The OEM-FTS relationship in automotive industry

Giuseppe Volpato

Dipartimento di Economia e Direzione Aziendale,
San Trovaso 1075, 30123 Venezia, Italy
E-mail: volpato@unive.it

Abstract: This paper is part of the project named ‘Coordinating Competencies and Knowledge in the Auto Industry’ (CoCKEAS) carried on by some research groups associated to GERPISA International Network and subdivided in five work packages. This one is conventionally indicated as workpackage N.1. It is focused upon the analysis of the evolution of the relationship between automakers (Original Equipment Manufacturers – OEMs) and the specific type of suppliers who directly interact with them, also carrying out the task of coordinating a hierarchy of other suppliers which are located upwards in the automobile supply chain. This specific type of suppliers, occupying the higher place in a multilevel hierarchy, are labelled First Tier Suppliers (FTSs). The paper analyses the recent evolutions that are characterising this part of the supply chain with particular attention to: the redefinition of the division of labour between OEMs and component suppliers; the transformation induced by the process of internationalisation and globalisation; the growth in outsourcing; the design of shared platforms; the impact of innovation and modular production on the restructuring of the automotive industry; the major trends in the new pattern of production processes organisation and the likely transformations induced by the growing role of ICT.

Keywords: automotive industry; supplier-customer relations; supply-chain management.


Biographical notes: Giuseppe Volpato is full Professor of management and business economics at the Faculty of Economics, Ca’ Foscari University of Venice. His main research interests include: industrial economics; strategic management; management of innovations; and the theory of the firm. His research activities can count on a worldwide network of research partners, both industrial and governmental, including all the leading car makers operating in Europe, dealer bodies, component and service suppliers. He is a member of the Società Italiana degli Economisti, Accademia Italiana di Economia Aziendale, Società Italiana di Marketing, European Business History Association. He is also a member of the GERPISA Steering Committee; Senior Adviser for the ICDP (International Car Distribution Programme); and a Research Fellow of the IMVP (International Motor Vehicle Programme) of MIT. He has published seven books and more than 70 essays and articles.
1 Introduction: objectives and methodological approach

This paper, conventionally named inside the CoKEAS project, workpackage No. 1 is focused upon the analysis of the evolution of the relationship between automakers (Original Equipment Manufacturers-OEMs) and the specific type of suppliers who directly interact with them, also carrying out the task of coordinating a hierarchy of other suppliers who are located upwards in the automobile supply chain. This specific type of suppliers, occupying the higher place in a multilevel hierarchy, are labelled First Tier Suppliers-FTSs (Figure 1).

As will be discussed later, the relationship between OEMs and OESs in general, and the one between OEMs and FTSs in particular, has undergone a profound evolution over time. The work carried out by various university research groups who have come together into the team in charge of developing workpackage No. 1, had the task of analysing such changes and attempting to develop some evaluations over the most likely future trends, mainly with respect to the outcome of the deployment of the potential offered by the new tools of Information and Communication Technology (ICT).
2 The transformation in the OEM-OES relations after the crisis in the 1980s

2.1 The redefinition of the division of labour between OEMs and component suppliers

One of the most significant turning points in the complex evolution of the international automobile industry is the 1979 oil shock. Such a crisis, linked to a strong and fast rise in motorisation costs, had various effects, but probably the most relevant one was the coming together of consumer requirements (i.e. the need for more compact cars and more fuel efficient engines) and then of the features of the most developed markets, which before were characterised by significantly different needs. With the oil shock the North US, European and Japanese markets found themselves much more similar than before, and this increased the import-export flow of vehicles, and accelerated the process of competitive confrontation among companies. Suddenly automakers in the Western hemisphere realised they were less competitive facing the challenge brought forward by Japanese automakers [2,3]. Besides the economic effect generated by the competitive disequilibrium among companies, in the Western world there was a true psychological and cultural shock since the new reality undermined at their roots managerial beliefs and methods, which had been consolidated over time. Hence the start of a stage of profound reorganisation, both on the managerial methods and on the actual innovation and manufacturing strategies [4–10] with eyes focused on the differences between the Western and the Japanese manufacturing approach, seeking explanatory variables for the competitive difference.

One of the areas in which the different approach between East and West was most evident was supplier relations. Western automakers were much more vertically integrated than their Eastern counterparts, since they preferred to manufacture a great share of their components themselves. At the same time they had relations with a much higher number of component suppliers. The relationship between OEMs and OESs were highly competitive since automakers wanted considerable freedom in choosing suppliers, privileging on a case by case basis the supplier offering the most attractive conditions (prices, quality, services). Such a behavioural model, named ‘Exit’, is based upon the interchangeability of suppliers, depending upon their capability to satisfy the needs expressed in every single case by automakers, and differs from the behavioural model named ‘Voice’. This second approach, which characterised the main approach of Japanese automakers, was based upon a strong interaction between customer and supplier aimed at consolidating their partnership, and to deal with any problem (defects in supply, efficiency losses, etc.) which could emerge over time, through forms of mutual cooperation. As a matter of fact, Japanese automakers had developed relations with their suppliers which were much more cooperative and structured. On the one hand, every Japanese OEM selected a limited number of FTSs, with whom to have systematic partnership relations; on the other hand, the supply chain of Japanese automakers was organised on a multilevel structure, in which every first-tier component manufacturer was in charge of coordinating a group of suppliers belonging to the tier below [11–16].
2.2 The importance of supplier contribution to vehicle innovation

Soon the importance acquired by innovation in the automobile product, due first to the oil shock and then to the outburst of the competitive challenge in all main automobile markets, put a marked emphasis on the strategic relevance of the role of component suppliers, and in particular of first-tier ones, since it became evident that the intense innovation effort in the technological content of models, in the reduction of product life cycles, and in the widening of the product line, could not be pursued without a tighter mutual cooperation [17–18].

As a consequence there was a large imitative process, through which Western automakers copied Japanese managerial practices, mainly in the field of supplier relations:

- first there was a marked process of evaluation of technological, organisational and financial potential of FTSs, followed by a process of selection of suppliers who were most suitable
- then followed a marked process of manufacturing decentralisation towards suppliers to whom the task of investing into component innovation was more and more frequently assigned
- one of the most relevant objectives of such a process was the concentration of purchasing orders, so that the chosen suppliers could achieve the scale economies needed in order to make the evolution in place economically sustainable – this required huge investments and the acquisition of competences previously belonging to automakers
- finally new forms of organisational and information coordination were studied, in order to activate supplier cooperation from the early stages of new product design (co-design), so that the speed and the efficiency of the process could be improved, stock levels dramatically reduced, and on-time deliveries (just-in-time) were achieved in assembly activities.

On the whole, one can say that, albeit with varying forms and details in each individual case, all Western automakers did base their development heavily upon the Japanese managerial approach, and did adopt the most relevant and effective elements.

2.3 The persistence of different partnering models between ‘Voice’ and ‘Exit’

However, albeit with a coming together of the automaker-supplier relationship models in the two industrial poles, it remained evident that the Western managerial style (and the North US one in particular) were inspired by the ‘Exit’ model while in Japan the ‘Voice’ model had many applications, as a legacy of commercial traditions in that country which, albeit having abandoned the structure inspired by large industrial groups integrated through cross-participations (zaibatsu), did maintain strong partnership relations between companies through groups defined as quasi-integrated (keiretsu).

The persistence of behaviours inspired by the ‘Exit’ model was more visible among US automakers. This was, firstly, because the most important automakers (the so called ‘Big Three’) had in the 1980s many component manufacturing activities, and were inclined to consider such activities as equivalent to FTSs, and then to consider less strategic for
their development the relationships with other suppliers. Secondly, this was because these automakers, having been involved for a long time in a wide range of markets, were starting a process of international comparison of supply opportunities which were present in the various countries. They started to develop forms of systematic comparison of the efficiency and effectiveness levels of suppliers in the various national markets, aiming at selecting the most efficient ones, and to negotiate with them a sort of exchange with large orders (generating scale economies) in return of more favourable conditions, based also upon agreed policies of systematic reduction of prices for individual components (price targeting).

