general acceptance of such technologies, GM and Daimler-Chrysler face uncertainty.
- The Great Lakes Region's share of the US motor vehicles and components manufacturing employment has been in long-term decline since the 1940s. In the last 30 years the pace of decline has accelerated (McManus, 2006).

The global automotive industry has changed dramatically over the last 15 years, which has heightened the competitive pressure facing Detroit. This pressure is mainly related to the development of a "parallel" automotive industry located in states like Ohio, Kentucky, and other southern states of the United States. Several foreign-owned companies have established production facilities there mainly because of the availability of a young, non-unionised workforce. This production process is competing directly with southeast Michigan and suppliers are following the manufacturing companies. This "parallel" internal automotive industry is booming because automotive manufacturers can access a younger workforce outside union collective agreements, with no legacy costs or pension liabilities.

Another major factor that affects the industry is demographics. As the baby boomer generation begins to approach retirement age it has created a "boomer shock". This is reflected in skilled-labour shortages and intensified competition for access to and hiring of talent. Indeed the availability of a skilled industrial labour supply is a major issue across the industry. As part of a short-term solution, automotive manufacturers are offering inducements for workers close to retirement age to work longer. Part of a longer-term solution is immigration. Despite popular misperceptions, immigrants to the region are relatively well-educated compared to immigrants nationwide. On average, 36% or more of the foreign-born population in Michigan hold a bachelor's degree (compared to a national average of 27%) (The Brooking Institution Metropolitan Program, 2006).

But there are also changes in the car-making philosophy of US manufacturers. Since the closing decades of the 20th century they have become truck manufacturers. They have let the car segments of their product lines languish. Indeed, the growth of the truck segment of the market – which was facilitated by cheap oil prices – was interpreted as a return to the good old times. Meanwhile, foreign manufacturers, such as Toyota and Honda, caught up. Given their success, the trend is back toward cars and crossovers.

Apart from these endogenous changes in the United States, the automotive industry is affected by global production and market shifts and the emergence of new economies. For most of the 20th century the United States dominated the automotive economy both in terms of production and consumption. It is still the largest market in the world. However, the enlargement of the EU and the emergence of new economic powers, such as China and India, have transformed the global automotive industry, both in its market composition and production topology. These regions are emerging as major locations for the production and sale of automobiles. Given the prevailing and anticipated cost differentials and market preferences this is changing product lines of global automotive firms and the calculus of their location investment decisions. Against a secular loss of market share in the US market, the key strategic question for US manufacturers is whether they can compensate in other parts of the world.

Against this background, US manufacturers are seeking to form strategic alliances with top engineering schools in China and India. To maintain market share in non-competitive areas they need to find partners both in the production and R&D domains. For instance, Ford has several alliances with leading schools in China to capture some of the intellectual capacity in the higher end of the value chain. This reflects the weaknesses of the US education system, especially in the middle levels of applied sciences, even though the upper echelons of the research centres of south-east Michigan are world leaders. Yet, the emergence of China has not had an impact yet on US manufacturers. Instead, the major driver of change in the industry has been the development of a "parallel" automotive industry which is largely foreign-owned, non-union and more flexible, and is not burdened by the legacy costs of US manufacturers.

This drive for access to international pools of skill and knowledge is related to technological transformations within the automotive industry itself, but also to the wider application of information and communication technologies (ICT) in the process of design and product development. For instance, ICT allows for the formation of transnational networks of engineers which facilitates the transition from physical to virtual prototyping of technology (reducing development times by up to 80%) and product development

timeframes reducing from five to two years. Even though intellectual property rights protection remains an issue the trend is toward virtual prototyping.

Thus, looking at the global automotive industry there are different strengths embedded in different regions. No region has a monopoly on the "high end". In fact, seasoned opinion in the industry speaks of a "flat world" in which global networks of automobile production enable companies to assemble engineering teams regardless of location. According to interviews conducted for this study, future success in the industry will be decided on the relative capacity of automotive manufacturers to manage their global assets.

However, this production topology tends to favour different corporate structures which place US automotive manufacturers at a disadvantage. US manufacturers, such as GM and Ford, have historically been built from different parts, brands and identities. Operating in a global "flat world" exposes them to problems of co-ordination and alignments of design and product development with global market trends. Japanese manufacturers such as Toyota and Honda, by contrast, have grown organically – from a centre outward – with a single identity which gives them the ability to adapt faster to global market and industrial shifts.

It is this set of factors that accounts for the reduction of the commitment of the "Big 3" US automotive manufacturers to producing automobiles in south-east Michigan. Their response to the loss of market share – especially by companies that produce automobiles in the US – legacy costs, and the associated search for cost efficiencies, has been to delocalise on a large scale, primarily toward other regions within the United States but also increasingly to international locations. Reduced commitment on their part to the future of the region has also come to mean reduced support for the development of its economic infrastructure, including its educational system, even though the sector continues to rely on research conducted in the region.

For regional government authorities, though the region's dependence on the sector remains high, the challenge is how to organise a strategic response to the loss of industrial strength and employment through the improvement of the education system and diversification of the regional economic base toward new economic sectors. It is characteristic of the scale of the change in the automotive industry in Michigan that during interviews, experts on the automotive industry remarked that automotive production in Detroit will cease altogether within the next 10 years.

