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The Changing Geography of the European Automobile System

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La nouvelle géographie de l'industrie automobile européenne

Résumé

Le papier analyse les transformations récentes de la géographie de l'industrie automobile en Europe. Il discute notamment les effets de l'élargissement de l'Union Européenne en s'attachant aux conditions de l'intégration des pays d'Europe centrale et orientale et à son impact sur l'industrie automobile des pays du sud de l'Europe (péninsule ibérique). L'étude de la répartition spatiale des activités de production automobile s'attache à l'analyse dynamique de la spécialisation, en prenant en compte les processus d'apprentissage, et à l'agglomération spatiale des activités de conception et d'assemblage(parcs de fournisseurs).

Mots-clé : *agglomération, division spatiale du travail, Europe, industrie automobile, localisation, proximité*

The changing geography of the European automobile system

Abstract

Based on the research done by the European thematic network CoCKEAS (FP6), the paper analyses the recent changes in the European automobile geography. It discusses the impacts of the EU enlargement: integration of Central and Eastern European countries and new spatial competition for Southern European countries (Spain, Portugal). The study of the geographic distribution of automobile production within Europe focuses on the dynamic of specialisation of regions through collective learning processes, and the clustering of design and assembly activities (supplier parks).

Keywords: *automobile industry, cluster, Europe, location, proximity, spatial division of labour*

JEL : F23, L62, 052, R3

1. Introduction[1]

Europe, defined for our present purposes as the European Union's 15 member states plus any associated country currently applying for EU membership[1], is the world's largest automobile producing region, with nearly 20 million vehicles having been assembled in 2001. It is also the world's biggest market, not only in size terms, but also due to the intensity of the competition here, this being a product of the presence maintained in this part of the world by the sector's main multinationals (car manufacturers and parts makers). The North American presence, which goes back a long way for carmakers such as General Motors (Opel/Vauxhall) and Ford, has been reinforced by a cohort of parts makers who have arrived in the aftermath of the recent wave of M&A. Asian carmakers, most of whom are Japanese, represent a significant force nowadays (5% of the European Union's automobile production) and parts makers from the Far East have also been steadily building up their operations in Europe.

Europe constitutes a true "automobile space", inasmuch as the routing and regulation of the supply and demand for automobile products here has mainly taken place at a regional level (Carrillo, Lung, van Tulder, forthcoming). We can therefore say that we are in the presence of what can be called a European automobile system (de Banville, Chanaron, 1991; Lung, 2001). This system has been integrated at two separate levels:

- at a market level;
- and at a production system organisation level.

1.1. A semi-integrated European market

Although some disparities do subsist between the various EU member states, as well as between this group and the Central and Eastern European (hereafter CEEC) candidates for membership, there is still good reason to believe that we are dealing with an automobile market that has been more or less integrated. After all, the following conditions have been respected: products (vehicles, product ranges, components) are homogeneous, and the institutional regulatory framework throughout the market is an identical one (technological and environmental norms, distribution regulations, competition policy).

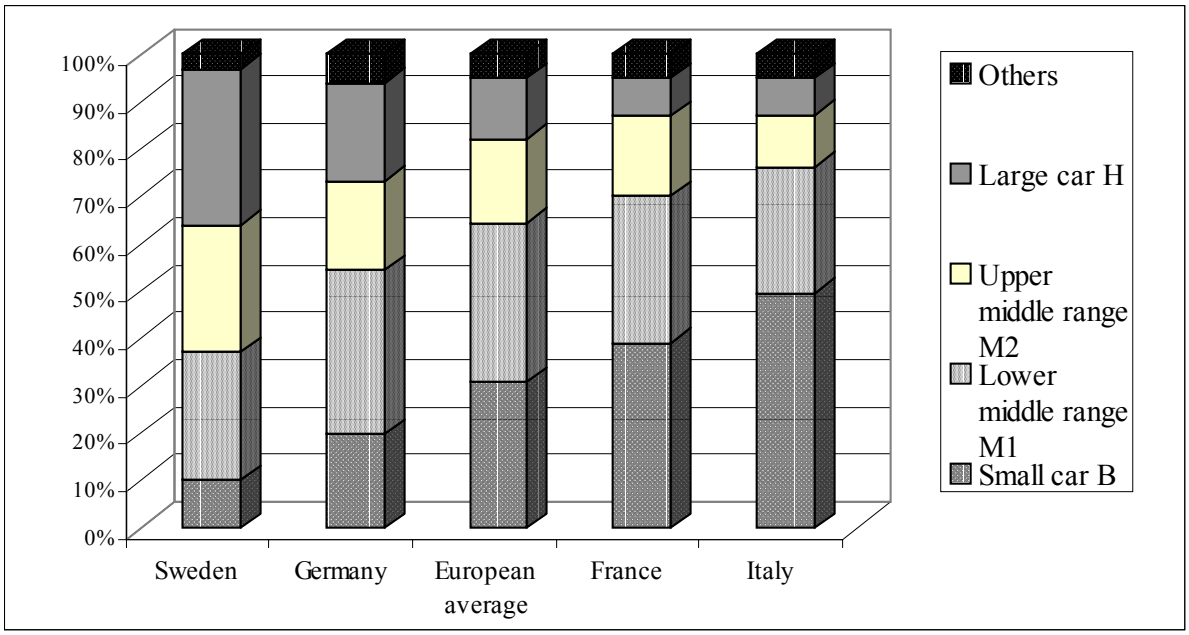
We can consider the first condition to be satisfied inasmuch as carmakers offer the same product ranges across the whole of the European market. Of course, a few differences do

[1] This paper is based on a research done within the CoCKEAS project (work package # 4) supported by the European Commission (FP5, Contract n°: HPSE-CT-1999-00022). Previous versions have been presented to the CoCKEAS consortium's and GERPISA international network's members within the research programme *Coordinating competencies and knowledge within regional automotive systems*. Thanks for their comments and remarks which helped to improve the paper. Nevertheless the author remains responsible for any mistake and omission.

[1] An initial wave made up of the following countries: Cypress, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, the Czech Republic, Slovenia and Slovakia. Then could be associated Bulgaria, Romania, and Turkey.

remain between EU member states (Figure 1) or between EU and CEEC. However, intra-European heterogeneities are very small when compared with the differences between the European market and the world's two other major industrialised markets. Consumers in the United States and Japan are offered product lines that only partially intersect with European ranges (Jürgens, 2004). This is due to the importance of light trucks in the former market and of mini-cars in the latter. In this respect, intra-European heterogeneity is similar to the disparities between North America's different states and provinces.

Figure 1 – Segmentation in the EU automobile markets



Source: CCFA

European authorities have paid a great deal of attention to the automobile market because of the regulatory issues that are associated with it, and because of its economic significance. Since safety and environmental issues transcend national borders, the subsidiarity principle has meant that interventions are being carried out at a European Commission level. These are actions whose purpose is to harmonise responses to problems such as technical certification and environmental standards (emissions levels, recycling etc.). Although certain differences do remain between EU member states, there has been great deal of convergence in this domain, a trend that is coherent with the birth of a single market. Since 1985, retail automobile distribution has enjoyed an exceptional status when compared to other sectors of economic activity (block exemption), and the recent changes in this regime will accelerate the convergence of car prices within the EU.

The price of a given model that is being sold in Europe's different national markets may vary, but these differences are mainly caused by structural factors, and more particularly by varying levels of taxation. Calculated on a pre-tax basis, price differences can be reach up to 30 or 40% in certain extreme cases. These ostensible disparities have not shown any downwards trend, despite pressure from the European Commission [2], actions by consumer

[2] The European distribution regulation that has been in effect since 1985 (and which is being reformed) sets a maximum limit of 12-18%, but the Commission has been paying close attention to motor vehicle price disparities between the various EU members states. See: http://europ.eu.int/comm/competition/car _ sector/price _diffs/

groups (such as the BEUC) and the role played by the brokers and the other intermediaries who are supposedly in favour of greater convergence. Nevertheless, price disparities are difficult to measure, with economic studies having tended to highlight the significance of structural factors (tax regimes, foreign exchange volatility, etc.) when analysing such divergences (Degryse, Verboven, 2000). After taking these factors into account, the gaps appear to be smaller (around 5 to 6%) and recent developments (a single currency inside of the Euro zone, retail distribution network reform) plus vigilance by the Commission should accentuate price convergence, even if a modicum of disparity will remain due to the fact that price discrimination is a normal practice in an oligopolistic industry.