This tendency was reinforced in the early 1990s by the process of manufacturing internationalisation of the main automakers, which was linked, on the one hand, to the tendency to make cars to be marketed in a range of markets (world car) and, on the other hand, to the direct investments carried out in countries usually identified as Newly Industrialised Countries (NICs) which were starting a stage of development of motorisation [19]. In substance, the development of manufacturing activities in emerging economies (such as Brazil, Argentina, Poland, Turkey, China, etc.) required the installation, near to the new markets, both of final assembly managed by automakers, and of component supply plants [20–24].

3 The transformation in the 1990s

3.1 The transformation induced by the process of internationalisation – globalisation

In the mid 1990s, the stage of creative imitation by Western automakers with respect to technical and organisational solutions developed by Japanese automakers, and by Toyota in particular, was reaching completion and a new stage of intense manufacturing reorganisation started, triggered by the enhanced process of internationalisation of the automobile industry, and by forms of globalisation of automaker strategies. With respect to internationalisation, the phenomenon is certainly not new for the automobile industry, which since the early 20th century had recorded significant import-export flows among markets, and cases of relevant direct investments abroad [25]. However, the breadth of the new wave of internationalisation of activities, linked to initiatives of acquisition, mergers and alliances between automakers, was such to profoundly modify the nature and the forms of the competitive process. At the same time, such a fast and diffuse worldwide extension of activities of automakers and of their suppliers required forms of coordination between production areas which were deeper and more articulated than in the past. Such a need for ‘organisational and decisional integration’ of all the main industrial activities – from purchasing to R&D; from design to manufacturing; from logistics to marketing and distribution – labelled ‘globalisation’ did stimulate new and increased needs to rationalise the activities in the whole automobile supply chain which has manifested with growing intensity since the mid-1990s [26–28].

The analysis of the recent evolution of the automobile supply chain shows that an extraordinary reorganisation in the whole industry structure has begun [29–34]. This reorganisation mainly stems from the effort carried on by OEMs to develop a new relationship with end customers, based upon a make-and-deliver-to-order approach, as
opposed to the previous one, based upon the stock order approach. This implies a radical transformation in the internal organisation of automobile firms, but it also requires a profound reorganisation in the component supply chain. As a matter of fact, the component supply chain has been under pressure for about a decade, towards higher efficiency levels, but until now this pressure mainly related to forms of internal firm organisation (OEMs and OESs), and to their work methods. The new feature of the emerging programme of supply-chain reorganisation lies in the strategic dimension of the whole stream, mainly in the forms of interaction between different subjects in the chain: customers, manufacturers and suppliers. This transformation can be seen as a move from a ‘production’ rationalisation of the component supply chain to a ‘strategic’ rationalisation, whereby production rationalisation means a rationalisation mainly (although not exclusively) based upon innovations applied on component manufacturing processes, while strategic rationalisation means a much wider process, which can influence the forms of component manufacturing, but which involves the competitive structure of automobile firms, and in particular, their way of interacting: from design of whole vehicle to manufacturing and distribution of the final product to drivers. What we want to underline is that while the first thrust towards rationalisation in mainly applied within individual firms in the automobile supply chain, the second mainly applies to the way of interaction among firms in the chain, as elements of a more and more articulated and complex system [35,36].

The scope and the radical nature of the transformation in progress cannot be immediately grasped in its amplitude, since the objectives of automobile firms have not changed. They still aim at the supply of innovative components, capable of ensuring higher standards, to the final product, with lower costs. But this objective cannot be pursued further in an effective and efficient way with the present structure of the manufacturing chain. About one decade ago, when competition triggered a further rationalisation process, known as lean production [37,38], this has translated into a internal reorganisation of supplier firms (as well as some reorganisation within automobile firms), through the definition of higher quality standards: in products, in manufacturing processes, and in servicing. This led to a stage of great managerial and technological effort which has generated considerable results [39]. Now, however, after this stage of intense innovation, the process of production internationalisation [40] on a worldwide scale and the new stage of mergers and acquisitions, rapidly accelerating after May 1998, with the merger between Daimler and Chrysler, has led to a wider competitive confrontation, which requires broader and more complex initiatives than the previous ones, which were mainly aimed at higher internal efficiency within individual supplier firms. This previous line of action will continue further, but with less and less relevant results.

From the organisational model of the lean organisation, the greatest share of the potential for improvement has been extracted. In order to achieve additional important efficiencies of a structural nature, and not based upon a continuous improvement process (kaizen), significant but marginal, a new and more advanced organisational model must be adopted, where the whole structure of the component supply chain is under scrutiny. The transformations in the last ten years have turned out to be undoubtedly effective, and have led to leaps both in innovation and in cost reduction, but margins of future improvement have become gradually thinner. If one wishes to maintain the trend of improvement expressed over the last decade, one must shift to a new organisational
model which encompasses not just the internal structure of individual component manufacturers, but the whole structure of the international automobile supply chain.

3.2 The objectives of the reorganisation

As is known, the pressure towards this profound transformation stems from the quest of automobile manufacturers for higher profitability levels, which during recent years have decreased, along with the growing financial needs generated by production expansion in emerging markets [41]. The ‘hunt’ for higher profitability levels, made more important also by the inter-industry competition in capital acquisition brought by the new economy, lies in a set of dimensions. However, it can be summarised as a hunt for larger scale and scope economies, accomplished through forms of mergers and acquisitions, and the focus by car manufacturers on strategic activities which are believed to be capable of providing higher added value. On the whole, the key fact is to externalise all activities which a supplier can perform at a lower cost compared to an integrated production, allowing a reduction in total capital investment and an increase in the net profit of both kinds of firm: suppliers and OEMs. The effective development of this scheme would lead to a higher ROE, and thus to the possibility of fairly compensating all stakeholders, which represents a necessary condition in order to gain the substantial financial means required by the internationalisation of the manufacturing structure and by the merger and acquisition operations.

This strategy of externalisation of investments and costs, but not of rates of return which should rather increase, moves through a reorganisation of the supply chain to an extent which would have appeared unthinkable just a few years ago [42,43].

From a general point of view, this transformation process can be synthesised as a twofold evolution of the division of labour between car makers and component suppliers concerning design and body final assembly. Looking at the design area, the new tendency is directed towards the passage from one in which the car makers buy parts manufactured on the basis of their drawings [44,45] to that in which the components suppliers, following a car makers’ press, take the lead of a wider activity of R&D for the proposal of technological innovative components. Even for body final assembly the new tendency is towards an enlargement of the role of FTSs. To them, car manufacturers ask the delivery of modules (as a complex of parts already assembled and tested) and a deep work of coordination of the second- and third-tier sub-suppliers. This change aims at a bunch of reduction of costs and organisational simplification such as: a shorter assembly line, less investments for machinery; less worker on the line; less inventory due to synchronised deliveries and so on [46,47].

It is easily understood that this twofold line of evolution discloses many difficulties in the field of integration and coordination among the players of the supply chain. Furthermore, the solutions of the new problems generated by the new structure of the division of labour involve aspects which are rather conflicting. For example, on one hand car assemblers are interested to maximise the upstream decentralisation of part manufacturing because, in the short term, this reduces the total amount of expenses in either areas of R&D and production operations. But, on the other hand this evolution worries the car makers because, in the long term, this could imply, for them, a lost of relevant competences as far as the overall design process and the capability to magnify
the perceived value of the car brand. As a matter of fact, this competence dilution could reduce the bargaining power of car assemblers vis-à-vis their most important component suppliers.

On the whole this articulated delegation from car makers to FTSs of new responsibilities on research, design, manufacturing and assembly (for example, in the FIAT group, [48]) came through a wide array of initiatives whose key points are:

- the growth in outsourcing
- the concentration in the number of FTSs
- the co-design
- the design of shared platforms
- the integration of systems and modularisation
- from the supplier parks to consortiums
- the global sourcing.