Regional governance and strategies

South-east Michigan has experienced massive delocalisation of the automotive industry, presenting historic challenges for the region and the state of Michigan. Despite the scale of the challenges the sector faces, the US Administration has not responded with any measures of support (with the possible exception of currency policy). As for the regional government, the response so far has been of an *ad hoc* nature involving specific but largely disconnected initiatives rather than of a strategic nature in the sense of seeking to establish framework conditions for the protection and promotion of the sector.

Apart from the short-term political factors which account for this (Michigan being a Democratic state, the US Administration being Republican), the nature of the institutional response to the challenges Detroit faces has roots in US history which does not encourage overt framework intervention in the regulation of economic affairs. As a result, the region

is confronting a secular trend of deindustrialisation (largely through the delocalisation of the automotive industry), while lacking the political and institutional means to mount a policy response to confront it.

Against the background of these massive shifts, south-east Michigan and Detroit have attempted to ignore the fact that these changes are structural and permanent – not cyclical and ephemeral. Indeed, much of the policy discourse and the approaches to confronting the changes are marked by nostalgia and the belief that the region and the industry can return to the glory days of the 1950-60s. Short-term perspectives prevail.

Given the industrial history of the United States and the prevailing approaches to intervention in the economy, most of the responses to the crisis and transformation of the automotive sector in Michigan have been *ad hoc*. The region has responded with several initiatives and there are several strategies in the non-profit sector. However, there is no overall regional strategy. Political priorities attached to electoral politics militate against public admission that the current crisis of the industry is a structural one. Interviews conducted for this study revealed a certain desire for a "New Deal" approach. However, at the same time, they indicated scepticism that such an approach would be forthcoming. As it stands, the region has no institutional structure that frames strategy. The responses of the automotive industry are mostly through *ad hoc* networking.

Various responses seek to promote the competitiveness of the region internally, through the co-ordination of capabilities, and externally, through the promotion of the region internationally. The organizing principle of the different initiatives is: the private sector expresses their needs; the regional public sector helps with the implementation. The sources of the different responses are as follows.

Detroit Renaissance (see *www.detroitrenaissance.com*) is an initiative structured around a group of CEOs of leading companies who convene to address the development needs of the region. The original focus of the group was on the development of Detroit, especially its downtown core. However, more recently the emphasis has expanded to include three counties – McComb, Oakland and Wayne. This approach centres on Detroit but seeks to capitalise on the interdependencies across the counties. It is based on co-operation and the search for synergies with a strong emphasis on education and the formation of human capital which would help re-establish the region as a key investment location. However, the initiative is composed of different visions which are only loosely structured. As a result, the focus on education is the only common denominator and the glue that holds its different approaches together.

Detroit Regional Economic Partnership (see *www.detroitchamber.com/business_development*) is a group of ten counties hosted by the Detroit Chamber of Commerce, with the objective to develop strategies to attract foreign companies to the region. The group engages in "environmental" investments to attract companies to the region. A major part of its operations involves providing marketing material and carrying out trade missions to promote the region as an investment location and to get companies to relocate operations there.

SEMCOG (see *www.semcog.org*) is an organisation that was originally created to develop planning and co-ordination of business and policy initiatives among 10 countries in order to improve business and regional economic performance. More recently, it focuses most of its activities on workforce quality development initiatives.

Automation Alley (see *www.automationalley.com*) is a technology cluster networking companies linked through technology providing a "brand" separate from Detroit. Its members include organisations from the worlds of business, university and research, and government. The cluster seeks to address some of the concerns of the automotive sector while focussing on synergies across developments in the industry and new economy and knowledge-intensive activities. For instance, the automotive sector has been a magnet for ICT in the region. The organisation has conducted a quantitative mapping study to determine the areas of strength of south-east Michigan. Its emphasis is on education, especially in middle levels of applied sciences and the development of new skills in advanced applications within the automotive sector, but also in emerging sectors. As such *Automation Alley* functions as a nodal point for the development of key competencies and their networking on a cross-sector regional basis.

Examples of state-level strategies include business retention programmes, tools for generating employment and tax credits against the single business tax. The *21st Century Jobs Fund* concentrates on Advanced Manufacturing, Advanced Automotive, Homeland Security and Biomedical, which have been identified as strategic priorities for the development of the state. Technology transfer is a key priority: moving from concept to product to market. In each of the above initiatives leading people from each sit on each other's organisation's boards in order to ensure coherence and avoid duplication.

There are also initiatives at the county level. For instance, Macomb county is seeking to align its regional capabilities with emerging new economy activities. The county is focusing on advanced manufacturing, alternative energy and health care as key sectors that will drive future growth. It has divided its set of priorities into four subcategories: business development, workforce development, transportation and quality of life. With respect to the automotive sector the emphasis is on high value added activities such as lean manufacturing with advanced engineering skills and high-wage employment. The objective is to attract advanced portions of the automotive manufacturing process to the region and embed them into its existing R&D and manufacturing capabilities.

Wayne county, as the site of the Detroit Willow Run airport, in collaboration with international players such as Schiphol and Beijing, has been active in developing a logistics cluster around the airport. The objective of this initiative is to place Detroit in a position to guarantee delivery of products to and from anywhere in the world within 12 hours. In addition, Detroit is a junction point for several main freeways, such as the one connecting Montreal to Mexico City, which offer further benefits in terms of commercial traffic volume. The goal is to build Detroit into a global logistics centre. In terms of regional policy support, Wayne county has been the initiator. It has bought 2 000 acres of land for future expansion, as well as ensuring a federal grant of USD 100 million. The initiative has been co-ordinated with other local counties and the "Big 3" automotive manufacturers own a significant amount of land on which the project will be built. In terms of the financial plan for its completion the project will rely on public as well as private funds.

