

COMPANY RELATIONSHIPS IN A TECHNOLOGICAL DISTRICT: THE CASE OF THE TURIN AUTOMOTIVE INDUSTRY

by Giampaolo Vitali, Ceris-Cnr, Turin, Italy

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Giampaolo Vitali, Ceris-Cnr (Institute of Research on Firm and Development of Italian National Research Council)

Via Avogadro, 8

10121 Torino - Italy

phone 39-011-5601217, fax 39-011-5626058

e-mail: g.vitali@ceris.to.cnr.it web: www.ceris.to.cnr.it/Vitali.htm

Abstract

The paper is focused on the company relationships among the small and medium sized firms of the supply-chain of Fiat. In particular, we consider how the "second-tier" suppliers - i.e. the sub-contractors mainly composed of small firms that usually do not have commercial relations with Fiat - deal with the first-tier suppliers, i.e. MNEs that have direct relationship with Fiat. The descriptive statistics of the study is based on a sample of 79 firms, that can be located within 7 different supply chains of first-tier companies of the Turin area.

The study is organised as follows.

After a description of the automotive district of Turin, the second section of the paper considers the main characteristics of our sample of 79 suppliers, from the quantitative and qualitative point of view. Within the third section we study the company relationships according to some quantitative indicators, such as the value, the weight and the dynamics (1998-1993) of the commercial relations. The fourth section is about the qualitative aspects that support company relationships: production organization, labour organization, just-in-time, contractual systems, innovation process, co-design, simultaneous engineering, etc. A final section summarises the main findings of the study.

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by Giampaolo Vitali¹, Ceris-Cnr

1. Introduction

This study is focused on the relationships existing between first-tier suppliers (i.e. automotive companies that supply the car-maker) and their second-tier suppliers (i.e. small-and-medium sized firms that mainly supply the first-tier ones) within the automotive district of Turin, Italy. In addition, also the relationships between second-tier suppliers and third-tier ones are considered.

The main hypothesis of the paper is about the increasing importance of the second-tier suppliers in Europe: the characteristics of these SMEs are going to strongly affect the competitiveness of the car-makers, as well as the economic welfare of the EU automotive districts. We can remember that within each European countries we can find one or more geographical area where the manufacturing production is specialised on the automotive industry. For example, we mention the areas of Turin (where is located a relevant part of the Fiat supply chain), Stuttgart (Volkswagen), Munchen (Daimler-Chrysler), Birmingham (Toyota), the Wales (Ford, Bosch), etc.

If second-tier suppliers are so important, we suggest that in order to develop the EU automotive districts the industrial policy has to improve the technological and managerial innovations within these SMEs: their competitiveness will affect the EU car-makers and the local area development.

We have to remember that during the Eighties first-tier suppliers were involved in a similar restructuring process: the top of the filiere, i.e. the carmakers, asked to OEM to innovate processes and products.

The analysis of the relationships between the different tiers of the supply chain is made as follows.

Next section will summarise main characteristics of the automotive supply chain both at EU industry level and at the Turin district level.

Within the third section we will describe the 79-SMEs sample that was analysed by our study, whereas the fourth section will focus on the research findings. We studied the

companies relationships within the Turin districts in terms of product organisation, business-to-business contracts, dissemination of technological innovations, commercial concentration, international relationships, etc.

It is worth to underline the main finding: the company relationships are based on a network organisation and not on a merely hierarchical one. This organisation of the automotive filiere is going to positively affect the dissemination of technological innovations.

2. The product organisation within the European automotive supply chain

Since few decades, automotive supply chain has been influenced by a deep reorganisation process (Clark and Fujimoto, 1991; Lamming, 1993).