All these initiatives, which must be moved further in parallel to the process of geographic expansion in all consolidated automobile markets (USA, Western Europe, and Japan), and more recently in all emerging markets, must then be linked to a scheme of integrated management which can be referred to as globalisation.

### 3.3 The growth in outsourcing

The most evident measure of the diffusion of outsourcing lies in the gradual reduction in employment levels of car manufacturers, linked to a marked increase in the production volume. A clear example of this trend is General Motors. Total employment for this manufacturer decreased from 761,000 units in 1990 to 388,000 units in 1999, though this same period saw a growth in car and truck production from 7.45 to 8.78 million units. As is known, a considerable share of this change has been accomplished through the de-merging of internal component manufacturing activities which led to the establishment of Delphi, but undoubtedly the growth in outsourcing extended far beyond this de-merging operation, which has been anticipated or followed by many other manufacturers such as Daimler-Chrysler, Ford, Fiat and Renault, which were previously more highly vertically integrated. The outcome of this policy has generated also a great increase in the size of the component supply market, which presently is estimated at about $1,000 billion, for cars alone.

### 3.4 The concentration in the number of first-tier suppliers

As has been said, the effectiveness of production decentralisation is based upon the hypothesis that the supply system can take the place of direct production by OEMs, with reduction in component costs. Car manufacturers try to favour this objective through supply concentration and the more frequent adoption of relationships based upon single suppliers. This led to a transformation of the supply system from a flat structure, where each supplier, even of small size, had direct relationships with the car manufacturer, to a highly hierarchical structure, where only FTSs have direct contacts with the OEM, and are
in charge of setting up, in turn, a hierarchical system of specialist sub-suppliers [49]. The new division of labour between automobile firms and suppliers [50] has in turn generated new opportunities of merger and acquisitions with a dramatic reduction in firms specialised in production dedicated to the automobile industry. According to estimates by the Economist Intelligence Unit, the number of suppliers has declined dramatically over ten years, from approximately 30,000 in 1988 to less than 8000 in 1999.

But this is just one side of the picture, although one of the most important in the transformation cycle triggered, given that individual suppliers are also redefining their respective areas of technological competency. In the previous ‘flat’ supply scheme each supplier tried to maximise the range of products offered, as this tended to simplify the procedures of buyer evaluation and selection by car manufacturers. Now, in the hierarchical structure, this aspect does not represent an advantage, but rather a weakness since a broad product catalogue implies too large an investment and difficulties in sustaining an adequate level of innovation on the whole range of products offered. Hence, the supply chain is experimenting a process where FTSs are focusing on a narrower and more homogeneous range of products, obtained through sale of activities where one is less competitive, and purchase from other suppliers of those where one already has a strong specialisation [48].

Furthermore, the firms’ concentration stems from specific technical needs. As suppliers must be activated with short lead times, if one wants to make them capable of supplying an effective development on parts to be inserted in new models, it is necessary to carry out a process of strong information exchange with manufacturer designers, and the establishment of a true culture sustaining co-design [51–53].

3.5 The co-design

The quest for a faster new product introduction has induced most OEM to dramatically change the scope and the structure of their product development process. In the wake of the success deserved by the Toyota Production System, many authors underlined the importance of a stricter relationship between the car maker and its supply chain [54,55]. But we have to acknowledge that there are many different kinds of relationship among car makers and suppliers, particularly in the field of new product development [56].

In literature we find a procurement based on:

- ‘supply proprietary part’, in which parts are standard items based on a catalogue proposed by the supplier
- ‘black box part’, in which the car maker defines the functional features the component (or the system) must perform, but the product development responsibility are totally left to the suppliers
- ‘concurrent engineering part’, or ‘co-design part’, in which there is a mutual exchange of competences and information between the car maker and a specific innovative supplier for a common development of a part or a car system [57–59].

Co-design part development is considered a very complex task, but very promising in order to achieve relevant results in innovation, time-to-market shrinkage and cost reduction.
The successful involvement of suppliers in co-design of new products is dependent on engineering, organisational and relational issues. However, the outcome of the new productive relations set up with competent suppliers by the OEMs in the automotive sector, is not clear and straightforward. Supplier involvement at a very early stage of the OEM product development process, in fact, has implied not only a mere redefinition of the design activities, but also a dramatic change in the management of the OEM business processes and knowledge management. Supplier involvement in OEMs’ product development has led to:

- the relocation of knowledge and tasks within the supply chain
- a major organisational change within the OEM and in the buyer-supplier relationship (information flows, team staffing and building, etc.)
- the redefinition of the tools (relational and based on engineering practices) used to implement the relationship.

These considerations show that the problem of integration in co-design between OEM and OES is very complex. It could be simplified by the use of the same software tools, by standard solutions for data management and by proper communication culture. All these factors contribute to changing the nature of the buyer – supplier relationships and, at the same time, the way car makers design new vehicles. As a consequence, not only the division of labour between the different parts of the auto manufacturing value chain has changed, but also the coordination of competencies required in the design, engineering and manufacturing activities.

The innovativeness of the co-design effort enables the car makers to be much more active in leading the competitive edge. It is noteworthy that the capability to cooperate in concurrent engineering is not a feature reserved to FTSs or to big suppliers in general. In fact, car makers seem to be more willing to cooperate with medium-sized suppliers than huge suppliers. This fact probably could be explained by the difficulty giant organisations have in sharing sensitive competencies and data. The contribution made by small- and medium-sized companies is particularly valuable, thanks to their creativity and flexibility.

### 3.6 The design of shared platforms

The suppliers’ move towards scale and scope economies can be adequately enriched only with forms of further standardisation of products by car manufacturers. However, it is now clear that ‘simple’ forms of standardisation based upon the offer of world cars have proved to be a failure. This has already emerged from the difficulties encountered in the transfer of products in more advanced markets of the triad (USA, Western Europe and Japan), but the inadequate standardisation of models is going to worsen as emerging markets will consolidate (Eastern Europe, Latin America, China, India and so on).

As a consequence, car manufacturers are experimenting with new forms of standardisation, which are more refined and complex, but partial, since they aim at sharing parts without standardising models in order to maintain margins of customisation in different national markets and with respect to the needs of the individual end customer [61–64] as well. This process moves through the design of ‘common platforms’, capable of using a considerable number of common sub-systems, but leaving room to develop the body and other elements which can be perceived by the consumer according to exigencies.
of different markets. It is a crucial step which no car manufacturer can claim to have satisfactorily accomplished so far, but towards which all manufacturers, with no exception, are striving, aware that it is the only way to solve the contradiction between market variety and manufacturing standardisation.

This kind of evolution is particularly crucial for European and Japanese Automobile Groups which, besides presenting different brands with specific peculiarities, have a keen desire to serve many differentiated markets. In the past, this goal bore a multiplication of models and options with negative effects on the exploitation of economies of scale and with relevant difficulties on spare parts logistics and new cars delivery. It deals with a new kind of organisational scheme, not entirely controlled and with innovative solutions still under test and evaluation [65,66].

3.7 System integration and modularisation

Another key element of the strategic reorganisation of the automobile supply chain lies in designing a vehicle as a sum of integrated systems, and in assembly’s modularisation [67]. These are different things which are worth distinguishing, although they evidently share common aspects. Vehicle design by integrated systems stems from the fact that the vehicle can be described as a set of functional elements, each in charge of carrying out specific tasks: production of moving energy and its transmission to wheels (engine and powertrain), the braking system, the steering system and the exhaust system. Functional systems are a group of components that are integrated by a functional link, rather than either proximity location or physical coupling, like modules. For example, the different parts of a brake system or a steering system are located in a separate area of the vehicle and incorporated into several different modules, but they will have been designed to work together as an integrated device.

