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Outsourcing in Spain´s automotive industry-a case study

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ABSTRACT
Outsourcing is a technique implemented and consolidated through the organisation of production in the automotive sector, which consists of fragmenting the value chain into more specialised stages and deciding which activities, products and services are to be seen to within

the firm and which externally. This article seeks, from among all the factors involved in the practice of outsourcing, to find indicators associated with the factors that are significant to the carrying out of outsourcing and to quantify the evolution, trends, causes, effects and consequences of its practice in the automotive industry in Spain.

Keywords: Outsourcing; Procurement/Purchasing Processes; Supply Chain Management; Automobile Industry.

Outsourcing en la industria del automóvil de España: Un caso de estudio

RESUMEN
El outsourcing es una técnica implantada y consolidada de organización de la producción en el sector del automóvil consistente en fragmentar la cadena de valor en fases mas especializadas y decidir que actividades, productos y servicios se realizan dentro de la empresa y cuales se externalizan. El presente artículo pretende de entre todos los factores que están involucrados en la práctica del outsourcing encontrar indicadores asociados a los factores que sean significativos con la realización del outsourcing y cuantificar su evolución, tendencias, causas, efectos y consecuencias que tiene su práctica en la industria de fabricantes de vehículos en España.

Palabras clave: Outsourcing; procesos de compras; cadena de suministro; industria del automóvil.

1. INTRODUCTION

Vehicle manufacturing firms in Spain produce the following types of goods: private cars, industrial vehicles and four-wheel drive vehicles, buses and coaches, tractor trucks and motorcycles. The sector has enormous power in the Spanish economy's production sector, with 11 brands installed and 18 production factories.

According to the Spanish Association of Car and Lorry Manufacturers in 2008, the direct contribution to the GDP was 3.5% and the generation of direct and indirect employment was 8.7% of the active population. Spain exported 85.8% of the vehicles it produced, the European market being the principal one, meaning 13.1% of Spain's total exports (Spanish Association of Car and Lorry Manufacturers-ANFAC, 2008). It is the vehicle manufacturers that have the decision-making power in the auto industry. Their decisions are transmitted downstream to the Tier 1 manufacturers, from these to the Tier 2 manufacturers and from here to the Tier 3 manufacturers and so on down

the supplier chain, in such a way that the decision-making chain and number of firms in the auto industry is a pyramid in which the vehicle manufacturers are at the upper apex and at the lower levels we find Tier 1, Tier 2, Tier 3, etc. Vehicle manufacturers are those that contribute the greatest added value to the final product and touch off the outsourcing practice that is transmitted downstream towards its suppliers (Spanish Association of Automotive Suppliers-SERNAUTO).

1.1. Components manufacturers

The automotive auxiliary industry came into being from outsourcing by manufacturers (OEM). The reasons for the growing pace of outsourcing by the OEM (today over 75% of a vehicle's added value) are: specialisation, particularly as regards the technological contribution; lower costs; conversion of fixed cost into variable cost, which means running a lower risk; and improved profitability of capital employed for vehicle manufacturers (Kimura and Ando; et al, 2005). This sector covers a broad industry spectrum, ranging from steel to electronics and including chemistry, textiles, mechanics, glass and of course services (financial, insurance, etc).

Altogether it is thought that 65% to 75% of a vehicle's value comes from firms that manufacture automotive equipment and those that manufacture components, and hence the huge importance that suppliers have for the automotive sector. In terms of direct employment generated, three out of every four workers associated with the automotive sector are directly hired by equipment and components manufacturing firms (Price Waterhouse Coopers, 2003). For the most part, the automotive auxiliary sector in Spain manufactures for vehicle manufacturers in terms of both invoicing and the number of firms aimed at this sector. Hence, the success of components industry firms lies in their being able to pinpoint and react to changes in strategy by the vehicle manufacturers. This means that the components industry is now facing the concentration of vehicle manufacturers, market globalisation and product development with greater technological requirements.

1.2. Outsourcing

Outsourcing or vertical disintegration is a production organisation technique that has been implemented and consolidated in the automotive sector. It consists of fragmenting the value chain into more specialised stages and of deciding which activities, products and finished or semi-elaborated services are to be done within the firm and which are to be outsourced, regardless of whether the outsourced part is carried out within the same country or outside it (offshoring) and who the owner is (self or third parties) (Curzon, 2001).