Roughly speaking, the product organisation within the automotive industry is based on different levels of suppliers:

- Car-makers represent the zero level. Fiat, Volkswagen, Daimler Chrysler, etc. coordinate all the production phases, such as the project, the manufacturing, the assembling of the final products. They have relations with a short number of "first-tier suppliers" (Kamath and Liker, 1994; Wells and Rawlinson, 1994).
- First-tier companies are suppliers of systems and sub-systems (OEM, i.e. Original Equipment Manufacturers). Lear, Dayco, Allied Signal, Delphi, Eaton Automotive, PPG Industries, Breed, Reydel, Arvin, Mannesmann, Valeo, Magneti Marelli, Bosch, etc. have technological and managerial capability in order to supply complex products (Chanaron, 1998). Generally, they are MNEs having strong relations with a high number of small suppliers (second-tier).
- Second-tier firms are usually suppliers of simple components (Larsson, 1999). Even if they are sometimes autonomous as far as the technology is concerned, they are not technological leaders, as their competitive advantage is based on organisation. They can be local SMEs or MNEs. They are going to increase the relationships with the first-tier because of co-design, co-development, co-manufacturing process (Jurgens, 2000).
- Third-tier and the following ones are composed of generic and very simple component suppliers. Usually, these companies are local ones, and not MNEs. They can supply customers outside the automotive sector, too.

Outside of the supply chain we can find die or machinery suppliers, as well as design or Cad-Cam consulting firms. They have relations with all the different tiers of the chain, accordingly their specialisation or their technological capability (the higher the technological capability, the higher the tier involved).

The location along with the supply chain does not strictly mean that there is a unique and hierarchical link between the suppliers, according to their level: some SMEs of the second-tier can be a car-maker supplier too, even if their main customer belongs to the first-tier.

Following the above segmentation of the supply chain, we find a similar division concerning the product complexity and R&D content: the production of a system or a sub-system is very complex, and it requires a high R&D content. Usually, car-maker and first-tier supplier co-design that system in order to match the car-maker needs and the OEM specific know-how. On the contrary, single standardised parts composing the system can be produced outside the first-tier plants: they are produced by second or third-tier suppliers. These single parts do not require a high R&D content, but a good organisation in terms of just-in-time, quality control, price efficiency, etc.

As the characteristics of Italian first-tier suppliers are quite known, thanks to Enriettiⁱⁱ and Volpatoⁱⁱⁱ, our research is focused on the second and the third-tier suppliers.

It is worth to remember at what extent this section of the supply chain has been affected by the EU sector evolution:

- the outsourcing process from car-maker to first-tier is going to influence the second-tier too, as far as the quantitative aspect of the outsourcing (increasing production) and the qualitative aspect of it (strong links).
- the internationalisation process of the car-maker and first-tier is going to spread within the second-tier too. The goal of the internationalisation process is twofold: it is both market-oriented (search for new customers in new countries) and resource-seeking (search for cost-saving factors). As car-makers and first-tier are going to follow that internationalisation process, the second-tier is led to make a follow-the-leader strategy, in order to supply its main customer at a world-wide level (i.e. following the foreign direct investments of the main customer).
- as the international competition among the first-tier suppliers is increasing, OEMs are global competitors that are not linked any more to only one car-maker within one

country. They supply several car-makers in different countries. As the OEMs are global players, they create a supply chain at global world-wide level: OEMs are going to buy components from suppliers localised world-wide, according its quality to price ratio. Because of this, second-tier suppliers are becoming competitors each others at global level.

- because of the increasing of the technological complexity, the first-tier suppliers are becoming the controllers of the technology and the R&D related to systems and sub-systems. OEMs suggest technological innovations concerning modules and systems to car-maker. This new relationship is, roughly speaking, the opposite of the previous one: few years ago, car-makers gave to suppliers all the technological information and know-how in order to satisfy contractual commitments. Nowadays, first-tier has a delegation from car-maker in order to check technological innovations: this kind of delegation is going to shift towards second-tier suppliers. The latter, will develop technological innovation on behalf of first-tier suppliers.

- the product specialisation of OEM, as well as the OEM concentration degree, is increasing in order to exploit ownership competitive advantage within a specific module or system. Due to higher size, economies of scale and scope can be better exploited. This process will increase the product specialisation of the second-tier suppliers and will reduce the number of customers that each first-tier supplier has.

The automotive sector in Piedmont is following the same evolution that occurs at the European level. In addition, the automotive sector in Piedmont has its own characteristics that are going to affect the future evolution.

Firstly, the automotive filiere is the most important industry in Piedmont and within the Turin area^{iv}. Because of this, the Turin area can be defined an automotive district, according to the definition of Enrietti (1999). It represents a great deal of the Italian automotive sector: 35-40% of Italian component employees or Italian component production are concentrated in Piedmont; because of the process of Fiat product delocalisation toward the South of Italy, the importance of car assembling in Piedmont is less relevant than that one of the automotive filiere (CCIAA, 1997).