In the past, these systems had a low degree of internal integration from the design point of view, as they were made of individual mechanical elements which could be drawn and formed with limited forms of interdependence. Presently all these functional systems feature a very high degree of internal integration due to the fact that their operation is managed by electronic devices. In substance, each functional system is not the mechanical sum of many different parts, but it represents an integrated complex which can be designed in an optimal way only through an unitary lead, managed by a supplier acting as system integrator [68].

On the other hand, the aspect of modularisation does not refer to the design of individual parts in a functional system, but focuses on its assembly and testing activities to be carried out in the stage immediately preceding its transfer onto the vehicle final assembly line. Modules are sets of components that are supplied to the vehicle maker ready assembled. Additionally, they are delivered just-in-time or in a sequence synchronised with the car maker’s final assembly schedule. The OEM may also assemble modules in-house, as part of a process of reducing the final assembly line complexity, but frequently modules are coupled with a growing level of outsourcing.

At the early stages of modularisation of the automobile industry, modules were a simple collection of parts for off-line assembly, but increasingly modules are being designed at complex units which incorporate multiple functions. Examples of modules includes seats, doors, cockpits, front-ends and suspension corner modules. Each of these can include components from two or more major vehicle functional systems.
The module is then a macro-component, made with many parts, which is possible and economically convenient to assemble and test outside the vehicle final assembly line, in order to increase simplicity and speed. In some cases, it can happen that a functional system coincides with a module, as in the case of powertrain and exhaust system, but in other cases this does not happen. For example, the vehicle lighting system or the steering system clearly represent functional systems, but their complexity and their extension over a variety of vehicle parts prevents their pre-assembly as modules [69–73].

In spite of all the progress made in the realisation of module strategies, this new division of labour between OEMs and OESs is still in its infancy. But some experts [74] forecast a bright future for modules. The present overall market value of supplier modules is estimated at US $ 40 billion. All in all the module market is expected to take off over the next years. According to SSSB and AutoBusiness research the market volume should in excess of US $ 100 billion by 2010.

SSSB and AutoBusiness are convinced that further development of modularisation strategies will unfold according to the following four steps.

• The supplier manufactures modules according to EOM specifications. The OEM develops and test the modules and leads the supply chain. According to the authors’ opinion, this concept currently applies to approximately 80% of all supply agreements in the automobile industry.

• The OEM assumes development responsibility and wields extensive control over buying. Within certain limits supplier have a free hand in selecting their sub-suppliers. Assembly and sequencing are the OESs’ main task. This stage is typical of cooperation arrangement in supplier parks (see below).

• The OEM specifies technical demands and requirements and shares development activities with the OES. Subsequently suppliers hold the entire responsibility for manufacturing modules and supplying them to OEM operations.

• At this stage suppliers – at least theoretically – are accorded extensive freedom to revise modules, possibly present new concepts and solutions.

3.8 From ‘supplier parks’ to ‘consortiums’

A transformation induced by the search for higher integration between OEMs and OESs has generated, among other things, opportunities to establish parts manufacturing, assembly and control sites in plants which are very close to automaker final assembly lines [75,76]. Such marked proximity of the partners is seen as a required condition in order to ensure both the necessary speed of supply for small component batches, synchronised with the pace of the final assembly line, and the speed of intervention in the case of defects. This led to the more systematic establishment of ‘supplier parks’ represented by suppliers locating themselves close to assembly plants. In practice, it is a solution which, albeit costly for suppliers since it requires the establishment of more manufacturing units located near the major assembly plants of the customer, has many advantages for the automaker, since it ensures a quality of delivery which is much higher than long-distance shipment, mainly with respect to lead times in case of problems reported in the final assembly [77].
The number of supplier parks activated by automakers in the various continents is currently already significant, as there are about 20 of them in Western Europe alone [78]. However, they are due to increase further given the tendency to manufacturing modularisation with the effect of producing a new relevant change in the automaker–supplier relations. Global outsourcing of modules has grown hand in hand with the development of supplier parks. Supplier parks, in this context, are not simply industrial parks with a concentration of suppliers for a particular vehicle manufacturer. Instead they are a distinct area near or inside the car maker’s final assembly line with the suppliers’ operations tied into the sequence of the production process [79].

Since a module represents a macro-component of the vehicle, final assembly as well can be organised as an assembly of modules which can be directly carried out by FTSs in charge of supplying them. The first example of this new assembly approach, which implies also a new form of division of labour between OEMs and OESs, was developed in Resende (Brazil) in a Volkswagen truck plant [80,81]. However, such a new organisational form is regarded with much interest by automakers since it allows a relevant reduction in their investments. This is true both when suppliers are directly developing assembly lines for modules, but also when the automaker maintains the ownership of plants, but renting (with fees related to the volume of products accepted, depending on the quality levels) the areas and tools needed to FTSs who manage the activities.

3.9 Global sourcing

Last, but not least, comes global sourcing (a buying system based upon a world-wide monitoring and selection of most convenient suppliers). A firm has a global sourcing system in place when it can source parts through a choice which compares supplier offers on a worldwide scale. The system requires a specific organisational structure which allows not just the monitoring of a large number of potential suppliers scattered around many continents, but also a system of evaluation and constant control for supplier performance (actual and potential), whose costs can be borne only by major car manufacturers. As is known, ‘integral’ applications of this form of globalisation do not presently exist, but scholars and practitioners agree in expecting this form of buying strategy to be enhanced [82].

According to some, this system would allow the selection of suppliers with the best quality/price ratio. The ‘would’ relates to the fact that on the one hand this principle of globalisation clashes with other forms of globalisation and, on the other hand, the fact that it is systematically more convenient has yet to be demonstrated. With respect to the first aspect, it is clear that a global sourcing supply clashes with criteria of just-in-time service which privileges suppliers located nearby. If the just-in-time supply should be carried out by a supplier just for a few years, to be then replaced by a supplier capable of offering a higher cost reduction, it becomes obvious that the system could not work. Hence, global sourcing represents an organisational form which can be applied effectively only to specific types of components such as highly standardised parts with a commodity nature, or parts in manufacturer catalogues which, although of technological and sophisticated nature, do not require specific customisation to the needs of different vehicle models (e.g. tires, alternators, batteries, brake pads, etc.).
However, by considering this process of FTSs concentration and the growing usage of common platforms the share of parts negotiated through global sourcing procedures is likely to expand further [83–87].

4 The likely transformations in the next decade and the role of ICT

4.1 Towards information integration

Co-design activities, shorter time-to-market, greater manufacturing flexibility, more efficient logistics and higher productivity, are all advantages than can be traced back to the increased use of information and communication technology (ICT). The internet has revolutionised the transmission of information, and new applications are constantly being found for its use, for example in part procurement or sale and distribution.

At the end of the 1990s, a new stage of reorganisation has begun with respect to the relations between component manufacturers and automakers, linked to the new potential of information and operational integration brought forward by ICT.

Clearly the ongoing process of supply-chain reorganisation has several consequences. Among these, the reshaping of information flows among supply-chain contractors: relevant changes are taking place in the way supply-chain agents have to manage information flows, not only with respect to the management of technical issues, but with respect to organisational consequences. In this picture, the most peculiar aspect of this move from production rationalisation to strategic rationalisation of the automobile supply chain is represented by a marked growth in integration needs. As a consequence the new supply-chain structure is based upon operations which require:

- downwards, a tighter link of production with automobile demand like the elements of make-and-delivery-to-order previously quoted, increase in product range and shortening of life cycles of individual models, obtained through the compression of the time-to-market

- upwards, a stronger cooperation between operators such as co-design between FTSs and OEMs and co-makership between the system integrator and second- and third-tier suppliers [88].

Then the success of this great transformation is linked to the capabilities of the actors to carry out systems of information and organisational integration, with higher levels of quality and complexity compared to those reached so far.