1.2 A spatial division of labour on a European scale

Against this backdrop, a great deal of attention is being focused on the geographic organisation of the automobile production system in Europe, i.e., on the distribution of car and car component design, manufacturing and assembly activities. Although a spatial division of labour on a European scale is nothing new (this has in fact been building up throughout the second half of the 20th-century), the continent's automobile production geography has been affected in recent times by a number of factors that the CoCKEAS project (especially its Workpackage Four study group) has been trying to study.

One of the first elements of study is the automobile industry's continued internationalisation drive (Freyssenet, Lung, 2000, 2001), something that has been analysed as part of a two-dimensional framework:

- globalisation on one hand, with the entry and/or reinforced presence of North American and Japanese firms in Europe, and the loss of a European identity as a result of global mergers;
- regionalisation, on the other hand, with a European integration process involving an enlargement towards Central and Eastern Europe, and deepening of the European-wide division of labour.

Against this backdrop of ever-increasing competitive rivalry, the acceleration of economic and technological change is also noteworthy. This stems from a broadening of the product ranges that are on offer, from the introduction of new technologies (electronics), and from a frequent renewal of product lines (Lung, Chanaron, Fujimoto, Raff, 1999). In this regime of permanent innovation, the management of innovation becomes a major strategic issue for the automotive firms, in terms of their internal organisation as well as their way of managing the relationships they maintain with their partners, suppliers or clients, allies and competitors (Hatchuel, Le Masson, Weil, 2002). All in all, the co-ordination of competencies and knowledge become a major issue for this industry (Lung, 2001).

We must therefore, at long last and as a matter of urgency, incorporate the branch's reconfigurations into our thinking. The diffusion of the principles of modular production means that an ever-greater role has been allocated to first tier suppliers (FTS), viewed as system integrators who are involved in the design and production of modules and systems (Volpato, 2002, 2004). In addition, it means that there has been a redistribution of the roles that some of the branch's other actors (lower tier suppliers, engineering companies, design companies, etc.) have been playing (Lung, Volpato, 2002; Chanaron, 2004).

These developments carry a threat of delocalisation (from the South to the East for labour-intensive activities) and give birth to new spatial dynamics driving the agglomeration

of activities and the redistribution of the division of labour within the European area. This raises questions about the fact that the automobile system's extension towards new areas (and its reconfiguration of its existing relationships) has undermined the spatial organisation that had prevailed in this industry as the 20th-century came to a close, marked as it was by a clear hierarchical layering between core European countries and their peripheral zones (Bordenave, Lung, 1996).

This split between the centre and periphery provides us with a benchmark that we can use to characterise a mode of geographic organisation that has been validated by historians (Braudel, Wallerstein), geographers (Dollfuss) and economists (Krugman). It shows that centrality is the permanent feature of a geographic organisation that is based on the spatial concentration of its most complex activities, meaning competencies that mobilise economic factors (i.e., decision-making powers) and technological factors (i.e., design and production activities invoking a higher order and diversified type of knowledge) which are significant. Inversely, in the peripheral areas, activities remained largely dominated by impulses that are being transmitted from the central areas, and the competencies that are being mobilised are comparatively smaller. Their contours can change depending on the opportunities that the firms are encountering, and because of learning and developmental dynamics that will cause such spaces to modify their positioning in the overall configuration. Between these two extremes exist intermediary (or pericentral) areas covering various types of activities. This latter category exists because the gap between the two extremes remains a relative one, after all, and also because developmental dynamics are still no more than progressive in nature.

This socio-economic centrality does not translate perfectly at a geographic level. At first glance, Europe's industrial heartlands (its "blue banana") would appear to incarnate the centrality of its automobile industry; the countries that lie at its regional borders (Portugal or CEEC) correspond to its peripheral areas; and intermediary zones such as Spain or Eastern Germany nowadays fulfil a hybrid status as its pericentral areas. This kind of concentric vision would be partially incorrect, however (Layan, 2000). The route from one area to the next is discontinuous one, like travelling across an archipelago, replete with all of the dynamics that can be associated with a discontinuous space (Veltz, 1996). There is no automobile centre in Europe, as is the case in North America with the city of Detroit (Carrillo, 2004). Instead there is a kind of poly-centrality, a product of the fact that the historical development of the continent's national automobile industries preceded its integration process. Paris, Turin, Munich and the rest are clearly part of a centrality dynamic, while Belgium and Northern France (highly dominated regions) have more of a peripheral status, or a pericentral one at best.

Above and beyond these schematic representations, it is important not to fall prey to a simplistic vision of the split between a centre and a periphery, forgetting that this distribution is constantly being reconfigured by the dynamics of learning and of conflict. In addition, we should also maintain a clear vision of the particular complexities that drive the spatial dynamics of automobile production.

As such, our analysis of the European automobile system's geography will be developed in two dimensions, meaning that we will be apprehending it both as an extension of a production space (i.e., a search for new peripheries) and also as a reorganisation of a spatial division of labour, a trend that has been marked by the intensification of intra-branch trade and by the localisation of intra-European investments.

This geography should cover the spatial distribution of all of the activities involved in the production of (passenger) vehicles that are mainly destined for private individuals (thus excluding commercial vehicles such as buses and trucks). However, our main focus will be on the carmakers themselves. Their relatively small numbers and the clearer vision we can develop of the final product they turn out (the assembled vehicle itself) means that it is much easier to access available data on such actors. Furthermore, they continue to play an important role throughout an industry that they still dominate, inasmuch as suppliers' localisation decisions are partly related to their desire to accompany carmakers when the latter set up new operations, specifically when this involves modular production. As such, assembly plants nowadays create a new type of polarisation effect, and it therefore seems appropriate for our analysis to focus on their geographic distribution. In systemic terms, our approach emphasises inter-firm interactions instead of a dynamic that is specific to a single firm. In addition to assembly-related issues (this being a key moment in the organisation of a vehicle's manufacturing), special attention will be paid to the spatial distribution of design activities. This will allow us to hone in on another key moment of co-ordination for the various actors in this system.

2. The European Automobile System's Enlargement Towards New Areas

During the latter half of the 20th-century, the European automobile industry was marked by a multi-phased decentralisation of production towards new areas, once the first opportunities for European integration had let themselves be known. Concentrated at first in a few large agglomerations (Paris in France, Turin in Italy), this decentralisation trend was first felt by the countries that had signed up to the 1957 Treaty of Rome. For example, from the 1960s onwards, Belgium became a special host region for carmakers seeking to maintain a presence in Europe, whereas the automobile countries' peripheral regions (the Seine Valley and Western France, Southern Italy) also benefited from the kind of investments that were necessary to ensure the growth in production and assembly capacities an expanding market requires.

Starting in the 1970s, the outlook for Community expansion encouraged the automobile industry to grow into the Iberian Peninsula, mainly into Spain where several of the major carmakers set up assembly plants (Layan, 2000). More recently, new investments have tended to be made in the CEEC – without necessarily implying any weakening of the automobile industry's position in Europe's central regions (Table 1). Quite the contrary, we should look at the way the industrial heartlands have resisted this move, before studying the modalities of the enlargement that has taken place towards the new areas in the East.

2.1. The resistance of Europe's industrial heartlands

Some of Europe's traditional automobile regions have been hit by the closure of a number of historical assembly plants: France (Paris region), Italy (Piedmont), England or Sweden. Yet Europe's industrial heartlands continue to draw strength from their advantages, even as new assembly sites (including for the assembly of small cars) are being opened in the automobile countries' pericentral regions. The decision to locate new small car assembly plants (Mercedes A Class, MCC Smart and Toyota Yaris) in the industrial heart of Europe's automobile landscape attests to the attractiveness of these pericentral regions, which offer favourable workforce-based competencies; good supplier networks; market proximity; nearby

(assembler and supplier) design and decision-making centres; and possible greenfields sites, i.e., areas that have not yet been structured by the automobile industry.