Secondly, the product specialisation of the component industry in Piedmont is about design (main companies are Bertone, Pininfarina, Italdesign, etc.), plastics (with leaders such as Ergom, Foggini, Saiag, etc.), mechanics (Itca, Magneti Marelli, VayAssauto,

etc.). On the contrary, we do not find important companies within the electronics or the chemicals.

Thirdly, another characteristic of the Piedmont component industry is its internationalisation degree: in terms of “passive” internationalisation, there are a lot of foreign companies that acquired local firms in order to produce in Piedmont; in terms of “active” internationalisation, all the local OEMs made some foreign direct investments outside Italy, in order to gain new markets or cost-saving resources.

As far as the foreign direct investments made in Piedmont by multinational enterprises is concerned, this is a traditional aspect of the Piedmont industry as a whole, where percentage of FDI (in terms of employees) is higher than the Italian industry. In Piedmont too, the external growth of the multinationals is based on acquisitions of local small firms (CCIAA, 1997). We can remember that Lear, Mannesmann, Delphi, TRW, Dayco, Arvin, and others have a tradition of FDIs in Piedmont, and that a long list of local firms were acquired by MNEs (such as Ferodo, CTM, Fils, Tecnocar, Foggini, etc.).

As far as the foreign direct investments made abroad by Piedmont OEMs, this is a new process of external growth that was born during the Eighties, when the internationalisation growth of Fiat had to be supported by FDIs made by its first-tier suppliers. It is worth to underline the FDIs made by automotive component firms in Poland, Argentina, Brazil, Turkey.

The international open of the Piedmont automotive component industry is evident in its high level of exports. The export to production ratio in Piedmont is higher than in the rest of Italy (CCIAA, 1997 e 1998), and it represents the competitiveness of Piedmont companies. This is an important item of the structural characteristics of the automotive filiere, if we consider that the main export market is the European Union, where competition among producers is very strong and it is based on non-price factors, such as technological, organisation or financial innovations. On the contrary, exports toward extra-EU countries are quite low, and mainly concentrated where Fiat has de-localised its plants.

Finally, the automotive component industry in Piedmont is quite concentrated in terms of production: even if the sector is composed of thousands of firms, the 90% of Fiat's components are acquired by one hundred of companies (mainly large companies and

multinationals), whereas the remaining 10% are acquired by 200 companies (mainly small firms) (Enrietti, 1997).

3. Some characteristics of the sample

Table 1 shows that our sample is composed of 79 suppliers, that in 1998 had 4722 employees, 111 plants, 614 million Euro of sales. The sample grew strongly during the Nineties: the sample sales increased by 82% in the period 1993-1998 and the sample employees by 40%.

The development was mainly driven by the Italian demand, as exports represent only 10% of total sales. By anyway, 18 out 79 firms export more than 10% of the total sales in 1998. The most important export markets are the EU countries (80% of total exports) and not where Fiat delocalised its production (Poland, Latin America, Asia). This confirms that the competitive advantage of the Piedmont firms let them to win the strong EU competition, maybe thanks to technological and organisational innovations.

Table 1 - Sample characteristics (1998)

	total sample	second-tier suppliers	third-tier suppliers
number of firms	79	64	15
firm's size (employees)	60	69	19
firm's size (mln euro sales)	7.772	9.281	1.300
investments per firm (mln euro)	0.759	0.928	0.249

Source: CESOS

In order to study the most relevant part of the automotive supply chain, our sample is only composed of small companies, i.e. companies having less than 250 employees.

The sample firms made a lot of investments in 1998: the investment per employee ratio is about 12.000 Euro, in line with other research about Piedmont industrial system

(Unione Industriale, 1996). These investments were mainly financed by internal capital and not credit bank finance. Of course, all the modern financial tools, such as venture capital, are never used.

The sample SMEs have a complex organisation: 8 firms belong to an industrial group, 12 firms are organised as an industrial group (in the sense that they control other firms)^v.

In addition, 20 firms have more than one plants, maybe in order to exploit some learning economics coming from the product specialisation of each plant. The plant specialisation is consistent with the district relationships of the Turin area, where firms have strong horizontal links.