The control of the system implies the capability to exchange information with a degree of completeness, speed and precision which is largely superior to the one which is presently available. The qualitative aspect of the new information required must be underlined and qualified, since this dimension appears much more relevant than the mere quantitative development of exchanged information. The move from an operations chain governed by a push logic to a pull logic, led by a demand which is differentiated and variable overtime, implies a different management of information. In the push logic, the whole coordination of the supply chain relies upon the *ex ante* planning activities, carried out by car manufacturers and transmitted through a cascade-like approach on the whole supply chain. In this scheme, the chain slacks represent an efficiency loss which is considered as inevitable, and which can be partly recovered through an
anticipation of times associated with initial operations (if one wants to arrive earlier one must leave earlier).

On the contrary, in a pull logic, where the starting point for operations is not governed by car manufacturers, but results from the composition of a large number of individual decisions by consumers, it must be taken as a given (without any possibility to be changed), and any reduction in the chain slack represents not just a cost reduction, but also (and most important) a strategic capability to anticipate the competitor in design, manufacturing and delivery of vehicles which are better synchronised with the evolution of the market. So far the difference between push and pull organisation was applied only to manufacturing stages, but with the strategic reorganisation of the supply chain the difference must be looked at within a wider context, which encompasses also the design and development stages both of new models and of components associated to them. In other words, the system should evolve towards a supply chain which does not require only *ex ante* coordination of decisions, which in turn is based upon information managed by planning activities, but also a simultaneous coordination of operations, based upon execution information [89].

### 4.2 From hierarchical links to network links in the whole supply chain

If we look at the relationship between a car manufacturer and its suppliers from the standpoint of information flow management, we could say that, until the 1980s, such a relationship was quite simple. To make a long story short, the OEM was the one who led the whole project; parts and components were mainly designed and engineered by the car manufacturer, while suppliers were asked to manufacture them. In an oversimplified description, one could say that such as relationship consisted in a few key elements:

- The decision making process related to product development – concept, design, engineering, product tests, changes – took place almost exclusively within the car manufacturer’s organisation; suppliers were more or less asked to manufacture some parts at some cost. No or very little interaction took place between the car manufacturer and its supplier with respect to product development issues. Consequently, key decisions were mainly taken in an intra-firm process, that is: if it was necessary to take a difficult decision (e.g. to choose among different and/or incompatible solutions), the problem could have been simply shifted to the higher hierarchical level in the organisation, until someone took a decision. This is a form of coordination based upon *ex ante* planning, which has a key requirement: exclusively the final assembler must be fully aware of the whole supply chain operations.

- In such a condition, the relationship with the supplier is a ‘market-hierarchical relationship’ in its proper sense: the car manufacturers purchases a product (part or component) at a set price. Its overwhelming bargaining power is the main element which causes the agreements on price of the supply to take place almost in the form of a spot market auction; for suppliers, profitability comes from their capability to make the process as efficient as possible.

- Consequently, the information involved in such a customer – supplier relationship mainly consisted in one-way flows of technical details, prices, quantities, billing, terms of payment, etc.
Let’s now look at the actual supply chain as far as the customer–supplier relationship is concerned: as previously said, it is based upon an *ex ante* planning mechanism, thus some interesting asymmetry takes place with respect to the elements specified above. First, the fundamental aspect of coordination, based upon *ex ante* planning, is that any individual operator does not need information on the whole chain of operations. Any chain operator must know only the start and end date for a given activity, and must be concerned about precisely meeting its specific deadline. This implies a hierarchical management of information. But forms of simultaneous coordination on the whole of operations, aimed at compressing chain slacks, require online access to the whole sequence of operations, in order to carry out adaptations any time downwards demand triggers a wave of change which involves the whole upward operation chain. In other words, this implies forms of network connections among operators.

The decision making processes related to product development, involve both the car manufacturer and FTSs. According to the continuous improvement both in product and process technology, nowadays the competencies that are necessary in order to manufacture a competitive car encompass a wide range of fields of expertise. As a result, critical decisions might often take place in an inter-firm process and thus an agreement among peers could be required. For instance, managers of both the car manufacturer and the supplier might be asked to share a strategic belief as, for instance, an idea of what will be positively evaluated from the market, or an opinion of what will be the technological trend, and so on.

In such a condition, it is absolutely not advantageous to base the relationship with the FTSs upon a mere spot-market agreement. Since the part supplied consists in a complex module which the FTSs develops for that specific customer, the idiosyncrasy of the relationship increases in a significant way. The price-fixing process shifts from a bargaining power-based process to a long-term partnership-based one.

Since the car manufacturer needs a complex module to be developed and integrated in its vehicle, the amount of information exchanged with the FTS is huge. The vehicle architecture definition is clearly still the core activity of the car manufacturer, but design and engineering of parts and modules deeply involve FTSs. Consequently, the relationship will not only include the usual commercial terms (prices, quantities, billing, terms of payment), but will become a mutual exchange of designs, projects, suggestions, changes and technical details [90].

If one considers that here the activities to be synchronised and integrated more closely are not just those of the manufacturing process (where the time frame of reference does not exceed a few weeks, and individual events can be forecasted rather effectively), but those related to the whole design, production and delivery process (where the time frame of reference amounts at least to a few years, and the variability game can apply to a largely more differentiated and complex level), it is easy to understand that the information exchange to be achieved in the move from the hierarchical information scheme to the network information scheme appears much more sophisticated than the one obtainable through the traditional information tools. For example, if one considers a variation in the levels of an information chain which is rigidly hierarchical, according to the coordination mode based upon planning, the addition of new operators implies the establishment of further stages, but from the information viewpoint complexity grows by an additional factor. If, on the other hand, new elements are added to a definite number of subjects who are linked in a network, information complexity due to the increase in the number
of potential subjects involved grows by a multiplying factor. Here we are facing a transformation which requires mechanisms of information integration which are largely more advanced and flexible.

Two steps are therefore needed in order to implement such evolution. Firstly, a shift from the classic tools of data transmission (sheets of paper, phone calls and so on) towards electronic communication tools and standard protocols is needed, that is the adoption of Electronic Data Interchange (EDI) systems, in their broad sense (standard protocols of data sending and receiving). The first step is a move towards information flow integration.

Secondly, the whole supply chain might gain in efficiency if the internal processes of each firm are planned and scheduled on real-time requests. Significant shortening of cycle times might be obtained through the adoption of Enterprise Resource Planning (ERP) systems [91], intended as a system (based on software packages) which is supposed to synchronise the resources required to optimise manufacturing and delivery of products, considering constraints such as lack of materials or capacity limits. This second step is a move towards production process integration.

4.3 The B2B challenge – towards a single ‘Exit’ model?

At first glance this evolution has been interpreted as an additional push towards a tighter partnership relation between OEMs and OESs according to the lines of the ‘Voice’ model, derived from Japan. However, the shift from an information integration based upon dedicated links between a single automaker and a single supplier (EDI – type Odette) to an integration based upon an ‘open’ internet-based network has opened new possible scenarios and new options between the ‘Voice’ and the ‘Exit’ model.

A turning point lies in the establishment by US automakers of information ‘portals’ aimed at managing, in an integrated way, a range of functions between OEMs and OESs. In November 1999, there was the announcement by General Motors and Ford of the establishment of the respective web-mediated exchanges named TradeXchange and AutoXchange. But already in February 2000, there was the establishment of a new company, different from the previous two, and also participated in by DaimlerChrysler, named Covisint, with the objective of carrying out a single wide-ranging marketplace in charge of channelling and managing the multiplicity of information exchanges and of economic transactions among all automakers and suppliers interested in the initiative. From the standpoint of general objectives, Covisint appears as a complex reality in charge of managing a very wide range of relations indicated as Business-to-Business (B2B). Relationships which refer, for example, to the purchasing of products sold by catalogue (standard goods, such as Maintenance, Repair and Operation-MRO), but also dedicated components, designed and developed on purpose by a given supplier for a given automaker, besides the complex information exchanges required by co-design and co-makership initiatives.