Table 1 – Opening and closure of assembly plants in Europe since 1991

Year	Closure	Opening
1991	Renault, Valladolid 1 (Spain) Saab, Malmö (Sweden)	Eurostar, Steyr (Austria)
1992	Renault, Billancourt (France) Rover, Cowley Sud (UK) Lancia, Desio (Italy) Lancia, Chivasso (Italy) Innocenti, Lambrate (Italy)	Opel, Eisenach (Germany) Mercedes, Rastatt (Germany) Honda, Swindon (UK) Toyota, Burnaston (UK) Suzuki, Esztergom (Hungary)
1993	Volvo, Uddevalla (Sweden)	Seat, Martorell (Spain) Volkswagen, Bratislava (Slovakia)
1994	Volvo, Kalmar (Sweden)	Sevelnord, Hordain (France) AutoEuropa, Palmela (Portugal) Volkswagen, Mosel (Germany) Fiat, Melfi (Italy)
1995		NedCar, Born (Netherlands) Ford, Plonsk (Poland)
1996	Seat, Barcelone (Spain) Chausson, Creil (France)	Autonova, Uddevalla (Sweden)
1997	Renault, Vilvorde (Belgium)	MCC, Hambach (France)
1998	Renault, Setubal (Portugal)	Opel, Gliwice (Poland) Audi, Györ (Hungary)
1999	GM-Opel, Szengotthard (Hungary)	
2000	Ford, Azambuja (Portugal) Ford, Plonsk (Poland) Foden, Sandbach (UK)	
2001	GM, Luton (UK) Fiat, Rivalta (Italy)	Ford (Turkey) Toyota, Valenciennes (France)
2002	Ford, Dagenham (UK)	Volkswagen, Dresde (Germany) Porsche, Leipzig (Germany)
2003		
2004		
2005		BMW, Leipzig (Germany) PSA-Toyota (Czech Republic)

Source: CCFA

Automobile production has risen continually in the EU member states, and the opening of Central and Eastern Europe has not broken this trend. The EU countries' automobile output rose for example by more than 1.9 million units between 1990 and 2000, with Germany and Spain having been the main beneficiaries of the extension of productive capacities (*c.f.*, Table in appendix) [3].

[3] Changes in production accounting rules (inclusion of assembled vehicles ex. CKD after 1996) explains France's downturn and Belgium's upswing. If adjustments are made to offset these changes, France moved ahead (with three new assembly plants) whilst Belgium fell behind.

Note also a significant rise in British automobile output over this period, despite the problems caused by the strength of the Pound. Increased production at assembly plants opened by Japanese carmakers who had arrived in the UK in the late 1980s/early 1990s more than offset the British carmakers' decline. However, uncertainties about the Pound's fortunes did become a major handicap for the country's components and finished motor vehicle industries[4], inasmuch as a large part of such productions were supposed to be sold in Euro zone markets. Top-of-the-range vehicle production (Jaguar, Range Rover, etc.) was not necessarily handicapped, since North America was the real target for this segment - but otherwise, and in light of the overall integration of the European automobile system, British industry continues to suffer from a low level of competitiveness, both in its components sector, and also as regards its production of high-volume vehicles.

Despite the fact that generic components production was delocalised on several occasions towards the peripheral countries (thus entering into a spatial division of labour, see above), the European industrial heartlands' continued competitiveness in vehicle production and assembly is in fact a reflection of an automobile production that has been renewed, in the sense that it has become more complex. The accelerated introduction of technological innovations (electronics), the reinforced links between design and manufacturing, the broader basis of the recurring interactions between carmakers and suppliers during the design (and/or manufacturing) phases, without forgetting the proximity of the final market - all of these factors have consolidated the attractiveness of regions that offer firms advantages such as a non-price innovation-based competitiveness; product differentiation; and quality.

In a context of intense territorial competition within Europe, this attractiveness has also involved an overhaul of the sector's previous employment relationships. In actual fact, the threat of delocalisation is a powerful vector that enables firms (manufacturers and parts makers) to pressure EU labour unions into making concessions. For example, Volkswagen's 5000x 5000 project was negotiated in Germany with the implicit threat hanging in the air that this new production could be allocated to Portugal or to the Czech Republic, if need be. Often the immediate price for the maintenance (or expansion) of activity levels in Europe's regions is that workers are being forced to make concessions on pay and/or accept an intensive and flexible work organisation. Of course, this raises questions relating to the long-term sustainability of such practices (Castillo, Lopez, 2003). After all, the increasing precariousness of actors' professional status (the outcome of externalisation, of precarious forms of work, etc.) may well be limited by economic and social factors.

2.2. The enlargement of the European automobile area

The opening of the CEEC and the possibility that they might join the Europe Union has induced a number of car manufacturers and parts makers to set up operations in these new areas, with a view towards their ultimate integration.

2.2.1. The opening up towards Central and Eastern Europe.

As was the case with the operations they had once set up in Southern Europe (and specifically in Spain), the carmakers' main purpose in moving into the CEEC has been to

[4] As attested to by the fact that Ford stopped its production of passenger vehicles even though Great Britain had historically been its leading overseas country of production, ever since the model T came out in 1911.

build new sites for the assembly of smaller vehicles (see Table in appendix). The attractiveness of these regions stems from a combination of factors (Havas, 2000):

- the move there is made easier by the fact that the products involved feature relatively lower levels of technological complexity (small cars, light commercial vehicles) and the generic components are based on technologies that are already well under control;
- labour costs can be relatively low (compared with the EU), even though the workforce is capable of offering solid technical competencies;
- the market's proximity explains the area's product specialisation, since bottom-of-the-range vehicles are the only ones to offer a market volume that is sufficiently large for producers to be able to benefit from economies of scale. For instance, Ford and GM Europe closed some of their CKD vehicle assembly sites only a few months after opening them.

Unlike the Iberian Peninsula scenario in the 1970s and 1980s, learning processes are quicker now. This means that carmakers can move nowadays into production regions that are relatively complex (i.e., Audi with its TT assembly plant, production factory and technical engine centres in Hungary). Two factors explain why these countries' learning curve has accelerated:

- on one hand, the workforce's technical competencies and overall availability have created conditions that should make it easier for manufacturers to move up to a higher quality segment in the product range;
- on the other hand, automobile sector competition being what it is, it is impossible to reproduce scenarios that are based on a simple transfer of mature products and technologies into the peripheral areas.

First of all, a market that opens up to international trade will soon experience an increase in competition that can lead to a relative extension of the local product offer. Consumers begin to expect high-performance utilisation qualities and will no longer be satisfied with obsolete products. A country like Turkey[5], which up until recently had almost only produced and marketed 20 year-old models, now assembles carmakers' latest versions, including models for which it is the only European (or even worldwide) supplier (Duruiz, 2004).

Secondly, as part of their shared platform policies (Volpato, 2004), carmakers renew their models frequently. Platform renewal rhythms determine the type of vehicle that is to be produced in light of the opportunities that are created when new sites open up and when models are replaced. This is how the Skodia Octavia and Fabia, for instance, became the first models to have been designed and produced (in Czech Republic) on the VW group's new shared platforms, and to have also been broken out into a diversified product range for the group's Volkswagen, Audi and Seat brands. The quality of the local workforce and the efficiency with which parts makers can be monitored are both factors that encourage this type of situation.

[5] The Doblo model for Fiat; the Megane Estate (station wagon) and Symbol (Clio three-box) for Renault; the Corolla three-box and estate/station wagon versions for Toyota

Still, certain countries' breakthrough (i.e., Poland, Hungary, Slovakia and the Czech Republic) should not hide the fact that disparities do persist (Pavlink, 2002). Nor should we forget the disintegration of certain nearby countries, such as the Ukraine (Mezouaghi, 2001).

2.2.2. A competition between the South and the East?

This opening up towards the CEEC has raised issues relating to the role of Europe's other pericentral and peripheral areas, i.e., whether there should be a shift from the South to the East. More specifically, we should analyse the positioning of the Iberian countries that could become the main victims of this relocation of generic (standardized component and vehicle) product production and assembly activities towards these new frontiers.

The closure of Renault's assembly plant in Portugal and the concomitant development of the French carmaker's establishment in Slovenia may have raised the spectre of a general relocation, but this seems to have been an exception to a general trend defined by a strengthening of the automobile industry: 3.3 million vehicles were mounted in Iberian Peninsula assembly lines in 2000, 1.1 vehicles more than in 1990. Spain consolidated its position by becoming the third-largest automobile producing country in Europe, behind Germany and France, as well as the continent's leading producer of commercial vehicles (with a quarter of total European output). It may well be that no new plants were built in Spain, but all of the carmakers maintaining a presence there modernise and expand their operations regularly, starting with Seat, which closed its old Free Zone plant to move to Martorell – facilities that are very competitive at a European level.

Damaged by Renault's closure of its factories in 1998 and by Ford's closure of its CKD assembly plants two years later, Portugal's automobile production has become very dependent on the AutoEuropa factory that has been manufacturing passenger vans under the VW, Seat and Ford brand names since 1995. Initially a joint venture between Ford and VW, AutoEuropa has been a 100% subsidiary of the German manufacturer since 1998. It is destined to only produce models under the name of the group's brands, since the other carmakers with a presence on this site are only involved in limited CKD vehicle assembly activities.