Outsourcing is carried out for several reasons: to turn part of fixed costs into variable costs, to reduce costs, to lower investments for performing activity, to boost

flexibility and technological knowledge, to improve the final product / service, to enhance productivity through specialisation and so on (Hitt and Sturgeon; et al, 2005). The different types of outsourcing, taking into account the national border and firm limit, are: domestic intra-firm outsourcing, domestic inter-firm outsourcing, international intra-firm outsourcing and international inter-firm outsourcing.

Outsourcing done outside the country itself causes a reduction in the domestic production of the intermediate goods in which the country is not competitive and, as a result, decreases the factors that directly intervene in the obtaining of same. Two possibilities can be given in the case of Spain. Outsourcing carried out in labour-intensive activities causes the unemployment level of less skilled workers to rise; yet at the same time the relative employment of skilled workers also rises (Uribe and Rubert, 2009). Outsourcing performed in activities with a high degree of qualified labour has an encouraging effect on skilled workers since inputs continue to be produced in all countries involved and it enables the domestic economy to break its technological ceiling (Feenstra and Hanson, 1996). The two main elements in outsourcing are the distance from the place of product / service sale and the degree of disintegration. There are several advantages to fragmentation all along the distance: lower costs in wages and salaries, accesses to resources, infrastructures, a drop in the cost of consumables such as electricity, water, etc.

There are several drawbacks to fragmentation all along the distance: transport costs, telecommunications costs, inefficiency in distribution, commercial barriers, greater organisational complexity, etc. There are several advantages to fragmentation all along the disintegration: price reduction owing to the economies of scale produced in the supplier firm, acquisition of new capacities, acquisition of new technologies, etc. There are several drawbacks to fragmentation all along the disintegration: supplier management costs, risks in the contracts signed with the suppliers, the legal system of the country in which outsourcing takes place, etc (Bengtsson and Dabhilkar, 2008). To make outsourcing possible, two conditions have to be met (Gandoy; et al, 2005). The value chain can be fragmented clearly and concisely and the activities making it up are separable physically and the different stages and components of the product/service do not have the same factorial intensity. The push towards outsourcing in the past decade has been due to three basic reasons: the technological change that has made possible the division of the production chain into activities that are more and more specialised; the process of deregularisation and liberalisation, which has encouraged international trade; and the setting up of production networks and increased competition that has prompted new ways of organising production so that this can be more efficient (Gandoy; et al, 2005).

1.3. Production factors

Raw materials: By outsourcing, vehicle manufacturers transfer the variability risk and rising prices of raw materials to the components sector. We shall study the case

of steel since a vehicle is 55% composed of this material (World Steel Association) among its numerous components: bodywork, engine, transmission etc. The automotive sector is second in terms of demand for steel after the construction sector (The European Confederation of Iron and Steel Industries-EUROFER, 2008).

The price of steel has increased since the 1990s owing to the large demand by emerging countries such as China and India (EUROFER). Thus the greater demand for vehicles boosts the demand for the steel with which to manufacture them and can trigger a rise in steel prices if it is not accompanied by an increase in the steel offer. As the value of the outsourcing carried out by vehicle manufacturers grows with increasing vehicle demand, this causes vehicle manufacturers to transfer the risk of uncertainty and possible rises in the price of steel to the components sector. Both vehicle manufacturers and components manufacturers can buy steel futures or options in order to have coverage to prevent the uncertainty of steel prices from affecting them. However such operations involve risks such as exactly when to engage in these operations and how large a purchase should be made.

Energy: By outsourcing, vehicle manufacturers transfer the risk of variability and energy price increase to the components sector.

Labour costs: By outsourcing, vehicle manufacturers transfer the increases in labour costs to the components industry.

1.4. Contract Manufacturing

Many industrial firms no longer focus on manufacturing as their basic business core and are now concentrating on researching, designing and selling the product, leaving manufacturing to the new specialists: the contract manufacturers. In contrast to the orientation of traditional subcontracting towards cost reduction, contract manufacturing pursues two additional goals: responding swiftly to the volatility of demand and freeing resources in order to devote them to innovation (Arruñada and Vázquez, 2005). Its advantages are the following: The growing use of robotics in factories demands heavy investment and coping with greater technical complexity in its operation, two conditions that only specialised firms can fulfil in manufacturing, thanks to greater production volume and experience; and second, the contract manufacturer gains large economies of scale in its purchases, unattainable for those that manufacture only their own brands and reduce entry barriers, which increases competition since lower fixed costs facilitate the creation of new firms.