As is the case of the overall economic strategy of the region, there is no clearly defined strategy for the automotive sector. This is partly a function of the absence of an institutional strategic framework that can give coherence to different initiatives, partly of the prevailing nostalgia for the past. According to interviews conducted for this study, this amounts to a collective incapacity to face the truth. As a result, the initiatives to address the challenges confronting the automotive sector are largely *ad hoc*.

In terms of its regional industrial ecology the automotive sector is a magnet for other advanced technologies such as ICT, alternative energy research, and logistics, among others. However, there is an absence of mechanisms for technology transfer from the automotive sector, itself a major integrating force of advanced technologies, and technologies and innovations developed in the sector, to other industries. For instance, though there are sophisticated channels for technology transfer from research related to the military to automotive production, with significant federal government support, the results have been only moderately successful.

Given the current economic disruptions in south-east Michigan associated with the automotive industry, explorations are underway to assist the economy of the region to make the transition to the new economy. Regional policy-making institutions and leading academic and research institutions have reflected on the industrial history of the region and the factors that enabled the emergence of the automobile industry there. The pre-automotive regional industrial structure had elements that could be transformed relatively easily into automotive-related skills and processes. The region at the turn of the 20th century had already a cottage industry specialising in industrial ovens, tool making and shipbuilding, which allowed for a relatively easy transition to automobile manufacturing. In addition, the assembly line invented by Ford was precisely designed to simplify production tasks, which allowed for the integration of large amounts of immigrant workers of relatively modest skill levels into the production process, and after World War II generated unprecedented wage earnings.

However, there are great difficulties and discontinuities in trying to make the transition from an automotive economic base to advanced technologies such as ICT, biotech and health. The skills that are required for automotive production today cannot be easily reconfigured for adaptation to the needs of new sectors such as biotechnology, health sciences or ICT. It is obvious that such retraining requires a targeted educational and labour policy intervention.

It is here that the significance of education bears its full weight. Michigan is home to some of the top educational and research facilities in the United States. However, the university and training system is not fully in line with the demands of the automotive industry. According to interviews conducted for this study one of the major factors behind this is the tenure system which insulates university departments, professors and researchers from market pressures. At lower educational levels the challenges are even greater. For instance, the city of Detroit has a dropout rate of approximately 50% which is related to the fact that Michigan has one of the lowest rates of college education in the United States. Educational reform, especially of the middle levels is a critical issue. The economic activities the region is targeting require analytical skills, math skills, computer literacy, and the flexibility to develop new skills.

However, as in the case of policy design, the past weighs heavy on educational reform. Fordism was about the simplification and sequencing of tasks into the assembly line, which did not require advanced levels of education. The golden age that followed World War II helped consolidate a culture not particularly open to higher education, as young people of relatively modest education could achieve standards of living that became the envy of the world. It is this culture that has come under most pressure today given the significantly higher skill demands from automotive manufacturers and other advanced industries the region considers critical to its future. Part of addressing this issue would be

public funds. However, public budgets are constrained given the shrinking tax base of the state. Another part would be support from the "Big 3" automotive manufacturers. However, given their location strategies in the "parallel" automotive industry across the United States and the gravitational pull of globalisation, they have significantly reduced their commitment to the economic development of the region.

The impact of these factors is closely related to the region's stagnating entrepreneurialism. As recent research on the subject shows, this is likely the result of several conditions. Entrepreneurs are normally educated and more likely to be long-term community residents. Low overall levels of education in the region and the continuing out-migration of young, educated people could thus be hindering the development of new enterprises. On the other hand, some of the failure to commercialise new knowledge may be due to failures in venture capital markets, as these tend to have their investments in close proximity. Another factor, related to the attitude toward education, might be the change-averse culture that has been nurtured through several generations of industrial employment and general prosperity (The Brooking Institution Metropolitan Program, 2006). In this respect, as much as in the importation of skills, the region relies on immigration.

The region, with the assistance of regional government, has begun to diversify its economic base, especially toward new economy industries such as biotechnology, health science, and ICT. However, given the weaknesses of the educational system, especially in its middle levels geared to applied sciences, the development of skills critical to both leading technological fields in the automotive industry itself and emerging new economy sectors, the region confronts significant challenges. Leading manufacturers in the region have raised major concerns that the automotive sector faces significant skill shortages.

Detroit is perhaps the best reflection of the geographical dispersion of the automotive production process. The Detroit cluster remains vertically integrated with respect to the production of components, even as the major manufacturers have delocalized their operations into other states. However, relentless pressures to shorten product development and production cycles, coupled to the introduction of advanced technologies, enable functions such as advanced engineering and design to be performed through virtual networks. These allow access to knowledge and expertise on a global basis while they considerably lessen the reliance of manufacturers on the regional location in which they have been historically built. Given the shortcomings of the regional education system, this drive for access to global pools of skill and competence has taken on added significance for US manufacturers. Indeed, competitiveness in the automotive sector has come to depend to a large extent on how manufacturers can leverage their global, not regional, assets.