The design and the technological and organisational innovation competencies of both of these countries have developed as a result of a consolidation of their design and innovation capabilities. For examples: Ford's Valencia plant was the first in the group to experiment with the idea of setting up a supplier park; the design and engineering functions were consolidated by VW in Barcelona (200 employees) in an attempt to develop Seat brand models; and Barcelona was also put in charge of design functions for the VW group's sports car brands (Seat and Audi).

The automobile industry has on many occasions received a great deal of support from local government authorities for the consolidation and development efforts it has been making. The European Commission has been paying close attention to these State aid packages, fearing they could be harmful to the CEEC. For example, the Santana Motor plant in Andalusia has only survived since the Japanese carmaker Suzuki withdrew in 1995 because of involvement by and financial support from the region's government and from the Andalusia Institute of Development. Note also the significant involvement of the Portuguese government in attempts to consolidate that country's automobile industry via the P3 (Metrocubo) project for which Pininfarina designed a small cutting-edge city car that should make it possible to bring together local parts makers (multinationals plus Portuguese

suppliers) and scientific laboratories, thus creating an original configuration in which the competencies of a diversified set of actors can be co-ordinated, and this sort of niche vehicle produced industrially (Camacho, 2001).

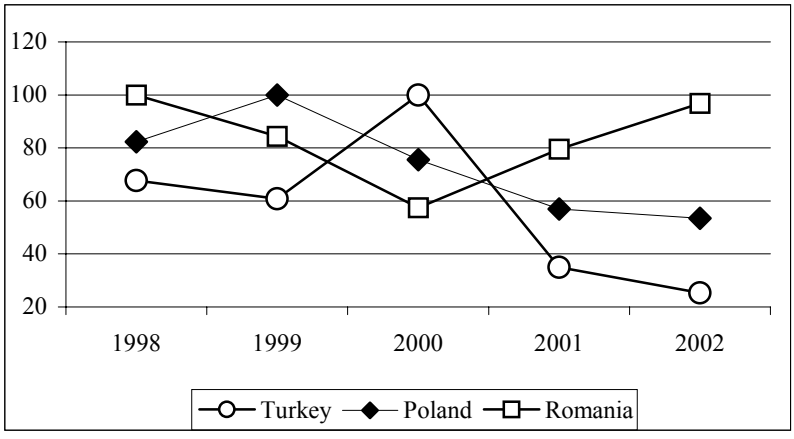
The Portuguese component industry will have to be fitted into wider international networks if it is to strengthen over time. This insertion can be achieved through a localisation there of large multinational firms – but also through an internationalisation of the country's own small and medium-sized businesses (Veloso et alii, 1999). The CEEC' experiences have shown that it is not enough to simply bring in multinationals from the global parts making industry if the local economic fabric is unable to cope with the new rules of international competitiveness (Bourassa, 2000; Balcet, Enrietti, 2002).

Looking beyond the Iberian Peninsula, there are further questions as to the Mediterranean countries' future role given their free-trade association with (or possible integration into) the EU. Asides from Turkey (which we deal with in our discussion of the CEEC), the positioning of the countries in North Africa should also be discussed. It is true that parts makers have had no qualms about setting up labour-intensive activities in the Maghrebi region with a view towards the production of certain components (i.e., wire harness), but whether an actual automobile production activity remains here, mainly in Morocco, will depend on to what extent borders stay open (Layan, Mezouaghi, 2004).

2.2.3. The conditions in which new facilities are being established

The CEEC are still economies in transition, meaning that their automobile markets will continue to grow in a highly unstable manner. For example, and as we can see in Figure 2, new car sales in these regions can shrink by 40 to 60% within a matter of months. This volatility explains some firms' reluctance to set up operations in these countries, and it means that the carmakers who localise there will be searching for flexibility solutions that will allow them to come to grips with the significant economic risks they incur due to the impact their high breakeven points can have on corporate profitability. To reduce these risks, three solutions are possible (Lung, 2000): operations can be set up on a step-by-step basis; sales can be decoupled from the local market; and the sunk costs associated with entering such markets can be cut.

Figure 2 - Volatility in emerging markets



Index 100: maximum of new vehicles' sales (Poland: 626,000 en 1999 / Romania: 115,000 en 1998 / Turkey: 467,000 en 2000)

Sources: Automotive News

Setting up operations on a step-by-step basis means following a standard approach: first a commercial presence; then a low-volume CKD vehicle assembly activity; and then maybe a more substantial investment, with the creation of an assembly plant. In the early 1990s, several car manufacturers (notably GM in Hungary [1990] and Ford in Poland [1995]) began to follow this cautious approach by setting up assembly activities that were good for a few thousand vehicles. The shift to the third phase never took place and these units were closed.

The decoupling of sales from the volatility that is endemic to an emerging market presupposes a strategy based on exporting vehicles back to the more stable markets, and to the EU countries in particular. This is similar to the configuration that views such countries as peripheral bases to be used for exports back to the system's central markets (i.e., Audi's TT complex in Hungary) and also as loci where systematic efforts can be made to orient bottom-of-the-range products towards entry-level vehicle segments (i.e., the third family car in the industrialised countries, or else the first new vehicle for a young household [Fiat Seicento, Opel Agila, etc.]).

This lowering of sunk costs is part of an attempt to develop modular production, with car manufacturers passing the modules' design and production costs on to their suppliers (thereby syndicating risks). The social environment is also amenable to the introduction of modular production, since this involves a delegation of the modules' design, production and assembly activities to the suppliers. VW's Skoda Bratislava factory is for example one of the first sites in this group to experiment with a system in which supplier employees mount modules directly on the manufacturer's assembly lines (Havas, 2000; Lung, Salerno, et al., 1999; Jürgens, 2004). Renault's attempt to co-operate with Dacia in Romania to make a €5,000 car also involves passing much of the investment risk that is linked to the new design, and to the new factories being built, on to the parts makers who are associated with the project.

Such areas therefore become loci for experimenting with new forms of productive organisation and/or with technological innovation (i.e., when new models are launched). Does this undermine the current spatial hierarchy of automobile production in Europe?

3. The Geographic Distribution of Automobile Production in Europe

The location of automobile production activities in Europe has been affected by a double trend: specialisation, reflecting actors' desire to benefit from the opportunities offered by the markets' greater openness and the enlargement towards new areas, on one hand; spatial agglomeration of activities (clustering), on the other.

3.1. The dynamic of specialisation

The regional automobile system's integration process has led to increased international and interregional trade within Europe by encouraging a greater degree of production specialisation. This latter factor is particularly apparent when we analyse car manufacturers' assembly plants, both because of the platform strategies being pursued, and also because of the way in which carmakers choose their locations in light of a given host area's particular characteristics. It remains the spatial hierarchy that is the product of this process is not written in stone.

3.1.1. Platform strategies

Due to the intensity of the competition in the European market, carmakers are having to make dramatic cost cuts at the same time that they are having to diversify their product ranges in order to gain a presence on the market's different segments by offering greater variety (Layan, Lung, 2001). In other words, they are having to work simultaneously on their economies of scale and scope. The platform strategies that all the major automobile companies started to announce in the early 1990s (c.f., Table 2) represent an attempt to come to grips with these different constraints. This has involved simultaneously developing an increasingly wide range of vehicles, all of which share the same platform (chassis and structure) and modules (mechanical subsystems); and at the same time preserving product differentiation. First tier suppliers have also been hit by this trend: the use of complex components (something that specifically requires major R&D investments) on different models (coming from different manufacturers or else from the same one) makes it possible to spread out costs and benefit from economies of scale and of scope. The shift towards a modular strategy has furthered this move whilst emphasising the need for product differentiation.

Table 2 – Platform strategies in Europe

Number of passenger cars platforms

Car makers	Brands	Number mid-90s	Planned number
Volkswagen	VW, Audi, Seat, Skoda	16	4
Ford Europe *	Ford (Mazda, Volvo)	5	3
GM Europe **	Opel, Vauxhall, Saab	5	3
Fiat **	Alfa, Fiat, Lancia	6	4
PSA	Citroën, Peugeot	6	3
Renault-Nissan	Renault, Nissan	5	3

Notes:
* Some Ford platforms will be shared with Mazda and Volvo products.
** Future GM Europe and Fiat products will share platforms, which could reduce the total number from seven to four for the two groups.

Sources : *Firms, Presse.*

With this in mind, carmakers (especially multi-brand groups such as PSA and Fiat) are more inclined to allocate the production of the various models that are derived from one and the same platform to a limited number of assembly plants. By so doing they are focusing their flexibility efforts on producing an ever-increasing number of model variants. PSA for example gave up on its old idea of specialising each of its surviving factories by brand (Peugeot vs. Citroën), deciding instead to dedicate its French factories to one of the three platforms its two brands use: Aulnay and Poissy for the PF1, Mulhouse and Sochaux for the PF2, and Rennes for the PF3.