By outsourcing, vehicle manufacturers transfer knowledge, knowhow, skills, technology, R+D+I and so on to components manufacturers. This means that components manufacturers are in a position to see to the majority of the products/services that vehicle manufacturers do. There are several reasons for contract manufacturing to be consolidated in the automotive sector: Lower profitability as a result of a capacity glut and a saturated market, meaning that specialists that manufacture for several brands can reach the minimum efficient size

more easily while vehicle manufacturers can invest less in production plants, reducing the risks of their investments, competitive pressures to reduce costs have pushed vehicle manufacturers towards consolidating and reducing platforms since this facilitates production, reduces defects and eases the outsourcing of the assembly process, thanks to the information technologies (EDI) and the standardisation of procedures (ISO/TS 16,949) have cut production costs and exchange costs.

These are some examples of contract manufacturers focused on very specific market niches (sports cars, cabriolets, four-wheel drive vehicles, etc) and not on the manufacture of large series of vehicles: Magna manufactures and assembles for BMW (X3), Saab (9.3 Cabrio), Chrysler (Jeep Grand Cherokee, 300C), Mercedes Benz (G-Class); Pininfarina assembles several models for Alfa Romeo (Brera), Ford, (Focus) Mitsubishi (Colt), Volvo (C70) and collaborates with the leading vehicle manufacturers; Valmet Automotive assembles for Porsche (Boxster and Cayman) in its Finland factory.

2. DESCRIPTION OF THE MODEL

The aim and scope of the research based on this model is the quantitative study of outsourcing in Spain's automotive sector, analysing its evolution, trends, causes, effects and consequences. From all of the factors involved in the practice of outsourcing (costs, flexibility, productivity, competition, investment, etc), we seek to find indicators associated with the factors described previously that are significant with the practice of outsourcing. This article breaks new ground in that it quantifies the causes, effects and consequences of outsourcing in the automotive industry in Spain.

Two initial hypotheses have been taken into consideration in this model:

1. Technological changes or technical advances have not altered the consumption of intermediate inputs per unit of final product.
2. There have not been disparate alterations between the prices of intermediate inputs and prices of the final goods, a condition which has been met since the linear regression technique has been applied and the variables have been significant according to Table A1.1 in Correlation Tables Appendix A.1.

Once established the initial hypotheses, the methodology has been the following:

In the first place the values of the variables have been compiled in the Spanish Annual Industrial Company Survey (Spanish National Institute of Statistics-INE) and in Structural Business Statistics (Eurostat), according to the European classification NACE Rev 1.1 by which vehicle manufacturers have Code 341 and components manufacturers have Code 343. The series of data compiled (ranging from 1995 to 2007) has been divided by the value of the invoicing in those variables in which it has been feasible. Next we have selected the variables that are more important and with

greatest importance with regard to invoicing. Following this, we have grouped these by areas: costs, productivity, purchases, added value, investment etc.

Next the outsourcing value has been calculated, taking the following definitions into account (Gandoy; et al, 2005):

1. Raw materials: Goods acquired for transformation in the production process: These are goods in which the vehicle manufacturing firm contributes the greatest added value to the final transformation, due to the fact that they have high strategic value, high technological content, final product differentiators, etc.
2. Merchandise: Goods acquired to be resold without subjecting them to a transformation process. These goods are incorporated into the vehicle without any subsequent transformation process in which the vehicle manufacturing firm does not contribute further added value. They are goods in which the components industry is very specialised; they are goods that are very standardised and the final product has little differentiating quality since any vehicle manufacturer has access to them
3. Jobs done by other firms (TRE): the cost forms part of the process of one's own production, and the job is commissioned to and carried out by other firms.
4. External services (SE): operation costs of different types (R+D+I, repairs and maintenance, professional services, etc).

The calculation of the value of the fragmentation value of internal production (FPI) is as follows: Raw materials / production value + Merchandise / production value + Jobs done by other firms / production value.

[1] The calculation of the value of outsourcing services (SE) is as follows: External services / Production value.

[2] The calculation of the value of complete outsourcing index (OT) is the following: Fragmentation of internal production (FPI) + Outsourcing of external services (SE).

$$OT = FPI + SE$$

[3] With the value of complete outsourcing index (OT) (Table 1, Table 4) and the value of the variables compiled and calculated, the linear ordinary least squares regression statistical technique has been applied, and their correlation has been analysed for levels of significance of $p<0,05$ and $p<0,01$ and correlation coefficient r (Appendix A.1; Tables: A.1.3; A.1.4). With the results obtained, we have analysed the effects, causes and consequences that outsourcing has in the automotive sector in Spain.