Companies that have a complex organisation (i.e. group plus multiplant production) show an higher size (98 employees or 13 million of Euro of sales) with respect to the other firms (37 employees or 4 million of Euro of sales).

Before analysing the vertical relationships concerning the innovation process within the filiere (see section 4.3), our study shows some general characteristics about both the input and the output of the innovation process.

On average, the number of researchers is 4% of total employees, and 41 firms out 77 have a R&D department: this confirms the effort made by the sample in order to improve its technological degree and to participate actively within the co-design and product-development process.

In addition, 24% of firms introduced some technological innovations or patents during the period 1993-1998; an other 6% of firms have some relationships with R&D centers or Universities.

If we define all these firms as “innovative firms”, we can find that innovative firms have a higher size with respect to the non-innovative ones: the former have 79 employees and 10 million Euro of sales, on average; the latter have only 27 employees and 3 million of Euro of sales. This strong relation between innovation and company's size is confirmed by a positive and significant correlation index.

All the aspects concerning the innovation process are strictly related to the total quality approach that automotive firms are generally going to implement. Within the EU competition, the non-price factors, such as innovation and quality, are very important in order to overcome competitors coming from low-cost countries, such as Asia or Eastern Europe.

As far as the management of the quality process is concerned, 84% of firms have a quality department, that represent the 5% of the total employees. In addition, three quarter of firms have a certified product, and 46% of firms have a wholly certified production. As far as the diffusion of technical standard is concerned, 75% of firms have implemented UNI standards, and 82% of firms have implemented QS9000 standard. This is an important results, if we consider that our sample is composed of SMEs. This results could derived by the investments that OEMs made into the supply chain: in section 4.1 we show at what extent the OEM forced small suppliers to invest into innovation and quality process.

4. The company relationships within the Turin automotive district

Company relationships within the automotive filiere changed strongly during the last decade, both from the qualitative and the quantitative point of view (Camuffo and Volpato, 1997; Calabrese, 1997).

Our data-set can show some characteristics of the vertical relationships between first-tier and second-tier supplier, mainly with respect to the commercial relations (i.e. sale concentration, type of contracts, etc.) and organisation relations (i.e. just-in-time, co-design, co-manufacturing, etc.). In addition, section 4.2 will focus on the company relations outside the district at international level (i.e. the relationships of the Turin firms with the foreign automotive filiere) and section 4.3 about the technological relations within the district.

4.1 Commercial and organisation relationships

During the last decade, the outsourcing process from the OEM towards the second-tier suppliers increased the quantitative aspect of the company relations into the automotive district. This increase created strong relationships between OEM and suppliers: among the latter, for a lot of cases OEM is the main customer. In our sample, main customer represents 42% of the sales, on average, and first-three customers represent 68% of sales (table 2).

Table 2 – Sales distribution by main customers - 1998 (%)

	total sample	second-tier suppliers	third-tier suppliers
First customer	41.6	42.9	37.1
Second customer	17.1	17.2	17.3
Third customer	9.4	9.3	10.1
Main three customers	68.1	69.4	64.6

Source: CESOS

This characteristic is changing according to the level of the filiere: second-tier suppliers are stronger linked with their main customer (the OEM) than the third-tier suppliers. Within the second-tier suppliers, main customer represent 43% of sales, whereas it is only 37% of sales within the third-tier suppliers^{vi}.

If we consider the qualitative evolution of the company relationships within the district, our data-set shows the changing occurred during the Nineties. This evolution is the completion of the co-manufacturing process started during the Eighties (Vitali, 1989), when the product organisation created strong relationships between Fiat and OEMs (i.e. first-tier suppliers). During the Nineties, the vertical relationships between Fiat and OEMs shifted from the co-manufacturing process to the co-design and product-development process (Jurgens, 2000).

Nowadays, we can suggest a new evolution of the outsourcing process within the district involving the second-tier suppliers. These level of suppliers is involved both within the co-manufacturing and the co-design process.

The commercial tools that can implement the new relations between OEM and second-tier supplier are mainly long-period contracts. Unfortunately, within our sample we do not find a lot of that kind of contracts: only 13% of second-tier firms have a long-period contract with OEM. Maybe this indicates that the outsourcing process from OEM towards second-tier suppliers is at the beginning.