This trend towards increased specialisation also applies to the sector's single brand groups (such as Ford, Renault and GM), firms that have been creating model variants in such a way as to be able to target different market segments using one and the same platform. Renault for example will be producing three vehicles (Laguna II, Vel Satis and new Espace)

using just one platform at its Sandouville plant, although these are cars that are meant to attack different market segments. This regrouping can be explained by the difficulty of managing a constantly growing internal variety for variants such as body (3, 4 or 5-doors, estate/station wagon, monobox, etc.), driving systems and other subsystems. The difficulty also stems from the co-ordination problems that have arisen due to the fact that the modules' preparation has been externalised to suppliers who are situated right next to the assembly sites. The reorganisation of the Sandouville site was accompanied by the creation of the first suppliers park Renault built in Europe.

This specialisation means that in the central regions certain carmakers will no longer have more than one supplier plant for their medium-volume models (top-of-the-range vehicles and passenger vans), whereas the production of high-volume (midrange and lower range) vehicles can still be spread out over several sites.

Although there has been a clear move towards greater specialisation, it is not the only trend worthy of mention. In certain instances where variety has remained relatively high (2 to 3 platforms or even more), this corresponds to different types of configurations, involving for example historical production centres whose size allows for an assembly of several models at once (i.e., Fiat at Mirafiori). Inversely, this can also involve assembly plants that are located in the peripheral regions (especially Poland) whose variety and flexibility makes it possible to smooth out variations in the demand mix for one product or the other. Lastly, certain foreign carmakers (Japanese firms such as Honda and Nissan, in particular) only have a single passenger car production plant, so this establishment ends up assembling several models.

Elsewhere there is the example of VW which, after having experimented with regrouping the production of all of the brand model variants that it manufactures using a single shared platform located on one site, seems to have given up on specialising its plants by platform, preferring instead to maintain brand specificity. For instance, Seat production has been concentrated on the group's Martorell site[6] whilst Skoda assembly takes place in the Czech Republic. The VW group's modification of its strategies for allocating production spatially (specialisation by brand instead of its incipient specialisation by platform) raises many questions. The change means that the group has to transcend a pure platform strategy (where its four brands' model variants would be split amongst four shared platforms) to move towards a combinatory logic that is based on commercial positioning. This would allow both for brand differentiation (Audi and Seat for the sports car niche, VW and Skoda for technical cars) and also for a shared module policy that can take advantage of whatever economies of scale may arise[7]. Other carmakers have followed in VW's footsteps (Ford in particular, but DaimlerChrysler as well), although this does not mean they have dropped the one platform per site specialisation logic: modularity makes it possible to increase the number of models on offer and also to break then down into variants that are all based on the same technique[8].

Nevertheless, the trade-off between specialisation and flexibility could lead to some reversal in such trends which are not irreversible. Reducing their overcapacities, OEM reinforce their assembly plants' flexibility to be able to reallocate rapidly their production depending on the commercial success (resp. unsuccess) of their various models, and

[6] With the exception of the Seat Alhambra passenger van being assembled in Portugal. Seat also produces in Spain several variants of the models it sells under the VW brand name (Polo Classic/Cordoba and Caddy/Inca).
[7] The 4 brands' models will have 11 shared modules that can be used on different platforms
[8] Even though the manufacturers used to turn out no more than 2 or 3 models per platform, with today's practices they can make up to 9 different models (i.e., the VW Golf's A platform) and even more.

strengthening their bargaining power with local unions or authorities by the threat of delocalisation (see the recent announcements of a two platforms by plant orientation for Ford Europe and of the assembly of some Seat products in Czech Republic for VW).

In any event, whether with respect to the specialisation issue or else in terms of these cases in point, there is little question but that the spatial hierarchy of automobile production in Europe (Bordenave, Lung, 1996) has tended towards consolidation.

3.1.2. The assembly plants' dual localisation

The contrasting localisation of the assembly plants that are being used for top-of-the-range models or else for lower range models indicates a clear hierarchy within the automobile industry. The top-of-the-range models, characterised by a high level of technological complexity that mobilises specialised competencies and types of knowledge in an attempt to satisfy quality expectations, have been located in the traditional automobile countries' industrial heartlands, near their European markets (i.e., excluding their extra-European exports). Asides from Sweden, which has specialised since the very beginning in top-of-the-range products (Volvo, Saab), all such plants are located along the "blue banana", with (Southern) Germany, Italy and England dominating for deluxe and sports cars – vehicles that are hardly represented at all on the European periphery or in its pericentral regions (with the few presences of this ilk that are to be found here generally involving CKD assembly).

Inversely, small car assembly plants are much more dispersed throughout Europe. The search for economies of scale leads to higher volumes and to locations that are closer to the different marketplaces. It also induces actors to try to lower the costs that are associated with products whose level of technological complexity, whilst remaining high, is nothing out of the ordinary (given that the technologies incorporated therein are basically already well under control). As the new automobile countries are and will be entering the market with bottom-of-the-range products, the dispersed nature of Europe's small car assembly plants is a reflection of the historical development of its automobile industry. Note that these plants are still being maintained in the central regions, and that no real delocalisation per se has taken place for this type of output. Any extension thereof will therefore reflect the growth of a new market. Light commercial vehicle assembly, which is often derived from these same platforms and therefore carried out on the same lines, has tended to be mainly located in peripheral plants.

With fundamental trends such as these, it could be useful to discuss the recent factory openings that appear to be an exception to the rule. In terms of small cars, the proximity of a market and/or of an industrial fabric featuring a rich tapestry of suppliers explains why the Smart car or else the Toyota Yaris are being built in Eastern and Northern France, regions that are pericentral yet which remain part of Europe's industrial heartlands. These models are primarily destined for EU markets, and target urban households buying a second or a third vehicle rather than emerging market first vehicle purchasers. Toyota and PSA has decided to build this other kind of model in the Czech Republic, starting in 2005.

As regards the top-of-the-range cars, we should take a closer look at some of the German manufacturers' recent location decisions. Note first of all the operations that have been recently established in Germany's Eastern States: VW, which will be making its top-of-the-range Phaeton and Passat W8 in Dresden; or Porsche, which together with VW will be building its off-road vehicles in Leipzig - where BMW will turn out its new 7 Series starting in 2005. Finally, there is Audi, which will be producing its low volume TT coupe and roadster models in Hungary.

These pericentral location decisions stem from the search for a new presence in environments that lend themselves to more flexible types of organisational modes, whether in terms of the employment relationship they encapsulate or else as regards the type of supply relationships that are found within a modular production framework. These new organisational forms are meant to cut production costs whilst minimising sunk costs. The move away from Germany's traditional automobile regions has helped firms to lower their wage bills, and even more importantly to implement flexible forms of organisation (given the lesser degree of unionisation). This makes it easier to outsource module preparation to suppliers and to devise a work organisation in which staffing levels and schedules can be adapted to reflect trading conditions at any particular moment in time. The work flexibility of BMW's Leipzig plant is such that the firm can adjust its activity levels, implementing a schedule of anywhere between 60 and 140 hours per week, thanks to workweek durations that can vary from 4 to 6 days, possibly involving 2 or even 3 shifts and overtime facilities, depending on demand levels. This flexibility means that the firm can adapt its costs immediately. This is what helped Leipzig to beat out the two other sites that were competing for this BMW plant, Arras (France) or Kolin (Czech Republic), despite wages that were 50 to 75% higher.

This reduction of sunk costs is also crucial for establishments that turn out niche-destined innovative vehicles whose commercial success is not guaranteed (i.e., the VW Phaeton and the Audi TT). A localisation outside of the central regions will reduce sunk costs seeing as modular production means that entry costs are being split with the suppliers who will be setting up their own operations nearby; and inasmuch as the site's closure or re-conversion will be easier to negotiate. Audi's Hungarian factory, which makes singularly designed coupes and roadsters (cars that are destined for a volatile segment in industrialised country markets such as the EU, North America and Japan [with 57,000 Audi TT having been assembled in 2000]) can be compared with the VW and Chrysler's Mexican plants that are used to assemble models that target the same segment: the Beetle 2 and the Cruiser, respectively. For carmakers, these are marginal models – if they fail, an exit strategy is on hand.

There is little doubt but that this specialisation depends on the spatial distribution of the plants that are being used to assemble these top- or bottom-of-the-range cars (and light commercial vehicles). It is an expression of a function-based spatial hierarchisation.