"Clusters" and "cluster policies" remain generic terms. The case of Detroit indicates that there are significant differences in the organisational network topology of clusters. These are related to the industrial sectors in which clusters operate, but especially the technology- and knowledge-intensive, and value added elements they undertake. Though some clusters are embedded in geographical locations (requiring more traditional forms of intervention and support) others operate as "hubs" in geographically dispersed but technologically, organisationally and institutionally integrated networks. In other words, regional "clusters" need to be thought of both in traditional terms – embedded in a geographical context, *i.e.*, regions – and within a globally defined value chain.

Consequently, cluster policy must be designed according to the organisational and operational topology of different clusters and their precise location in the production process and value chain. Clusters specialising in the supply of components might require co-ordination mechanisms among collocated key stakeholders. Clusters engaging in design and other high value added activities are increasingly organised as "hubs" within geographically dispersed networks of knowledge flows. For these, policy should support the development of global approaches and mechanisms which insert the competences and requirements of the regional cluster into global circuits of knowledge and expertise.

Cluster policy in south-east Michigan is also marked by the absence of synchronisation with developments in the region's economic base. The diminishing commitment of the "Big 3" automotive manufacturers has come with a weakening commitment to the infrastructural development of the region reflected in the decline of downtown Detroit, now coupled to mounting racial tensions between the city and surrounding areas. At the same time, the historical weight of the glory days that lasted for the better part of the 20th century have left a cultural legacy where the problems of the automotive sector are seen as cyclical, short-term, and reversible. This problem is compounded by the general sceptical attitude toward education and change-aversion. The continuing inability to generate a strategic response to the challenges the region faces leaves room only for *ad hoc* responses which are neither able to confront the secular loss of industrial strength, nor to diversify the regional economy and reduce the vulnerability of the region.

General conclusion

South-east Michigan and its automotive cluster yield a number of lessons regarding regional economic policy and cluster support. These can be summarised as follows:

- Despite its dynamic economic history of the past the region is today facing an uncertain future. Globalisation and structural changes in the automotive production process, coupled to intense competition from other states within the United States and emerging economies, have challenged the region's economic primacy. The region today is facing two scenarios: a future marked by innovation that enables the transition to a new knowledge-based high value added economy, and one of long term deindustrialisation and decline.
- Despite the massive transformations in the regions' economy which continues to be dominated by the automotive sector, the region has not been able to develop a strategic response to address the crisis. This is the crux of the problem for south-east Michigan's economy: its major industry finds itself in a struggle for survival, while its regional policy framework is not equipped to provide it with the necessary support mechanisms. Given the prevailing approaches to intervention in the economy, most of the responses to the crisis and transformation of the automotive sector in Michigan have been *ad hoc*. This is partly a function of the absence of an institutional strategic framework that can give coherence to different initiatives, partly of the prevailing nostalgia for the past.
- The region's economy has begun a process of diversification into new economy fields such as biotechnology, ICT and health science. However, it confronts significant challenges in developing the relevant skills or reconfiguring existing skills and adapting them to the requirements of these sectors. The solution would be targeted intervention to strengthen educational skills, especially in middle levels of applied sciences.

- However, education is not a panacea. The case of south-east Michigan demonstrates the importance of regional policy frameworks for changes affecting the regional economy. This is not only an issue of policy design and alignment. It depends in a fundamental sense on the existence of strategic and flexible institutional frameworks with capacities to anticipate change and intervene strategically to open paths toward new economic activities and restructuring of existing ones. It is also connected to the dependence on, and commitment to, the development of the region on the part of the dominant economic players. Neither of these conditions is present in south-east Michigan.

Based on the foregoing analysis the following may be advanced:

- Several challenges south-east Michigan faces are related to the diminishing commitment of the three major automotive manufacturers to the region. Though it is likely that the loss of automotive manufacturing is a secular trend, the region has strengths in high value added economic activities such as design. As a result, emphasis should be on the development of regional capabilities to attract and retain these portions of the production process.
- The automotive sector is a magnet as well as an integrator of other advanced technologies such as ICT. It is also a generator of major innovations. A policy priority should be to improve technology transfer across sectors in ways that build synergies and competitiveness.
- The intensive application of technology in the automotive production process alters the topology of clusters. Component supply clusters tend to be vertically integrated and geographically collocated. Advanced engineering, design and other knowledge-intensive functions, as the case of south-east Michigan illustrates, tend to be ICT-enabled and networked on a geographically dispersed basis. As a result, cluster policy must be targeted according to the knowledge intensity and topology of different clusters within the automotive production process.
- A positive aspect in the case of south-east Michigan is the growing diversification of the region's economy. However, the existing fragmentation of the institutional frameworks allows only for *ad hoc* responses and hinders the co-ordination of policy actions necessary for support in the transition to new economy activities. As a result, institutional reform with emphasis on the development of a common strategy involving all the key stakeholders should be a priority for the regional authorities.
- One of the outstanding features of south-east Michigan concerns the role of education in the process of economic restructuring. Michigan has significant R&D capabilities and some of the top educational facilities in the United States. However, its major weakness is in the middle levels of education in applied sciences which are critical for employment in advanced manufacturing and production activities. Educational reform with an emphasis on strengthening this segment should be a key priority.
- However, education is not a solution to all the economic problems that the region faces. Education and training must be embedded in broader strategies of aligning education to the needs of the economic base of the region, continuous labour training and employment schemes and inclusive social policies, which by definition demonstrate the commitment of a region to long-term economic and social development. In the absence of such a framework, continuous repetition of the importance of education simply lacks credibility.