An other organisation aspect that characterises the vertical relationships between OEM and second-tier suppliers is the just-in-time organisation. Just-in-time is one of the main important aspects concerning the supplier selection and valuation process. As Fiat asked to OEM for just-in-time organisation during the Eighties, nowadays OEMs are going to

ask for just-in-time to second-tier suppliers. This is the reason why just-in-time is widespread among sample firms (table 3): 71% of firms are using just-in-time organisation within vertical relationships with their customers, and the 40% of total sample sales are based on just-in-time. According to the frequency of the deliveries, we can divide just-in-time organisation into three main groups: intra-day just-in-time (used by 11% of firms), daily just-in-time (30%), weekly just-in-time (33%).

If we classify the just-in-time organisation according to the firm position along the filiere, the dataset shows that the just-in-time organisation is more spread within the second-tier suppliers, than the third-tier ones: 77% of the second-tier firms use just-in-time, whereas only 47% of third-tier do it.

Table 3 – Number of firms by type of just-in-time

	Total sample	second-tier suppliers	third-tier suppliers
intra-day j-i-t	9	7	2
daily j-i-t	24	21	3
weekly j-i-t	26	23	3
Total	56	49	7

Source: CESOS

In order to use just-in-time organisation, or to have strong links within the filiere, it is necessary to manage some technological tools, such as Electronics Data Interchange or Electronic Data Processing tools. The sample firms fit quite well these needs: 32% of firms have EDI or EDP links with customers, and 5% of firms have EDI or EDP links with their suppliers. These electronic tools are used only by second-tier firms, in order to manage their vertical relationships with customers (OEM) and suppliers (third-tier). As the studies about the OEM characteristics show us that EDI and EDP are widespread, we can say that the diffusion of electronic tools started by the top of the filiere, too: during the Eighties between Fiat and OEMs, during the Nineties between OEMs and their main customers. We may expect that a similar process is going to change the relationships between second and third-tier.

Even if our dataset does not have any data about the number of suppliers of each firms, according to the interviews we can estimate a “short” supply-chain. Maybe second-tier suppliers are going to implement the same reduction of the number of suppliers that characterised Fiat during the Eighties and OEMs during the Nineties. For example, Fiat reduced the number of its suppliers from 1300 in 1979, to 850 in 1986, to 370 in 1998 (Enrietti, 1997). We can expect that all the changes that involved Fiat and the OEMs will strongly affect the second and third tiers too.

The relationships among the automotive filiere can be quantified using the intensity of the outsourcing process.

A proxy of it can be the vertical integration index of each firm. The number of employees within each firm’s department can show the importance of the production area: where outsourcing is high, the production area is less important in comparison with the other departments. In 1998, the employees belonging to the production area were 70% of total employment, on average (table 4). This percentage was quite the same in 1993, and it is similar within the different tiers. All these findings are confirmed by previous studies about the Piedmont industrial system (Unione Industriale, 1996).

Table 4 - Employment distribution by firm's department (1998)

	total sample	second-tier suppliers	third-tier suppliers
Production	70.5	68.7	71.0
R&D-design	3.7	4.0	2.2
Purchase	2.0	3.0	1.9
Quality	5.0	5.6	5.0
Other	18.8	18.7	19.9
Total	100.0	100.0	100.0

Source: CESOS

We do not know the importance of the outsourcing process within each firm production. Other studies tell us that the Fiat internal production is only 30% of the final production

value, and that purchasing from non-Fiat companies represent more than 50% of the final production value (Enrietti, 1997). We can suggest that OEMs followed the same evolution during the Nineties, by increasing vertical relationship with second-tier suppliers, and that second-tier is going to do the same with respect to the third-tier. As our dataset do not have data about the importance of the outsourcing process of the second-tier firms, it is worth to underline the findings obtained by other studies. For example, Unione Industriale (1996) found that a sample of small companies of the automotive sector made in outsourcing the 14% of total production.

Commercial and organisation relationships among the automotive filiere are strongly affected by the evolution of the technological progress, and so by the R&D strategy of the automotive firms (see section 4.3).