3.1.3. A function-based hierarchisation, renewed within a regime of permanent innovation

Design and engineering activities have been concentrated in the central regions of Europe's industrial heartlands, i.e., in metropolitan areas or specialised regions that not only agglomerate carmakers' development centres but also parts makers' and design and engineering firms'. Inversely, manufacturing activities, specifically when they involve components and technologically stabilised products, have tended to be more readily localised in Europe's pericentral regions or peripheral countries.

The delocalisation of mechanical and electronic component manufacturing activities towards these regions seems to be a fact now, although we should not forget to analyse this in the light of the hike in production capacities that has resulted from the new markets' growth. However, the deterioration in trading conditions from 2001 onwards, marked by a slowdown in the growth of sales volumes and by increased pressure on costs, has tended to increase the vulnerability of those establishments that are located in the central regions. This includes any

factory (often the oldest ones) that has turned out to be less competitive than the more modern recently built units located on the region's periphery.

Note nevertheless that the reinforcement of technological capabilities in Europe's Southern and Eastern spaces (a product of collective learning processes and of a consolidation of local workforce training) also encourages the localisation and development of design and engineering-related competencies. The confirmation of the activities that the VW Group's Seat and Skoda subsidiaries have been carrying out in this area, the emergence of a design pole in the Barcelona metropolitan area and parts makers' decision to localise their technical design centres in Eastern Europe (something that the manufacturers have also been doing, see Audi's technical engine centre in Hungary), all are developments that translate a collective learning dynamic (Lara and Carillo, 2003) which has converted these regions into spaces of technological and organisational innovation. The periphery can no longer be seen as a mere receptacle for solutions that have been designed and stabilised in the central regions. We are a long ways away from the idea of a polarisation between a centre that concentrates all design activities (exclusively) and a periphery that does nothing more than produce standardised components and products by means of a simplified technological transfer (with the intermediary regions being in charge of certain semi-complex productions). This was the automobile industry's geographic configuration during the 1960s/1970s (Lipietz, 1977). It corresponded to a technologically mature environment, one that was marked by fewer competitive rivalries – and therefore by much less innovation (Abernathy, 1978).

This context has changed radically. What we now have is a regime of permanent innovation (Boyer, 2001) and greater competition that causes firms to renew their models more frequently, to integrate new technologies (electronics and ICT) and to introduce new organisational principles. The recurring strategic re-orientations and ongoing organisational reconfigurations (notably relating to design management) reflect the unstable nature of the firms' institutional arrangements in Europe, this being the market that is considered to be the most beset by competitive rivalry, inasmuch as all of the world's global firms maintain a presence here.

The hierarchy of the European automobile area has tended to reproduce itself, even though it has also assumed other forms as part of this regime of permanent innovation. This is due to the fact that the reinforcement of technological and organisational competencies in the peripheral regions, which derives from the collective learning processes that are associated with automobile production, has not reduced their lag behind central regions that remain the real movers of the "technological frontier". This hierarchisation predominates as a result of the complex arrangements it entails. There is room for innovation in the peripheral countries, but this no longer takes on the form of a "spatial extension of the branch", one that allows for a disjunction of the various activities to be found in this space, activities that are interrelated via a merchandise transport system. The real schema is closer to that of an "archipelago" economy (Veltz, 1996) featuring an interconnection of innovation spaces, each of which is characterised by a local innovation dynamic that is capable of assuming specific configurations.

3.2. Spatial agglomeration

Against this backdrop of permanent innovation, the different activities' clustering behaviour at each step of the production process has tended to strengthen due to the complexity of the automobile product. This implies a co-ordination (and ongoing adjustment) of the many participants who take part in its various organisational structures. This clustering

effect unsurprisingly impacts automobile product design activities, but it also affects manufacturing activities due to the polarisation to which the assembly plant configuration lends itself.

3.2.1. Concentrated design activities

Design activities represent a major competitive challenge for car manufacturers who are being forced to design an increasing number of ever-more frequently renewed models, introduce new technologies, control quality and costs and shorten design-to-market lead times. An automobile remains a product system whose various components are highly interdependent. This is because drivers' satisfaction when using their motor vehicle will be determined not only by the intrinsic properties of each of the components, but even more so by the responsiveness of the whole (made up of several thousand parts) in an environment that is changing constantly, notably at a technical level. The vehicle must be adapted to different types of driving; to variable climatic conditions; to road networks of varying quality; to differences in altitude, etc.

Far from being a simple technical problem, this is a true "exercise in social relationships" (using Moisdon and Weil's expression [1992]). Interventions by a wide array of different actors need to be co-ordinated: different departments within the firm (Styling, Product development, Manufacturing, Purchasing, Marketing, Finance, etc.); different specialists within the same department; the parts makers that will be designing and producing more than 50% of the vehicle's value (through co-design), etc.

Co-ordinating this diversified set of actors means developing a proximity relationship that is multidimensional in nature, i.e., it is technical (membership in a given profession), social (networking between various engineering schools), cultural (shared values-objectives regarding the product that is to be designed, identification with the company's plans), organisational (a shared history in the field, a shared experience with the different procedures that govern the product's development and industrialisation) and of course physical.

Firms therefore have to build up this proximity in order to optimise design organisation (Lung, Rallet, Torre, 1999). For technological knowledge to be created and accumulated, temporally and spatially localised procedures must be in place. However, these procedures can also shut the organisation off from other modes of innovation management. The difficulty lies in managing internal interactions without cutting one's self off from the surrounding environment. Access to external resources exerts a major influence on the design process's functioning, due to the fact that interactive learning features a dimension that gestates outside of the design centre itself (access to production-related competencies or to more generic types of competencies such as basic research). The design activity lies at the heart of an interaction network (Hatchuel et al., 2002) that is both internal to the firm (within the R&D department itself but also inside of all of its other functions, i.e. Production, Purchasing, Sales, etc.) and also external to the firm (co-operation, public research, access to markets, etc.). This allows for a wide variety of spatial configurations. The function-based articulation between competency centres can be used to illustrate the different ways uncertainty can be managed. When the design function runs up against a model that expends much of the firm's resources, the combination of a high degree of uncertainty about the product's chances for success and the irreversible nature of certain aspects of the automobile product's development (the sunk costs and time involved) mean that during the concept definition phase there is often a need for a modicum of geographic proximity between decision-making and technical centres.

As such, the carmakers' remoulding of their design organisation over the past few years has been explicitly geared towards a spatial concentration of their product design resources (Carrincazeaux, Lung, 1998). The rationalisation of previously dispersed design activities is based on a co-location concept that the French carmakers Renault and PSA Peugeot-Citroën have specified at a "plateau" level. This involves bringing together, under the supervision of a project leader and at a shared location, a team comprising all the actors who be participating in the new product's design and development: the firm's different departments and business lines, but also their first tier suppliers. Not only does this get the departments that are directly concerned by this project involved in it from the very outset (Styling, Product development, Methods, Manufacturing) but it also brings in people from Finance, Purchasing and even Marketing, as well as the engineers whom the main suppliers have seconded to the project. This clustering is both mobile and nomad. Everyone participating in this plateau is working away from home (moving back and forth between their various assignments) and the plateau can call in outside experts who will make contributions, at critical moments, to specific problem-solving exercises. Moreover, the plateau is a truly mobile entity, in that it can move around as per the project's state of progress. For example, during the industrialisation phase, the team can be asked to move to the manufacturing plant (Midler, 1993).

Although every firm in the sector has already applied this general principle at some time or the other (each with its own specific modalities), most Western automakers have also committed themselves to building new design centres which are to be equipped with an architecture that will allow them to implement this modus operandi. The automobile company with the greatest attachment to technological innovation, BMW, one of the first to take advantage of the aforementioned studies, re-organised its R&D centre during the 1980s and built a 5,000 employee centre ("FIZ") that brought together departments which up until that point had been dispersed across Munich. The various departments involved in new product designing were brought closer to one another and placed in direct contact with production problems thanks to an integrated pilot factory that had been built on the site. Above and beyond the development of prototypes, BMW has been able to carry out life size test runs. More recently, Renault has regrouped its R&D activities (as well as its associated parts makers') at its Guyancourt "techno-centre", an entity that should bring more than 6,500 persons to the suburbs of Paris. Even if the other European carmakers have not made the same level of investment here as BMW and Renault, most have recently acted to regroup their previously dispersed design activities. Mercedes for instance has gone from 10 sites to 2 centres: Sindelfingen (7,400 employees) and Stuttgart-Untertürkeim (mechanical subsystems, 2,800 persons). The same trend towards a regrouping of design activities can be witnessed in the supplier industry.