Shanghai, China

Introduction and basic data about the region

Shanghai is the largest city in the People's Republic of China and the eighth-largest in the world. The 2000 census put the population at 17 million, including the non-official resident (floating) population of almost 4 million. Shanghai is now an international financial hub and a major destination for corporate headquarters. It is the third-busiest port in the world, following Singapore and Hong Kong, China. It recorded double-digit growth for 14 consecutive years since 1992. In 2005, Shanghai's nominal GDP experienced 11.1% growth to CNY 912.5 billion (approximately EUR 95 billion). The "pillar industries" which account for the majority of its gross regional product (GRP) include microelectronics, automotive, fine chemistry, high-quality steel, machinery and shipbuilding. It also includes prominent ICT, biotechnology and pharmaceuticals, and financial services sectors.

Administratively, Shanghai is a municipality that has province-level status. The municipality oversees 19 districts which are further subdivided into counties. Within the provincial government, the Shanghai Municipal Development and Reform Commission has a very broad mandate to lead economic and social development, in line with national-level goals. The Science and Technology Commission serves an important role in orienting science and technology policy as well as financing R&D and developing platforms to support the technology needs of different actors and sectors.

Shanghai possesses a number of important assets to support innovation. On many indicators, it is in fact the highest-performing region in the country (CITE RIS REPORT). For example, public R&D investment in the region has grown rapidly, from 1.78% in 2001 to 2.34% of GRP in 2005 (STCSM), albeit with a focus on basic and early stages. A number of the most prominent industrial parks, development zones and universities are located in or near Shanghai (Fudan University, Nanjing University, China Science and Technology University, Zhejiang University and Shanghai Jiaotong University). Central government policy has been a major driver behind the concentration of these resources in certain regions. It is expected that Shanghai and the rest of the Yangtze River Delta area, along with the two other major growth poles of the Pearl River Delta and the Bo Hai Rim, will drive China's high-tech industrialisation.

The automotive sector in Shanghai

When China decided to open its economy to market reforms by designating "special economic zones" and "open cities" to attract FDI, Shanghai was not included. The city was considered the core of the industrial structure of the country and as such not an appropriate target for economic experimentation. This decision was reversed in the 1990s when the central government opened the city to FDI. As part of this decision the government offered special support to international firms that established operations in the Pudong New Area, an area which until then was an agricultural zone. The automotive industry was selected as one of the "pillar industries" to shape the future development of the city. After the financial crisis in Asia, the municipal government strengthened its support of the manufacturing industry and postponed plans to focus on the financial and trade sectors.

The origins of the automotive industry in China can be traced to 1958 when the first car was designed in Shanghai. However, the origins of the automotive cluster are located in the early 1980s when the central government approved the production of automotive spare

parts for VW which came to be organised around the Shanghai Automotive Industrial Corporation (SAIC), on land provided by the Municipality of Shanghai. With the objective to bring the national automobile industry up to international standards and avoid having to import automobiles on a large scale, the central government had started negotiations with VW already in 1978. These resulted in a joint venture between SAIC, the Bank of China, the China National Automotive Industrial Corporation (the parent organisation of the Chinese automobile industry) and VW.

The joint venture, which was called Shanghai Volkswagen (SVW), started to produce the *VW Santana* in 1985. In its first years of production, SVW still imported most parts and components needed for local production from abroad. At that time, there were no firms within the region that could have supplied parts in required levels of quantity and quality. At the same time, for the German suppliers of VW the volume of *Santanas* produced in Shanghai in the 1980s was too low to establish production facilities in China. In 1990, for instance, SVW assembled less than 20 000 vehicles (Depner and Bathelt, 2003).

In an effort to increase local content in production the Chinese government in the late 1980s threatened to enforce a production limit on SVW. The objective of this measure was to stimulate the diffusion of automotive manufacturing competencies across the Shanghai region and integrate regional suppliers in the production process instead of having the cluster function as an importer and assembler of foreign components. In response, SVW enrolled Chinese parts producers, which at the time were largely state-owned enterprises (SOEs) into the production process.

The municipality played a key role in organising the involvement of SOEs which co-operated with foreign manufacturers in the initial phases of the cluster's formation. It also played a supportive role in shaping market conditions by increasing car prices by 16% and by providing low-interest loans to local suppliers. Furthermore, the municipality introduced a regulation requiring that all taxis in Shanghai had to be *Santanas*. In 1991, many of the parts producers had already been integrated into the SAIC group. The cluster got further support when VW demanded that some of its German suppliers establish production facilities in the region. As a consequence, the vertical cluster dimension involving automobile manufacturers and suppliers developed rapidly.

The resulting automotive supplier network is one of the most advanced in China. The SAIC group is the dominant Chinese player in the Shanghai automotive industry. As the group is largely state-owned, with the majority of its shares being controlled by the city of Shanghai, SAIC is closely connected with and supported by the city's policy makers. This does not mean, however, that SAIC is an entity linked to the old era of state monopolies. SAIC is a group made up of different companies which manufacture cars, trucks, busses and motorcycles, as well as automotive components and equipment. By the end of 2001, the group had established 55 joint ventures with other automobile and component manufacturers and employed almost 62 000 people.