3. RESULTS OBTAINED

3.1. Vehicle manufacturing industry

The values obtained from applying the methodology presented are shown in Table 1:

Table 1: Values obtained in calculating outsourcing index

Denomination	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Raw materials	0.311	0.321	0.347	0.356	0.324	0.333	0.535	0.476	0.455	0.434	0.410	0.427	0.416
Merchandise	0.175	0.184	0.221	0.223	0.291	0.272	0.199	0.170	0.180	0.202	0.184	0.188	0.185
TRE	0.006	0.005	0.005	0.005	0.003	0.007	0.019	0.017	0.016	0.013	0.011	0.007	0.003
FPI [1]	0.493	0.511	0.574	0.585	0.619	0.612	0.754	0.665	0.651	0.651	0.606	0.623	0.605
SE [2]	0.101	0.100	0.105	0.107	0.115	0.110	0.094	0.101	0.095	0.094	0.103	0.095	0.096
OT [3]	0.594	0.611	0.680	0.692	0.734	0.733	0.848	0.766	0.747	0.746	0.709	0.719	0.702

Source: Authors

As can be seen in Table 1, the greatest importance in the value of outsourcing is that of raw materials, the average values, variability and range of which have been 0.3962; 0.0048; 0.225. Next is the merchandise whose average values, variance and range have been 0.20; 0.0013; 0.12. The value of the external services whose average values, variance and range have been 0.0941; 0.000043; 0.022 have remained constant with scarcely any variation over the periods of study. The value of the external jobs whose average values, variance and range have been 0.0096; 0.000031; 0.0016 have little influence on the final outsourcing value.

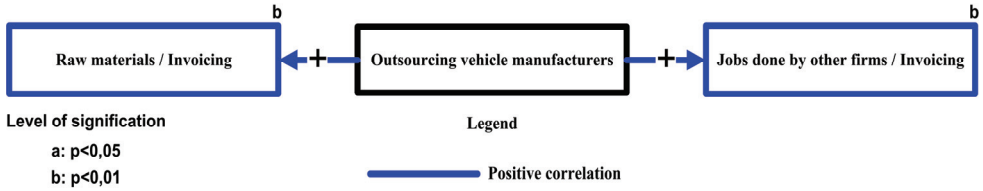
Table 2 and Figure 1 represents the results obtained from applying the linear ordinary least squares regression statistical technique (p-value and correlation coefficient r) between the value of outsourcing index (OT, Table 1) by the vehicle manufacturers and the purchases of raw materials, merchandise, jobs done by other firms and external services; the purchases of merchandise and the external services have not proved significant with the outsourcing value.

Table 2: Significant results between the variables used in calculating the value of outsourcing and the value of outsourcing

Denomination	Raw materials / Invoicing	Jobs / Invoicing
Outsourcing	0.71**	0.71**

Correlation with respect to absolute value / Invoicing; Level of significance: 5% (*); 1% (**).
Source: Authors

Figure 1: Relation of outsourcing to the main variables which make it up.



Source: Authors.

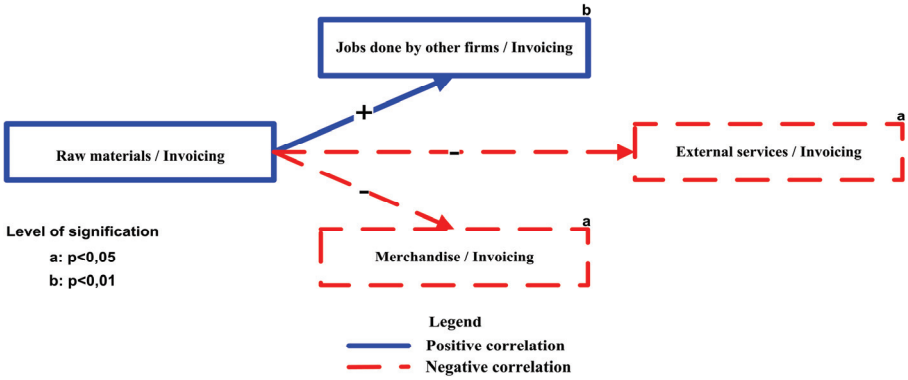
Table 3 and Figure 2 represents the results obtained from applying the linear ordinary least squares regression statistical technique (p-value and correlation coefficient r), among the variables that have been used for calculating outsourcing index (OT, Table 1). Only raw materials have a significant relation with the rest of the variables.

Table 3: Significant results among the variables used in calculating the value of outsourcing

Denomination	Raw materials	Merchandise
External jobs	0.84**	Insignificant
External services	-0.68*	Insignificant
Raw materials	-	-0.69*
Merchandise	-0.69*	-

Correlation with respect to the absolute value / Invoicing; Level of signification: 5% (*); 1% (**).
Source: Authors

Figure 2: Relation among the variables making up the value of outsourcing.