This clustering of carmakers' design activities has happened in urban agglomerations offering a cornucopia of qualified workers (presence of young graduates, proximity of schools, inter-firm mobility for engineers) plus access to diversified external resources (diversity of the various types of know-how that are mobilised during the vehicles' design). This starts with the presence of parts maker and supplier technical centres, and includes easier connections to other R&D sites (Carrincazeaux, Lung, Rallet, 2001).

Technological districts represent another configuration used in the spatial agglomeration of design activities. These are regroupings of diverse sets of actors who find the complementary competencies that they need in the local environment, within the relationships that they entertain with other specialised establishments and with the local institutional infrastructure. We refer here to the emergence of a styling pole in the Barcelona area (asides from Seat, note the localisation here of teams from Renault and VW), one that is based on the

presence of a good industrial design school not far from Sitges. Older technological districts of this sort can be seen in Northern Italy, which offers a remarkable concentration of specialist styling firms, all of whom regularly undertake work for the major carmakers: Pininfarina, Bertone, Ghia, ItalDesign, etc. (Chanaron, 2004).

A number of these firms have developed engineering-related competencies that allow them to play a major role in a new model's design, or even in its vehicle assembly activities, especially when production runs are small (as is the case with coupe and roadster versions, or niche vehicles). It is within this same environment that we also find the small deluxe sports car manufacturers (Ferrari, Ducati, Lamborghini, Maserati) who maintain close relationships with the world of sports. This remarkable density is based on a fabric of highly qualified suppliers and subcontractors, notably in the region of Emilia-Romagna (Bardi, Garibaldo, 2001). England also features this type of configuration, with extended competencies in areas such as sports cars or mechanics, something that allows it to gear most of its related design and manufacturing activities towards Formula 1 motor car racing (Mission économique, 2001; Jürgens, 2004). The ever-greater role being played by these specialised design and engineering firms suggests that such technological districts could be inter-linked throughout the European area. They offer the advantage of clustering niche vehicle design and manufacturing - something that does not occur with high-volume types of production.

3.2.2. The assembly plants' new polarisation

The diffusion of modular production that has accompanied the move towards ever-greater outsourcing has created a new form of polarisation for car assembly plants (Frigant, Lung, 2002). In the most advanced configuration of modular production, the main functions of a carmaker (Salerno, 2001; Chanaron, 2001b; Volpato, 2004) are: to define the architecture for the entire product; to co-ordinate all of the parts makers and suppliers who are responsible for the modules' design, production and assembly; and to organise relationships with the end-user market. The assembly site can cluster a whole group of workshops around the vehicle assembly lines, these being the places where first tier suppliers can produce and prepare the modules that are going to be mounted on the vehicle. There should be no discontinuity between these workshops – they are to be just as integrated as if the firm were managing them internally.

In extreme examples of this configuration, suppliers establish their operations directly inside the transaction principal's plant (i.e., Micro Compact Car at Hambach, where the Smart is made, employing more than 60% of the on-site workforce). In Europe, where the development of a modular logic (Lung, Salerno, et al., 1999) has led to a greater spatial concentration of automobile components makers and manufacturers, this clustering has taken on a weaker form with the development of suppliers' parks located right on the assembly lines' borders. It is true that these supplier parks do correspond to heterogeneous modalities (Larsson, 2002).

Modular production has therefore been the driver behind a polarisation dynamic that is based on an agglomeration around assembly sites which the modules suppliers (FTS) are running themselves. In certain respects, clustering is nothing new, inasmuch as these activities were already being carried out upstream by the carmaker itself. The transformation of Fiat's Cassino (Italy) plant into suppliers' parks where firms such as Textron could take over the carmaker's activities and employees illustrates this fact (*Automotive News*, January 14, 2002). However, externalisation has changed the nature of the relationship, and therefore the issues

(and modalities) that are at stake in the co-ordination process, which now covers relationships between separate firms - each of which pursues its own logic.

First of all, the shift towards modular assembly has reinforced the logistical constraint. The purpose of spatial agglomeration is to make it easier to adapt the modules' preparation to the variety of models that mounted on the assembly lines. Logistics become a strategic issue, inasmuch as they are responsible for co-ordinating the production and synchronous delivery of modules whose variety, sizes and fragility (and handling needs) are constantly rising, even as they are becoming increasingly important in the productive chain. It has only taken logistics a few years to become a new competency in the automobile branch. This has led to the development of firms whose basic competencies revolve around this complex activity. Logistics themselves are subcontracted to specialised firms that get involved both on the manufacturer's assembly site and also in transporting components and modules from the suppliers' plants to the assembly line.

Although transport does comprise an initial justification for spatial contiguousness, it is counterbalanced by the argument that economies of scale reduce the impact of the concentric forces which are at work here. Logistics make it possible to manage the transportation of parts and components, and especially of mechanical subsystems, from a distance (Lung, Mair, 1993). In many cases, suppliers' on-site activities involve a preparation of modules (an assembly) rather than a manufacturing activity. They concern a small number (10 to 20) of suppliers, those who produce components that are voluminous and/or highly variable (i.e., seats).

The second advantage of agglomeration is its ability to resolve in real-time the daily dysfunctions that companies firms have to contend with. These mutual adjustments are enhanced by convergent representations and by the implementation of procedures that are adapted in such a way as to cope with dysfunctions of this ilk, which can be particularly costly with just-in-time. The physical proximity between firms makes it possible to increase the number of opportunities that people have to interact on a face-to-face basis, this having revealed itself to be a particularly rich mode of communication inasmuch as it is a way to mediate a great deal of tacit knowledge (Salerno, et al., 1998). Above and beyond information that can be directly used for problem-solving (for example, a quality shortfall following a process problem), spatial contiguousness facilitates the birth of an organisational proximity (Kirat, Lung, 1999) that is specific to each individual productive site. As is the case within a firm, this organisational proximity makes it possible to create a shared language between different firms' staff members, thereby helping to establish collective devices that allow for a co-ordination of inter-firm activities.

Lastly, spatial agglomeration reinforces the interdependency between car manufacturers and their suppliers (Chanaron, ed., 2001a). Within a modular production framework, having an extended range of competencies is seen as being part of the supplier's brief. Involved since the new project was launched, the supplier is given total responsibility for the design, development and industrial production of a given subsystem or module. This transfer of responsibilities constitutes the main argument in favour of externalisation inasmuch as it allows the manufacturer to refocus on its own fundamental competencies yet to access, at the same time, the cutting-edge competencies of suppliers who are specialised in a field where they can benefit from research and production-related economies of scale and scope. This being the case, the sharing of responsibilities enables the assembler to limit its own (product and process) development costs for the new vehicle - and therefore to reduce its own level of risk.

Some risk does remain, but it is syndicated out since it is partially passed on from the carmaker to the suppliers, whose physical and immaterial investments will not end up being a bad deal if the vehicle turns out to be a commercial failure. For a given budgetary constraint, investing in a project means limiting one's prospecting of other potential customers, even though the stability of the original relationship is not guaranteed. In actual fact, vertical relationships can create failures, thus introducing a state of permanent tension that can potentially lead to a divorce. The contracts that the various parties negotiate are necessarily incomplete and the relationship has to be based on complementary reciprocal commitment mechanisms that facilitate the contracts' execution as well as any necessary adaptations (Williamson, 1985).

Spatial integration is part of these mechanisms (Frigant, Lung, 2002). The presence on one and the same site of suppliers' and assemblers' establishments limits the redeployability of their respective assets. We are referring here to Williamson's site specificity concept, although it can be interpreted somewhat differently. The assets that are being developed can be construed as forms of mutual commitment. By setting up operations close to the assembler's premises (or even inside of them), the supplier is creating a situation in which its assets can be taken hostage, given that a divorce between the two parties could cause major losses. Inversely, if the supplier owns its own premises, any break-up would mean that the supply chain transaction principal is losing out on having a nearby supplier. The opportunity cost would be especially significant if the supplier were to decide to keep its establishment open in order to supply another manufacturer (and/or if little land were available onsite).

Geographic proximity therefore offers another advantage, one that stems from the physical interdependency of the assets it creates - an interdependency that enhances contract execution by contributing to a convergence between the interests of the different parties to the contract. Whether or not this mechanism is efficient depends on the nature of the investments being agglomerated. We should point out that the agglomeration of suppliers does not impact manufacturing activities as much as it affects module preparation and sub-assembly workshops. This reduces the parties' commitment.