However, the initiatives taken by the company in this first stage have focused mainly on the management of outsourcing through tools such as the reverse-auction, which are seen by suppliers as a mechanism aiming at driving supply costs down, in an ‘Exit’ logic. As a consequence, albeit we have seen a gradual increase of component suppliers among Covisint stockholders, some of them have raised worried judgements over the mechanisms triggered by the present B2B tools, and over their effects on the type of partnering which will take shape between OEMs and OESs.
On this topic, the analyses available so far come almost exclusively by consulting companies. The picture which their documents sketch tends to be aligned with respect to the direction of the transformation:

- they forecast a wide and general diffusion of integration mechanisms based upon ICT tools, seen as powerful tools for peer cooperation between OEMs and OESs
- they estimated that the use of new telematics tools will generate a significant increase in the efficiency of partnership relations, generating wide-ranging economies; as a matter of fact the estimates for cost reductions vary considerably, but we will come back later regarding this matter
- they imply that, given the scale of the cost savings yielded by the use of the new technologies, the new organisational forms will be shaped by the need to fully exploit such tools, hence they envision an evolution which we could define technology-driven, rather standardised in the structure and in the operational forms, differently from those currently in place, which are rather different from case to case, since they are designed starting from the path dependency of each automaker and its own competitive strategy [92–95].

The questions brought along by such approach are manifold. Firstly, it becomes evident that both the speed of introduction of telematics technologies for B2B and the capability of such technologies to redesign the partnership relations between automakers and suppliers depends upon the scale of savings which they generate. However, not only is there disagreement over the estimates of the cost savings, but it is also quite hard to carry out a comparison since the studies neglect some aspects which are particularly relevant.

- They do not provide a clear definition of the area of activity which they intend to consider within the generic B2B label, hence the cost savings implied do not have a common basis for comparison due to the difficulties to understand their sources and the corresponding areas of application.
- The lower operating costs of the new structures integrated through the telematics B2B tools are not related to the size of investments (hardware, software and learning activities) required by new technologies.
- However, the area with highest ambiguity is the fact that such analyses, aiming in most cases at promoting the use of B2B tools, tend to lose sight of the complexity of relations in place in the automobile supply chain. On the one hand, they tend to forget that automobile component suppliers are not all equal, but feature a high degree of differentiation (degree of internationalisation, technological, organisational and financial potential, etc.) and hence such differentiation cannot but influence the respective contractual power with individual automakers. On the other hand, they do not take into account either the specific aspects of individual components, some of which are mere commodities bought by catalogue, while other are special components, designed and manufactured not just for a given automaker but in reality for a given vehicle model, very often through forms of co-design and co-makership.

In conclusion, one gains the impression that the common technology-based approach of such studies developed by consulting companies cannot but be derived by the fact that
they end up envisioning the automobile supply system (which they know to be extremely differentiated and complex) as based upon the exchange of standardised products sold by the supplier by a catalogue, hence oriented from its beginning towards an evolution of the partnering relations in the supply chain of the ‘Exit’ kind.

4.4 Restraints imposed by the nature of components: supply segmentation

In this document, aiming at highlighting the most recent tendencies in the relations between OEMs and OESs and their most likely evolution, we will try to propose an articulated framework which allows to better grasp the complexity of the relationships in place and the multiplicity of trajectories still open.

The first step in such an effort of synthesis requires the maintenance of a specification of the type of partnering required by automakers. To speak generically of partnering, without distinguishing the different kinds of relationship which can take place between automakers and FTSs, would mean including an excessive level of simplification, which would not allow the distinction of the significantly different realities which are present within the complex automobile supply chain.

Moving on to a classification of the forms of partnering, we must first distinguish between the ‘vertical’ forms of partnering which are those most interesting in this work (supplier – customer relations), and the ‘horizontal’ ones, which involve companies actually or potentially in competition, who develop agreements of mutual cooperation.

With respect to the forms of vertical partnering, we must now pursue a higher level of detail acknowledging that it can have various forms. The most reasonable way to define such forms moves from the definition of the type of supply, hence of the type of product required by the automaker. As a consequence we propose a taxonomy of the different products defined according to the degree of standardisation of supply to all the customers for a hypothetical supplier.

In other words, we can imagine a set of situations ranging from one extreme with a fully standardised product which is sold to any potential customer without any change or customisation (completely standard product) to the other extreme with a product designed and developed uniquely for a given customer on the basis of the indications provided by him (completely tailor-made product). We hence have a range of products which differ by a higher or lower level of commonality with respect to customers (Figure 2).

On the basis of this first taxonomy, we can then move on to a second one which groups the space which conceptually separates the position of the completely standard product from that occupied by the completely tailor-made product, by grouping these various situations which are gradually moving from one extreme to the other in four product clusters;

1. completely standard product
2. semi customised product
3. customised product
4. tailor-made product.
It is clearly a simplification, which however allows on the one hand to highlight the conditions which lead the insertion of one product into any of the clusters, indicating the reasons for the differences among the products (Figure 3), and on the other hand to reduce the diversity of situations to a manageable size, capable anyway to take into account the higher diversity among products.

**Figure 2**  Product segmentation

<table>
<thead>
<tr>
<th>Technological Aspects</th>
<th>Styling Aspects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Completely standard product</td>
<td>Product made by catalogue</td>
</tr>
<tr>
<td>Semi-Customized product</td>
<td>Product substantially made by catalogue with some customer adaptations</td>
</tr>
<tr>
<td>Customized product</td>
<td>Product designed with customer instructions Frequently in co-design</td>
</tr>
<tr>
<td>Tailor-made product</td>
<td>Product designed with customer instructions Frequently in co-design .....</td>
</tr>
</tbody>
</table>

It is clearly a simplification, which however allows on the one hand to highlight the conditions which lead the insertion of one product into any of the clusters, indicating the reasons for the differences among the products (Figure 3), and on the other hand to reduce the diversity of situations to a manageable size, capable anyway to take into account the higher diversity among products.

**Figure 3**  Levels of commonality
At this stage we are able to propose a classification of the relationships between FTSs and automakers which mirrors the type of product exchanged:

- exchange of completely standard product
- exchange of semi-customised product
- exchange of customised product
- exchange of tailor-made product.

The next step consists in the analysis of the type of impact which the introduction of ICT tools will have over the different exchange relations.

4.5 A taxonomy concerning E-business activities

As soon as one tries to evaluate the effect induced in the organisational structures of firms and in the vertical partnering relationships, one becomes aware that ICTs are typically cross-over tools, which encompass a wide range of situations, covering a larger area than the one typically activated in the supplier – customer relations. As a consequence it appears necessary, if one does not want to come across the same criticism highlighted before with respect to some consulting company studies, to restrict the field of application of the next arguments.

Hence, we propose to highlight the fact, which is absolutely straightforward, that in this work we intend to limit the analysis to B2B relations, by specifying, however, that even within this limited set of phenomena there are many partnering relations which are deeply influenced by ICT. What one must not forget is that the type of impact of ICT can be different, and even very different, if one considers one activity at the first tier or another, that is if one moves within an activity which lies within the various activities in a lower tier (Figure 4). For example, nowadays everybody acknowledges that the impact of the ICT tools is much higher for the ‘e-procurement’ and ‘e-logistics’ activities than in the ‘e-co-design’ ones.

**Figure 4** E-business map

![E-business map diagram](image-url)
4.6 The influence-map of ICT in OEM and OES partnering

We are now able to draw a classification of activities with enough analytical property (hence not ambiguous) so that the judgements on the impact of ICT on the relationship between OEMs and OESs are not referred generically to the automobile supply chain with the open-ended outcome that any thesis could be right or wrong depending on the change of hypotheses according to the activities in place. On the contrary, one will be able to (and one will have to) bring forward his opinion on the evolution of the OEM-OES relationship indicating at which area of activity and at which level his analysis is placed (Figure 5).