In order to improve the competitive advantage, automotive firms are going to make some organisation innovations in order to increase their flexibility. That organisation innovations are supported by new technology: firms have to invest in communication system that put in touch all the firm's departments, from R&D, to design, production, marketing, after-sale, etc. The main goal is to integrate all the department and to gain efficiency and quality. The new organisation is based on the outsourcing process of all the non-strategic steps, in order to assemble all the complex parts coming from suppliers. These parts are usually quality checked by the supplier itself.

Some preliminary aspects of the new organisation are present within our sample.

For example, we can check the importance of co-design by the percentage of sales or of purchasing that are based on co-design. On average, that percentage is 11%. And there is a clear correlation between the importance of co-design and the company's level within the filiere: the second-tier firms make by co-design the 12% of total production, whereas the third-tier suppliers make by co-design only the 3% of it. That percentage is very high between Fiat and OEMs, as it increased during the last decade (Calabrese, 1997). Maybe, this co-design organisation is going to be replied within the relationships between second-tier and third-tier. On average, 30% of total firms use co-design, 35% of second-tier suppliers and only 7% of third-tier suppliers.

4.2 International relationships of the district

Company relationships among the Turin district are characterised by strong international aspects. We can divide international relationships according to the production or the commercial ones.

The internationalisation process of production is based on foreign direct investments made by foreign firms in Piedmont (passive process) or by Turin firms abroad (active process).

As far as the passive process is concerned, direct investments made by foreign firms are mainly composed of acquisitions of local SMEs.

Some studies about this process show at what extent the attractive factors are based on the external economies of the local area (Balcet, Lanzetti, 1999), generated by the product specialisation of the Turin district.

As we mentioned in section 2, within the Turin district several OEMs are controlled by foreign capital. And we can suggest that the process of passive internationalisation is going to involve the second-tier too. Within our sample that process is at the beginning, as only one out 79 firms is a foreign firm.

If it is true that the international process is going to affect the second-tier firms, we can suggest a different pattern of internationalisation with respect to the OEM case. As the latter was characterised by a market-oriented goal, i.e. acquiring a local firm in order to acquire its commercial relationships with the car-maker, the former can be based on a technology or organisation-oriented goal: OEMs acquire a second-tier firm in Piedmont only if the SME has a competitive advantage based on innovation. That innovation derives mainly by technology (such as a new process or a new machinery) or by organisation (such as just-in-time, co-design, etc.).

As far as the process of active internationalisation of the local firms, we can remember the case of direct investments made abroad by a firm, or the case of exports.

As Turin OEMs are going to follow the foreign growth of Fiat, by investing in Latin America, Poland, Turkey, Russia, India, China, the second-tier suppliers are strongly affected by this kind of pattern of growth. If OEM does not find good suppliers in that countries, it will support the de-localisation of small suppliers from Piedmont towards the new markets. Within this contest, the OEM main goal is to reply in the new market the same organisation that gain success in Piedmont. The industrial policy problem is

about the lack of managerial and financial resources of second-tier suppliers: as they are SMEs, they usually do not afford to overcome all the problems deriving from the foreign de-localisation of production.

Our data-set shows that only one of 79 firms has a foreign plant, made in Argentina following the Fiat foreign growth. In addition, the sample shows a high interest of SMEs towards the delocalisation process: 22 out of 79 firms declare that they are going to develop a similar international strategy in the future. The countries most involved within the direct investments are industrialised countries (11 cases), as well as Less Developed Countries (14).

It is likely that within industrialised countries, the SMEs coming from Piedmont are looking for new markets, or are going to make an export-substitution direct investment. On the contrary, within LDCs the SMEs are making follow-the-leader investments. They are not making cost-saving investments as only one firm is going to re-import to Italy the foreign delocalised production.

A local policy problem derives from the 10 Piedmont SMEs that declare that they will substitute local production with foreign production (export-substitution strategy), even if the majority of the sample will not substitute local employment by foreign one.

All the above empirical findings about the production internationalisation process of second-tier suppliers confirm the new increasing role of the vertical relationships at international level.

The internationalisation process of the automotive component filiere is made by exports, too.

Within the second-tier suppliers exports are not so important, as the second-tier suppliers are very linked to local OEMs. Usually, the second-tier product is assembled by OEM and, if it is the case, exported by it. Nevertheless, in our sample we find 23% of firms where exports represent more than 10% of sales. We can imagine that these firms have an autonomous strategy of growth, that it is not only linked to the local OEM or to Fiat. The exporting firms are going to exploit their competitive advantage at international level, reducing their dependency from the local district.