As a leading automotive manufacturer in China, SAIC has a vision to also become competitive at an international level. The group has recently expanded its operations beyond Shanghai and holds majority shares of the Liuzhou Wuling Automotive Company and Jiangsu Yizheng Automotive Company, as well as shares of Anhui Chery. In 2002, SAIC acquired a 10% stake in GM's South Korean operations (Depner and Bathelt, 2003). Reflecting the extended cluster's production capabilities, SAIC expects an annual group production of 1.5 million vehicles by the end of 2007.

However, as the cluster was established and operations gained maturity the role of the government also changed from being directive to "steering" by regulating the structure of incentives for the cluster stakeholders. The later phases of growth of the cluster have been supported by different policies of the municipal authorities, such as infrastructure development, labour market reforms and targeted industrial policies (Depner and Bathelt, 2003).

Regional governance and strategies

The evolving transformation of the China's economic and administrative structures depends on the ability to learn from the policies and implementation of initiatives being successively launched by government agencies, and ensure that this learning is applied to the formulation of new policies and better targeting of current ones. Such mechanisms of learning and adjustment in turn depend on the generation, dissemination and application of policy-relevant knowledge. Such learning in the domains of regional economic policy stems largely from two sources: from international experiences and from experimentation within the transition process itself. It is this learning process that frames the launching of objectives and serves as a framework within which policies and priorities are assessed, adjusted and implemented.

In the process of the transition to a market economy the central government and the municipality of Shanghai have placed great importance on the high-tech sector to support export-led development. However, there are several issues that adversely affect the development of regional economic policy. Primary among them is insufficient alignment between technology development goals and economic contribution. This represents a challenge for the existing system governing regional economic policy to the extent that the criteria for assessing priorities related to high-tech development often are not properly aligned with indicators of economic growth. In this respect, as the relationships between the university system and the market suggest, the main challenge for the regional economic system of Shanghai is to develop an innovation system in which project funding decisions are taken in the context of the market, with private enterprises able to engage with the research community and drive regional growth and innovation.

This relative lack of alignment between technological and economic objectives is also linked to a broader problem concerning the prioritisation of R&D targets on a regional basis. In recent efforts toward industrialisation the government has allocated resources for R&D in a top-down manner to ensure investment and development of research in certain strategic but limited technological areas considered critical for catching up with leading international trends. At the same time, most of the state funds for R&D are allocated to universities and research institutes, leaving less for support for R&D in the private sector, particularly among SMEs. The private sector, as interviews conducted for this report revealed, has difficulties in developing and introducing new technologies in areas outside strategic priorities defined at the level of the national government (Remoe, n.d.).

Many observers of China's recent economic development have emphasised that the country is unified by a single party but fragmented as a federal system. The outcome of this is that domestic companies, though benefiting from more or less uniform support stemming from the national economic strategy, are not able to fully access the huge market of the country as they are dependent on regional and local structures of administration. This undermines their ability to develop unique and proprietary technologies targeted to indigenous market needs. This, according to some analysts, has

two major consequences: first, the heavy reliance on FDI up to now means that China's high-tech exports are dominated by foreign companies; second, China's firms that have the scale to compete internationally remain dependent on imported designs of crucial technology components and manufacturing equipment.

These features of the regional economic strategy and the challenges it presents for SMEs were reflected in interviews conducted for this study. For instance, several interviewees stressed the importance of a change of policy direction on two fronts. With respect to the role of government support in the strategy of the cluster, interviews revealed that SMEs would like the government to eliminate policies that are preferential to foreign firms. In particular, they prefer parity on tax rates which are now higher for local and regional firms. They would also like easier access to bank financing which is now rather complicated. For instance to get access to loans through Credit Guarantee Companies (which are state-owned) SMEs have to meet 36 different criteria, which greatly slows down the approval of credit for innovative activities.

In addition, regional firms wish to see changes in labour regulation. Several interviewees pointed to the existing administrative hurdles to the free movement of labour across provinces, which is the result of the residence control system introduced in 1958. For instance, without an official certificate that confirms an individual's residence in Shanghai, prospective employees cannot access employment benefits and welfare, while facing less job security, higher taxes and rent rates. A related issue concerns competition from foreign firms for the attraction of local skilled labour. This leads to the "internationalisation" of wages and working conditions, undermining the cost competitiveness of regional firms. To counter better offers from foreign firms, regional SMEs are forced to offer shares or options to prospective employees, which at least in advanced sectors, avoid the formation of a dual labour market.

Today SAIC collaborates with 60 international companies involved in automotive manufacturing. Since 2003, large international firms have been drawn to Shanghai to reduce costs both in production activities but also increasingly in R&D. Cost pressures are also fueling the transfer of R&D activities to Shanghai, as has been the case with the recent establishment of Delphi, the US automotive components manufacturer, in the region. International firms are also one of the main sources of funds for research involving universities, research institutes and regional firms. As such, international firms constitute a major pillar of the automotive cluster in Shanghai.

However, SAIC is not entirely dependent on FDI through outsourcing, but also to internal market growth dynamics. The rapid development of the car industry in China and the involvement of many Japanese car component manufacturers are forcing some of them to establish product development centres in China to create parts that meet local needs. Indeed, the projection of SAIC to be able to develop 1.5 million vehicles by the end of 2007 is testimony to the region's productive capabilities. Economies of scale have been created through the accumulation of numerous companies within the cluster. Further industrial expansion of component suppliers belonging to different industrial groups will increase competition and reduce procurement costs for auto makers.