![Field-research matrix](image)

4.7 A methodological framework: the meta-strategies

Still bearing in mind the objective which is to identify the impact of ICT in the partnering relations between automakers and FTSs, it becomes necessary to assume which kind of strategic posture automakers will develop. Let’s try to explain this issue through an example. Let’s assume that one believes that the most important issue for the survival and the development of an automaker is the development of a fuel cell vehicle. In such a case, the focus and the investments of automakers will give priority to R&D activities focused on such kind of technology. If we assume instead that the priority would be to have a sales system at the distribution network level, capable of minimising the lead times between order input and vehicle delivery, there is no doubt that the investments would focus on the development of information systems more than in the previous case. As a consequence, one must understand to what extent ICT tools have a strategic role in the near future, that is in about one decade, in the automotive industry.
From the standpoint of a theory defined in an abstract way, it would be necessary to move from the definition of the strategies which will be deployed over the next decade by automakers. In reality such an approach cannot be fully adopted, and it will be replaced by the presentation of some meta-strategies. Firstly we define as meta-strategy a ‘strategic goal common to automakers’. As has been said, in many instances in the studies developed by GERPISA, automakers’ strategies have specific traits which derive both from their history, which over time has shaped their competences, their competitive position, their image, and in general, their respective strengths and weaknesses. However, for this study it is useful and appropriate from the standpoint of the research methodology and of the value of interpretation, to isolate, if any, the common traits among the firms’ strategies. On the whole, automakers, competing among themselves to acquire shares of the same market, are led by the needs expressed by consumers, which are usually common to all. For example, in the most developed markets, such as North America, Western Europe and Japan, the nature of automobile demand is clearly more sophisticated than in first-purchase markets, both because consumers have higher income levels, and because these consumers already have a vehicle, and they are interested in changing it depending on the degree of novelty on offer. As a consequence, one can see a common goal for the main automakers, which is to broaden their product range, in order to manufacture niche products which are, more specialised when compared to the past, and are therefore capable of attracting a market which is more inclined to buy innovative and customised products. The actual and specific forms through which every firm will interpret such an orientation are, and will remain, idiosyncratic with respect to their competitive structure, to their image and to their tradition, but this does not rule out that a common goals can be singled out: a sort of conceptual space given by the intersection of spaces represented by the individual specific strategies (Figure 6).

**Figure 6  Meta-strategy**

![Diagram](image-url)
As a consequence, if on the one hand it would be perhaps difficult to try to define in a prospective way the individual strategies of each automaker, on the other hand it gains ground the hypothesis of defining some meta-strategies [96,97] which, albeit with the limits due to the simplification of the likely actual behaviours of firms, provides the opportunity to identify some unifying aspects within the automobile industry [98].

4.8 Two meta-strategies: the Extended Enterprise and the Decisional Globalisation

In order to evaluate the future impact of ICT, we propose to consider two meta-strategies which appear highly crucial for the prospective analysis which we want to bring forward:

- the Extended Enterprise
- the Decisional Globalisation.

The meta-strategy of the Extended Enterprise can be defined as the effort of integrating and steering the whole automotive industry’s activities of an OEM from the customer’s order to the part suppliers and back to the dealer and the customer [99], while for Decisional Globalisation, we intend the effort to move from an optimisation of the company choices made by compartments to an attempt to bring together in a single optimisation framework the whole of the operations carried out by an automaker on the whole of operational areas in which it is involved.

With respect to the development of an Extended Enterprise, there is no doubt that all automakers are aiming at a policy which allows them to integrate within a make-to-order scheme the whole complex manufacturing and logistics chain which moves from the identification of the automobile demand (orders) to be transformed into production programmes to be cascaded over the supplier network from which to gain the maximum efficiency in terms of lead times, prices and quality, for the delivery of parts to be assembled into final products, to be supplied to distribution networks for the sale to end customers. Clearly here we do not imply that all automakers aim at selling 100% of their automobile production according to a make-to-order scheme. As a matter of fact, this objective could not be achieved, mainly for markets in which they sell vehicles manufactured in distant areas. Nor do we imply that the search for solutions of the Extended Enterprise kind represents a relevant and common objective for all major automakers.

Similarly, the Decisional Globalisation appears a meta-strategy of great interest for automakers since the internationalisation process, linked to many cases of acquisitions, mergers and alliances, appears as a system which is fragmented over a range of markets with respect to sales, and over a range of countries with respect to manufacturing, with a very high amount of overlap in product, plants, R&D centres and logistics networks. An independent management of such a complex of activities can be a need, because it is hard to manage so many activities located in different countries, with different organisational structures, taking into account different languages and cultures. However, on the other hand, there is no doubt that both automakers and component suppliers (FTS) feel with great urgency the need to try to develop a much more integrated decisional system, which aims (albeit over a not too close time frame) to replace decisional models for local optimisation with decisional models for global optimisation.
In such a sense, the world car experience represents an attempt, which turned out to be premature and excessive, towards forms of global optimisation. Today, such an attempt has been replaced by a more flexible approach, more adherent to the various needs of the different markets, which consists in the development of common platforms for products to be differentiated in the various markets [100,101].

The same thing applies for component manufacturing. There is no component manufacturer which is not trying to develop a more integrated system than the present one, through which to improve the degree of optimisation of decisions. Also the standardisation of ‘core’ technologies for individual components is nothing but a sign of the effort to unify and optimise the core aspects of a component, with the subsequent capability to customise it according to elements required by individual automakers.

The development of e-learning and e-competence diffusion systems themselves are an example of the effort to share (achieving synergies and scale and scope economies) knowledge, hence tools, and then strategies which are different but made complementary among them.

The introduction, over the next decade, of the two above mentioned strategies, both extremely relevant for the use of ICT tools, hence selected among the many which will actually be in place, allow as now to assume which will be the most likely developments of the relationships between OEMs and FTSs.

4.9 ICT driven solutions and industry competition driven solutions

Firstly, we must underline that the evolution of partnering relations in the supply chain will not be homogeneous because the differences in the operational conditions are many so as to rule out a common evolutionary path. On the one hand the information tools will be more wide-ranging and more important in defining the aspects of the future transformation, depending on how much they will applied to non-specific realities. Going back to one of the two extreme cases of partnering, described in Section 4.4, that is the one defined as ‘exchange of a completely standard product’, it appears reasonable to assume that we will see an almost exclusive implementation of relations mediated through an electronic marketplace. In such a case, the identification of the product features (which are rigorously standard, such as the MRO products) appears much easier compared to a tailor-made product, hence all relevant aspects in the transaction (excluding the final physical delivery) can be developed and concluded over an information system, minimising the times needed to select potential suppliers, and applying reverse-auction mechanisms for the selection of the supplier who, with respect to the individual procurement need, is capable of providing the best conditions for the OEM. This is a form of interaction completely led within conditions defined by the information technology which is used. In other words, the minimisation of transaction costs needs the application of an organisational solution of the ICT driver kind.

These are partnering forms which will tend to evolve more and more towards ‘Exit-type’ relations, since there is an evident and easy interchangeability of suppliers depending on the economic conditions (price and service) proposed to any individual auction. From this standpoint there are some signs indicating that even the firms which in the past were most supportive of ‘Voice’-type of partnering relations (such as Toyota), are evaluating, given the results achieved by the Nissan Revival Plan on the procurement side, the need to introduce the adequate corrections to exploit the advantages offered by the electronic exchange procedures [102].
On the contrary, it appears rather reasonable to assume a different evolution in the partnering relations which involve highly complex operational conditions. Clearly the most evident case involves the supply of tailor-made products. In such a case, the relations do not end within the ‘Purchasing’ function of the OEM and within the ‘Sale’ function of the FTS. The relationships of exchange of ideas and mutual interaction are much more articulated and, even before the purchasing/sales functions, they originate from contacts between the designers of the two partner companies. On the one hand, it is straightforward that the cost of a component is an important aspect, but clearly in these cases the priorities to be taken into account (as strategic with respect to the automaker’s success) are, for example, the intrinsic quality of the component which must integrate both the reliability over time, and the perfect degree of integration capabilities of the sub-system to which it belongs. In other words, the evaluation of the component cannot be split from the evaluation of the competences of the supplier and of the sub-system integrator (when this is other than the supplier).