In order to better clarify this findings, we have to control exports for the country of destination: if exports are directed toward countries where Fiat has delocalised its

production, the international commerce is again a simple operation between second-tier supplier and its local customers. Our sample shows that its exports are mainly toward European countries, confirming the autonomous pattern of growth that exporting firms have, and the exploitation of their competitive advantage at international level.

On average, exports represent 10% of sales in 1998. In 1993 that percentage was quite the same.

We find a strong relation between exports and firm's position within the filiere: second-tier companies have a percentage of exports (11%), with respect to sales, higher than third-tier suppliers (3%), confirming that the former are better organised.

If we split second-tier suppliers according to the characteristics of their customers, we find that companies linked to Fiat (i.e. Fiat is one of the first-3 customers) have the same export-oriented strategy than the companies not-linked to Fiat. This means that Fiat does not negatively affect the export-driven growth of its suppliers.

4.3 Technological relationships within the district

Within the Turin automotive district there are some special nodes where technological innovations are very important. These technological innovations represent an external economy that can be exploited by all members of the automotive filiere.

As technological level of Fiat has positively affected the technological progress of OEMs, we can suggest that the latter are going to ask to their second-tier suppliers for a higher technological degree.

In our sample we find a sort of "technology push" driven by OEM, that forces second-tier suppliers to invest in R&D. Sometimes, OEMs try to support the R&D investments of the second-tier supplier by incentive contracts (table 5).

Within 30 out 79 firms, OEM tries to force its supplier in investing within R&D. According to the tier involved, we find that second-tier suppliers are more requested to invest in R&D by their customer (OEM) with respect to third-tier suppliers. This means that the technology is perceived as an important competitive factor by Fiat, that forced OEM, and by OEMs, that are going to force second-tier suppliers, but it is not important for the second-tier, because its SMEs are not going to force third-tier supplier to invest in R&D.

Table 5 - Customer's effort to force supplier to innovate

	total sample	second-tier suppliers	third-tier suppliers
High	39.0	41.3	28.6
Medium	26.0	27.0	21.4
Low	35.1	31.7	50.0
Total	100	100	100

Source: CESOS

Maybe this is due to the low level of technological skills that third-tier suppliers have: within these SMEs only 2% of employment is engaged within the R&D department, whereas that percentage is 4% within the second-tier suppliers (see table 4).

In addition, we can remember that 61% of second-tier firms have a R&D department, whereas only 20% of third-tier suppliers do it.

The same difference occurs within the quality department, confirming the strong links between quality strategy and R&D strategy. Within the second-tier 85% of firms have a quality department, whereas that percentage is only 64% within the third-tier.

The output of that investments in quality growth is represented by the percentage of certified sales: 83% of second-tier firms have gained a certification degree, whereas 78% of third-tier do it; 50% of second-tier firms have all sales certified, whereas 21% of third-tier do it.

All the above findings confirm that the efforts both made by Fiat on the technological improvement of OEMs, and made by OEMs on second-tier firms, gained an important success in terms of technological skills and quality improvement.

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ⁱ The author is grateful to Cesos (Rome) for the permission to process the original dataset created under a Adapt-UE programme (701/A2/M). Of course, the responsibility for the contents of the paper rests solely with the author.

ⁱⁱ See Enrietti (1997), Bianchi-Enrietti (1998), CCIAA Torino (1998).

ⁱⁱⁱ See Camuffo-Volpato (1997) and the references of the volume.

^{iv} The importance of the Piedmont component industry is going to affect all the other aspects of the economic life in Piedmont. For example, because of automotive filiere produces durable consumers goods, the economic cycle of Piedmont is strongly affected: the economic cycle will anticipate the Italian one, and will emphasise it (by higher development and deeper crisis).

^v This percentage is very lower than that one related to OEMs (Bianchi and Enrietti, 1998), but it is the same percentage shown by SMEs of the Turin industrial system as a whole (Unione Industriale, 1996) or by the Italian industrial system (Barca, 1997).

^{vi} We count only one firm within the fourth-tier supplier: its main customer represents 30% of sales, and the second and third customers are not automotive firms.