Moreover, this form of spatially organised production activity does not occur in a vacuum. An initial stumbling block is the management of the employment relationship. The diffusion of assembly and modular production principles will be encountering a few hurdles in the central regions, due in part to employee opposition. In many instances, there are still significant wage inequalities between car manufacturers (a unionised sector) and suppliers (who are often poorly defined). Moreover, such disparities can be even greater with a few widely subcontracted service activities (i.e., logistics). The clustering of a whole group of firms that are different from one another (but which interact closely, inasmuch as they are all oriented towards one and the same productive project) is likely to lead to the appearance of specific workforce management problems such as those that arose at VW's Resende (Brazil) plant (*c.f.*, Ramalho and Santana, 2002), and at MCC plant (Hambach).

If each of these firms manages this problem autonomously, the heterogeneous statuses and pay systems of workers who are all operating on one and the same site could create tensions and conflicts, something that would increase failure risks in a system that has been rendered vulnerable by the multitude of interactions whose co-ordination has become necessary. Disparities between the varying wage-earning situations can create feelings of frustration that will lead to "passive" forms of worker resistance which translate people's reluctance to adopt the kinds of co-operative behaviour that the implementation of the necessary collective co-ordination systems requires (hence problems with quality, de-phasing,

etc.). If one of the firms (often the manufacturer) offers a more favourable employment situation than the others do, this can cause labour instability phenomena (usually for the parts makers), i.e., a high rate of turnover as workers try to be hired by the best paying firm whenever a new opportunity arises. Of course, this latter firm may be a better position to assess the employee's capabilities if it is familiar with the activity that s/he has been carrying out on behalf of his/her former employer, the supplier. Here we are entering into a trilateral game (two firms plus the employee) in which geographic proximity opens the door to opportunistic behaviour. Nevertheless, it is hard to imagine that wage and employment conditions disparities will persist in situations of spatial agglomeration, unless we anticipate that collective union action is to decline once and for all.

A second stumbling block is related to actors' desire to create a modicum of coherency between the various actors' technological and organisational competencies. In modular production, the management of inter-firm relationships becomes a major strategic issue inasmuch as co-operation turns into the predominant mode of co-ordination for such relationships (Lung, 2001). Proximity in and of itself is not enough to resolve the problems caused by attempts to create a modicum of coherency between technological principles that are quite distinct from one another (Graziadio, Zilbovicius, 2003). Outsourcing, which involves refocusing on one's core business and basic competencies, is justified by the fact that is difficult to manage internally a diversified set of activities that do not all call upon the same type of competencies. During the final assembly phase, we again encounter the problem of how to co-ordinate technological competencies that have been voluntarily separated – it can be difficult to interconnect technical systems that are distinct (i.e., the interfaces between plastics-electronics-metals) and which are not compatible *a priori*. The various modules' interfacing modes need to be perfected. This entails developing new technical solutions (Segrestin, Lefebvre, Weil, 2002) that can only be discovered on a step-by-step basis - especially since they infer the co-ordination of a wide range of actors, all of whom possess specific competencies and who must learn to work together. Of course, spatial proximity should facilitate the interactive process that is needed for such mutual adjustments to take place. However, when this is carried out under the aegis of a manufacturer who is fulfilling a system integrator's role, the adjustment has to be made by a large number of actors: those who are working at the assembly plant and at the module preparation sites that are often agglomerated in the new configuration; but also the various departments (notably those that are in charge of the product's development or methods) which are involved at each level in order to create a modicum of coherency with the work being carried out upstream.

Such proximity configurations will vary, depending on activities they encompass. Modular production infers the existence of spatial concentration dynamics in a variety of locations. This mainly means a co-location in the central regions during the products' design and development phase, as well as a co-presence of production activities. The spatio-functional separation between these two activities remains the rule. It preserves the disjunction between the design spaces and the production space, thus weakening the requisite link between design and production. This separation is likely to reveal certain failures, given that the automobile product is still characterised by a high degree of systematic coherency, one which assumes that close interactions exist between these two moments. The fact that the increasing remoteness of the design-manufacturing link is a product of the design activities having been regrouped into large centres provides a partial explanation for the industrialisation problems (delayed launch of new models, quality issues) that the automobile industry has been experiencing with some of its recent products.

4. Conclusion

This double-faceted trend, characterised as it is by the extension and by the reconfiguration of the automobile industry's geography, is not specific to Europe. Specific configurations thereof can be detected in other regions of the world, ranging from North America to Southeast Asia. The major trend in the automobile industry has become the enlargement of borders following the progressive slippage of production towards new spaces (Carrillo, Lung, van Tulder, forthcoming). We can also find clustering dynamics in new emerging countries (Jürgens, 2004), whether in Brazil (Salerno, et al.1998) or Thailand (Lecler, 2002). Collective learning dynamics are obvious even in the *maquiladoras* of Northern Mexico, which have become more than simple turnkey plants (Lara, 2002; Carillo, Lara, 2003).

In Europe, however, the great variety of the countries and actors involved - at a corporate level (working for or with the manufacturers and suppliers) or at an institutional one (starting with the labour unions) - means that what we are dealing with is a wide array of diversified spatial configurations. These are not stabilised arrangements we should expect will become permanent features. Instead, they are transitory forms that have been exploring new productive solutions in the light of compromises that have only been set up on a provisional basis (Boyer, Freyssenet, 2000). The intensity of the sector's ongoing technological and institutional changes, and the socio-economic limitations it faces, raises questions about the sustainability of the changing automobile geography that is just beginning to take shape in Europe.

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Annex 1 – Automobile production in European Union 1990-2000

Countries with production over 100 000 vehicles per year

Country	1990			2000			Change		
	Passenger cars	Industrial Vehicles	Total vehicles	Passenger cars	Industrial Vehicles	Total vehicles	Passenger cars	Industrial Vehicles	Total vehicles
Austria	10 473	5 716	16 189	99 000	25 811	124 811	88 527	20 095	108 622
Belgium *	313 400	50 151	363 551	912 233	121 061	1 033 294	598 833	70 910	669 743
France *	3 294 815	474 178	3 768 993	2 923 093	406 943	3 330 036	- 371 722	-67 235	-438 957
Germany	4 660 657	315 895	4 976 552	5 131 919	394 700	5 526 619	471 262	78 805	550 067
Italy	1 874 672	246 178	2 120 850	1 422 281	320 015	1 742 296	- 452 391	73 837	-378 554
Netherlands	121 300	29 832	151 132	215 085	41 697	256 782	93 785	11 865	105 650
Portugal	60 221	77 466	137 687	193 651	55 286	248 937	133 430	-22 180	111 250
Spain	1 679 301	374 049	2 053 350	2 385 639	666 515	3 052 154	706 338	292 466	998 804
Sweden	335 853	74 415	410 268	396 170	115 164	511 334	60 317	40 749	101 066
United-Kingdom	1 295 611	270 346	1 565 957	1 621 228	187 072	1 808 300	325 617	-83 274	242 343
European Union (consolidated)	13 061 853	2 688 509	15 750 362	14 906 571	2 693 033	17 599 604	1 844 718	4 524	1 849 242

* Due to changes in the convention relative to the geographical allocation of vehicles production in Belgium and France occurred in 1996, data are not directly comparable between 1990 and 2000.

Source: AutoNews, CCFA

Annex 2 –Automobile production in Central and Eastern European Countries 1990-2000

	1990			2000			Change		
	Passenger cars	Industrial Vehicles	Total vehicles	Passenger cars	Industrial Vehicles	Total vehicles	Passenger cars	Industrial Vehicles	Total vehicles
Bulgaria	14 600	8 800	23 400		500	500	- 14 600	- 8 300	- 22 900
Yugoslavia	289 362	29 754	319 116				- 160 362	- 29 754	- 190 116
B&H				2 500		2 500			
Serbia			-	9 500		9 500			
Slovenia			-	117 000		117 000			
Czechoslovakia	187 773	28 587	216 360				394 082	- 895	393 187
Czech Republic				428 205	27 408	455 613			
Slovakia			-	153 650	284	153 934			
Hungary		9 003	9 003	148 200	3 400	151 600	148 200	- 5 603	142 597
Poland	283 890	51 604	335 494	653 140	73 322	726 462	369 250	21 718	390 968
Romania	90 000	11 400	101 400	64 181	13 984	78 165	- 25 819	2 584	- 23 235
Turkey	175 561	33 489	209 050	295 430	133 471	428 901	119 869	99 982	219 851
Non consolidated	1 041 186	172 637	1 213 823	1 871 806	252 369	2 124 175	830 620	79 732	910 352

Source: AutoNews

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