It then becomes evident that, when one considers tailor-made products, especially those featuring highly sophisticated technology, with high unit costs, there are a limited number of potential suppliers, since there will be only a very limited group of suppliers capable of supplying the desired product. However, on the other hand, it is very likely that the bargaining power, which usually considerably leans on the auto-maker side, is much more balanced and linked to evaluations which are more complex than those deriving from the mere exchange price. This also implies that the transaction economies, which can be achieved through the use of marketplaces, are less relevant.

Here there are forms of partnering which cannot be articulated in approaches driven by ICT solutions, whose strategic weight is much more reduced, and will be replaced by solutions of the industry competition driver kind.

The hypothesis which appears most sustainable is that even automakers more inclined to ‘Exit’-type partnering forms due to their traditions and cultural models, will be forced to develop ‘Voice’-type behaviours in the future in all cases in which they will face negotiations involving tailor-made products, with high unit cost, and with a high technological level. According to the studies carried out, the reason for such a need stems from the fact that in these cases the quality of the outcome will be directly proportional to the quality of the partnership developed between the OEM and its FTSs. Just as in the 1980s Western automakers imitated approaches of Japanese automakers to recover their productivity gap, also in the future (a future more and more based upon the broadening of the product range, the specialisation of products and the quality of product and service offered to customers) the most advanced forms of ‘Voice’ will impose the benchmark standards in the automobile supply chain, and in the OEM-FTS relationship in particular.

4.10 The coexistence of ‘Voice’ and ‘Exit’ models from West to East

By developing the explanatory potential of the model proposed, it seems reasonable to assume a vast process of concentration in component supply, in the case of standard products, as a response to the strong and systematic compression in product costs. Such a compression appears sustainable mainly for competitors with favourable differentials in scale economies.
On the contrary, it appears more likely a marked specialisation strategy for manufacturers of tailor-made products, especially those with high technological content. In such a case, the aspect with the highest competitive advantage is the innovation capability. However such innovation has to be expressed depending on the objectives of the customer (automaker). This is another reason to underline that such an outcome can be achieved only through forms of much tighter and prolonged cooperation between the OEM and its FTSs. Given the more and more complex nature of the automobile product, the outcome to be achieved cannot be limited to a relationship between the automaker and the individual supplier, but rather a group partnership will be needed, where groups of FTSs will have to actively cooperate, not just with their customer, but also among themselves to develop functionally integrated and high-quality sub-systems.

5 Conclusions

The most likely emerging scenario appears then based upon a wide range of different cases, mainly led by the specific traits of the component. As a consequence, there will be a range of supply clusters with forms of partnering ranging from ‘Exit-type’ to ‘Voice-type’ forms. Moreover, an individual component manufacturer, as a supplier of different components will necessarily have to operate in an ‘Exit’ environment when supplying standard products, and in a ‘Voice’ environment when supplying other components when the automaker is the same.

It then appears inevitable that there will be some dissension over the approach proposed by consulting companies, who tend to simplify the future evolution too much, by assuming a coming together of the partnering relations according to the schemes of B2B and marketplaces, which are made possible by the new ICT.

This approach is criticised since it is believed that it can be applied only for some specific types of components (those falling into the ‘commodity’ group). For the other categories and, in particular, for tailor-made components, long lasting and co-maker relationships are considered as necessary and more efficient.

References and notes

1 This paper is based on research and papers presented by the members of the Coordinating Competencies and Knowledge in the Auto Industry Consortium (CoCKEAS) and the GERPISA International Network. The author remains responsible for any mistake and omission.

2 On the analysis of such issues the International Motor Vehicle Program promoted by the Massachusetts Institute of Technology of Boston undoubtedly carried out an important role of understanding and of diffusion through a wide range of studies and publications since the 1980s.


4 On this debate a key role was played by the book by Womack et al. [5] oriented towards the definition of a new managerial one-best-way, to which were counter posed other more articulated and specific analyses developed within the GERPISA since 1993, then gathered in the book edited by Freyssenet et al. [6]. Other relevant contributions are found in References [7–10].

The OEM-FTS relationship in automotive industry

11 The analysis of the forms of cooperation between supplier and industrial customer triggered a long debate [12]. With reference to the automobile industry see References [13–15] and from 1995 onwards see the wide range of studies published within the GERPISA, starting with [16].
20 On the trajectories of internationalisation of the various automakers see in particular [21–23]. For a theoretical scheme on this subject see [24].
26 In this paper globalisation means: to implement a decision-making system able to integrate the managerial operations of an internationalised firm in all the most relevant aspects and functions (procurement, design manufacturing, distribution and so on).


40 In this paper the concept of internationalisation means the geographic expansion of the activities (purchasing, design, manufacturing, selling) carried on by a firm.


42 Another relevant aspect linked to this reorganisation, but which cannot be dealt with in this paper, lies in the future evolution of the forms of public regulation, both on vehicle emissions and on future forms of distribution. On the impact of community regulation on the European supply chain see [43].


44 The kind of relationship describing this phase is named in French *soustraitance* [45].


46 Belzowski [47] pinpoints that there is a shift of responsibility that includes the manufacturers’ focus on design, manufacturing, and marketing the complete vehicle, rather than the individual parts: and the consolidation of suppliers into either very large system integrators or tier one suppliers, and the gradual transfer of design and supply chain responsibility from manufacturing to suppliers.


The OEM-FTS relationship in automotive industry

56 Zirpoli (1999).
61 For an analysis of the evolution of variety strategies developed over time by car manufacturers see the essays in Reference [63]. On the issue of world car and common platforms see [64].
65 On this aspect, see particularly the synthesis to the workpackage No. 4 prepared by Lung [66].
68 The key feature of a system integrator is that it assumes responsibility for the execution of the most relevant technical tasks in the product/system chain and the coordination of the chain’s technical and operational performance over time.
75 This phenomenon, as an expression of a more general process of ‘spatial agglomeration’, presents many relevant aspects. Its analysis is developed in the synthesis to the workpackage No. 4 prepared by Lung [76].
In Europe, the automobile group most oriented towards this new organisational form appears to be Volkswagen with 5 supplier parks (two located near Audi plants and three located near VW plants).

One of the most recent applications of the supplier park is represented by the new Ford plant in Camaçari (Brazilian state of Bahia) appointed to produce the ‘Novo Fiesta’. Based on a huge area of 4.7 million square meters Ford invested about US $ 1.2 billion in setting up facilities covering a built up area of 1.6 million square meters. Some 30 suppliers invested another US $ 0.7 billion in the project. In Camaçari modular organization, the suppliers, apart from being responsible for fitting certain components, are also tasked with the maintenance and logistic relating to the specific sections of the manufacturing operations. What is more, they also shoulder their share of the respective cost items involved. With regard to integration levels this plant is somewhere between the Smart-DC plant in Hambach (Germany) and the VW’s plant in Resende (Brazil).

An ERP System can be defined as a massive computer application allowing a firm to manage all of its operations: finance, requirement planning, human resources, order fulfillment, etc., on a single, integrated set of corporate data. The ERP application, if successful, allow a tight integration of a various and discrete financial and operations activities within firm: general ledger, purchasing, accounts receivable, inventory, and other related functions.

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If one analyses the vast literature focusing on firms’ strategies, one can see that many authors, speaking about strategies relative to whole industries, actually speak about meta-strategies. See for example for the automobile industry [97].

Clearly in this work the thesis is developed for the automobile industry, but it is obvious that the argument also applies to all industries, since the supply of firms aims at gaining shares of the same complex of consumer demand.

The alliance developed by GM and Fiat itself for a common purchasing policy, for the development of powertrains to be used on both product lines, and for the design of common platforms, highlights the need to move from decisional models capable of optimizing individual products or individual product portfolios to decisional models which refer to a range of models and to a range of product portfolios looking for more globalised decisional systems [101].

See Automotive-Management International.