Yet, to this day, most activities of SAIC are in applications of solutions developed elsewhere, not high-level prototype research. Expectations are that this will soon change. For instance, in 1995 SAIC made its first inroads into design by participating in the design of the VW *Santana*. With the production of *Santana* a whole production chain has been

formed in Shanghai. Before 1995 all patents belonged to foreign manufacturers; from 1998 SAIC continued its participation in design with the production of the *Passat*. Critical in this respect is the role of Tongji University which hosts the Center for Automotive Engineers. The centre was established two years ago with the aim to develop co-operation between research and industry. R&D activities conducted by Tongji University extend to fuel cell technologies, and power control technologies. In terms of the breakdown of the university's activities in these fields they are organised as follows: application research (whole car making) 100%; future-oriented research (hybrid engines, etc.) 20%; basic research (fuel cell vehicles) 80%.

However, the innovation potential, especially among SMEs in SAIC remains limited due to the one-to-one vertically integrated relationships between automotive manufacturers and component suppliers. Based on interviews conducted for this report, this restricts the options of SMEs with respect to new ventures in innovative activities while it leaves them vulnerable to large international firms in negotiations regarding business priorities. Several interviewees noted that what is critical for the cluster is not attraction of FDI but rather the acquisition of technology and know-how in the international certification of components (this being done until recently by international firms and for which local SMEs feel they "have paid a high price"). This transfer of knowledge to the cluster – which would place it on a par with the leading manufacturers – is a key goal for the cluster stakeholders as it would enable them to open alternative paths toward R&D in leading domains such as alternative energy, environmental engines and advanced engineering, among others.

Another aspect on the strategic horizon of the cluster concerns the horizontal institutionalisation of SMEs. The existing one-to-one vertically integrated relationships between international automotive manufacturers and the SME supplier base does not allow for a horizontal view of the production process, leaving SMEs focused on specific components developed for the needs of the international manufacturers without the ability to develop synergies toward a total and indigenous model of automotive production. Such a horizontal view would require institutional development, specifically the formation of industrial associations responsible for competence development and resource allocation, which would give the cluster stakeholders more influence on the cluster's development.

This approach toward making SAIC relatively independent from particular international firms is reflected in the development of the alliances the group has formed over the past few years. To reduce its dependence on VW and to pressure the group to diversify its production in the region through the introduction of new models and increased technology transfer, SAIC decided to engage in a joint venture with GM. The resulting SGM has since its formation grown to be one of the largest car manufacturers in China. Between 2001 and 2002, for instance, SGM increased its market share in China from 2.7 to 7.7%. The formation of SGM has initiated a number of changes in the product strategy of SVW. The firm now produces several different models in Shanghai; *i.e.*, the *Santana*, *Santana 2000* (a model which was customised for the Brazilian and Chinese markets), *Passat* (since 2000), *Polo* (since 2001) and most recently (since 2002) the *Gol*, which was originally designed for Brazil (Depner and Bathelt, 2003).

At the same time Chinese auto makers such as *Chery*, *Great Wall* and *Geely* have significantly increased their production and market share. For instance, in the first ten months of 2006, 5.8 million cars were sold in China, an increase of 26% over the same

period last year – and Chinese car makers captured 27% of the market, while they will export 75 000 vehicles in 2006 to over 100 countries.

However, there are indications that this rapid pace of development has begun to test the limits of the industry's skills depth. According to the latest China Automobile Customer Satisfaction Index, the number of faults per 100 cars made in China rose from 246 in 2005 to 338 this year. Four out of five cars now experience a problem in the first six months of ownership. But with average retail prices falling substantially on an annual basis, manufacturers are racing to reduce costs, not increase quality.

Intense competition is also forcing them to accelerate development cycles. Manufacturers acknowledge that this means they are being forced to use lower-quality materials and spend less time on testing. So reliability is likely to deteriorate further. These problems have already delayed Chinese automobile manufacturers' plans to increase export sales in the developed world. Instead, the Chinese cars exported today mostly go to Africa, South-East Asia and the Middle East, where expectations are lower and price matters more.

From an international perspective, local automobile manufacturers in Japan and South Korea gradually came to dominate their domestic markets through a combination of cost competitiveness, nationalistic buying and technological leadership. Today, Japan's Toyota and South Korea's Hyundai make some of the most advanced, reliable, high-quality cars in the world. The accelerated pace of automobile production in Shanghai may be undermining the market dominance of Chinese automobile manufacturers. They have progressed rapidly largely because of government support and cost-conscious and relatively undemanding buyers. But as consumer expectations rise regarding quality, reliability and resale value of vehicles, loyalties are likely to change, changing with them the production values of Chinese manufacturers (*The Economist*, 23 November 2006).

The success of regional innovation clusters in China is the product of the interaction of three factors. First, the central government has played a key role in the formation of the regional clusters by providing the resources and an "enabling framework" for support of the various types of zones, industrial parks, science parks and incubators where national science and technology programmes have often been the drivers. Second, FDI and the growing industrial and technological integration of China with neighboring countries have provided a strong support base to regional development through technology transfer, management skills and extensive links to global markets. Third, the strategic targeting and development of technological and industrial clusters and subsequent reconfiguration of state involvement toward a "steering" role has provided the basis for further development.

To this day much of this drive for industrialisation has depended on FDI. The long-term goal of the central government is to reduce this dependence and make the country more self-reliant in developing its own technological base through advanced research capabilities. This goal rests on a desire to increase independence through economic dynamism. As a result of the success of the industrial zones, regional technology and industrial clusters now play a significant role and their embedded innovation systems might greatly contribute to China's technological and economic development.

This emphasis on regional clusters as key drivers of technological and industrial development is reflected in the sheer economic growth of the selected regions. Statistics from the Ministry of Science and Technology (MOST) show that from 1991 to 2002, major economic indicators of the 53 high-tech development zones in the country grew by almost 50% on an

annual basis, with an increase of total turnover volume from RMB 8.7 billion (USD 1.06 billion) to RMB 1 533 billion (USD 186.9 billion) in 2002. During the same period, the number of workers employed in high-tech regional clusters increased from 140 000 in 1991 to 3.49 million – an increase of nearly 25-fold. At the same time industrial clusters that were originally driven by FDI have progressively involved local companies which through interconnections with FDI have prepared the ground for technology transfer and management skills.

However, cluster policy confronts several challenges which are related to the lack of synchronisation between economic and administrative reform. One such challenge concerns the free movement of labour across regions and across urban and village enterprises. Urban enterprises have provided industrial employment to surplus rural labour, which has also contributed to increasing incomes in rural areas. However, this pattern of industrialisation has several weaknesses. One is the size of the operations of firms in many industries which does not allow for economies of scale. Another is the absence of linkages to services for business development and improvement of the efficiency of rural enterprises.

An equally serious challenge concerns the "holding" nature of many SOEs. Such enterprises often still provide infrastructure facilities and business services that could more efficiently be provided by separate dedicated entities. This issue has partly been addressed through combining SOEs into a number of large group companies, while allocating many of their peripheral activities to the private sector. Nonetheless, despite ongoing restructuring efforts, corporate governance reform with emphasis on private enterprise aligned to market demand is a major policy issue.

General conclusion

The Shanghai region and its automotive cluster yield a number of lessons regarding regional economic policy and cluster support. These can be summarised as follows:

- Current literature on cluster formation and cluster policy stresses that clusters cannot be created *ex nihilo*. Though this is largely true, the case of the Shanghai automotive cluster strongly suggests that, in the era of globalisation, carefully targeted government intervention can create conditions favorable to the emergence of clusters by establishing a structure of incentives toward market and industrial concentration on conditions advantageous to regional economic development.
- Another important aspect of the Shanghai automotive case concerns the alignment of strategic objectives between the central and regional government which has been critical in attracting FDI to the region but also organising the critical mass of local suppliers and their integration into the production process.
- However, the case also highlights certain key lessons central to regional economic policy, especially in transition economies. Primary among them is the need for tight alignment between concepts of technological development and economic contribution. As the two are not the same, economic policy needs to focus on the conditions under which technological development can be converted into economic performance.
- A related issue has to do with the prioritisation of R&D objectives. The Shanghai case highlights the need for flexibility in the planning process that structures research. In particular, the case of funding of research conducted at university and research institute levels which relies heavily on state financing means that research targets might not always

be aligned with market needs, while SMEs in search of financing for innovative projects find themselves in complex and time-consuming procedures of ensuring financial support.

- In sum, the Shanghai case illustrates the need for synchronisation of economic and political reforms around leading market transformations in ways that enable innovative firms take full advantage of emerging market opportunities and contribute to the regions in which they operate.

Based on the foregoing analysis, the following tentative suggestions for policy may be advanced:

- Though government intervention cannot be considered as the "creator" of clusters, it can play a major role in the formation of the conditions favourable to their emergence, especially in the early stages of cluster development. This intervention can be particularly effective when based on the close alignment between national and regional government authorities.
- Cluster policy must clearly distinguish between technological development and economic development. Effective cluster policy depends on "intelligence" mechanisms that can convert technological advances or technology transfer into economic performance within the economic base of a region.
- Funding of research programmes, usually an important axis of cluster development, needs to be assessed according to market demand. Though "ahead of the market" funding usually associated with state sources of finance is important in terms of planning, funding for research must be based on a balanced distribution of funds between universities and SMEs.
- Regional cluster policy must be based on the synchronisation of economic and political reforms around leading market transformations in ways that enable innovative firms to take advantage of emerging market opportunities and contribute to the regions in which they operate.

Notes

1. The report draws on the study "Global Outlook for the Automotive Sector – Future Drivers, Trends and Barriers", prepared for OECD International Future Programme by Dr Peter Wells and Dr Paul Nieuwenhuis, BRASS (Centre for Business Relationships, Accountability, Sustainability and Society Cardiff University), background material provided by the case study regions and interviews with representatives from industry, academia and local and regional authorities. As preparation for the interviews, a questionnaire, focused on basic information and statistics, was completed by the region. The interviews were carried out by the sector expert in collaboration with representatives of the OECD/Nutek Project Team. Sector expert was Dr Takis Damaskopoulos, European Institute of Interdisciplinary Research (EIIR).

   The views expressed are those of the authors and not necessarily an official position of either Nutek or the OECD.

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