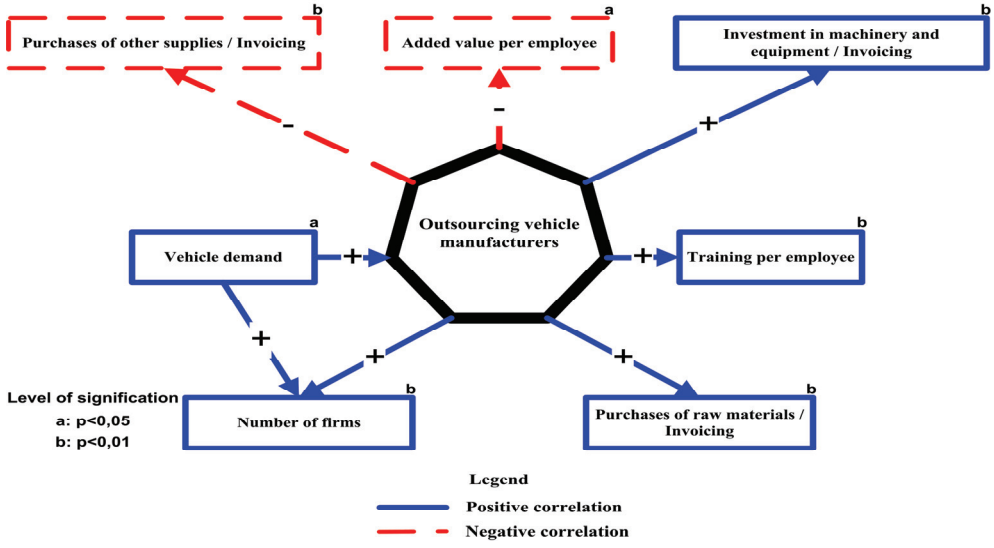


Source: Authors

Purchases of raw materials, the goods that greatest added value contribute to the final product, increase with the growth in the value of outsourcing. Nonetheless these have a negative relation with external services, which means that vehicle manufacturers devote more resources to the former activities, products and services which contribute greatest added value and differentiation to the final product. A negative relation has been verified between purchases of raw materials and merchandise, due to the fact that the greater the value of outsourcing, the more firms focus mainly on the raw materials which are the activities, products and services which greatest added and differentiating value contribute to the final product.

As regards merchandise, there is no significant relation with other variables since they are mainly undifferentiated products and any vehicle manufacturer can have access to them. Figure 3 represents the results obtained from applying the linear ordinary least squares regression statistical technique (p-value and correlation coefficient r) between the total outsourcing index (OT, Table 1) and the value of the variables; the most significant variables have been represented (all variables are contained in Table A.1.3 in Correlation Tables Appendix A.1) and their correlation with the outsourcing index variable (OT, Table 1).

Figure 3: Main significant variables related with outsourcing.



Source: Authors

3.2. Components auxiliary industry

The values obtained by applying the methodology presented are shown in Table 4:

Table 4: Values obtained in calculating outsourcing index

Denomination	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Raw materials	0.403	0.413	0.453	0.443	0.424	0.477	0.519	0.532	0.538	0.544	0.561	0.542	0.577
Merchandise	0.032	0.032	0.025	0.023	0.026	0.023	0.028	0.014	0.020	0.018	0.013	0.020	0.025
TRE	0.024	0.029	0.026	0.028	0.038	0.037	0.044	0.044	0.041	0.041	0.045	0.047	0.050
FPI [1]	0.461	0.475	0.503	0.496	0.490	0.537	0.591	0.591	0.601	0.604	0.620	0.610	0.653
SE [2]	0.108	0.100	0.101	0.105	0.106	0.105	0.111	0.113	0.114	0.112	0.111	0.115	0.117
OT [3]	0.569	0.575	0.604	0.601	0.596	0.642	0.702	0.707	0.715	0.716	0.731	0.726	0.770

Source: Authors

As Table 4 reveals, the greatest importance of outsourcing in the auxiliary sector is shown in raw materials whose average values, variability and range have been 0.49; 0.0037 and 0.174. Below are the external services whose average values, variability and range have been 0.10; 0.00003; and 0.017 whose value over the periods of study has remained constant. The value of merchandise and of external jobs has only a very slight influence on the total value of outsourcing. Table 5 shows the main results of applying the linear regression statistical technique (p-value and correlation coefficient r) among the variables used in the calculation of outsourcing index (OT, Table 4).

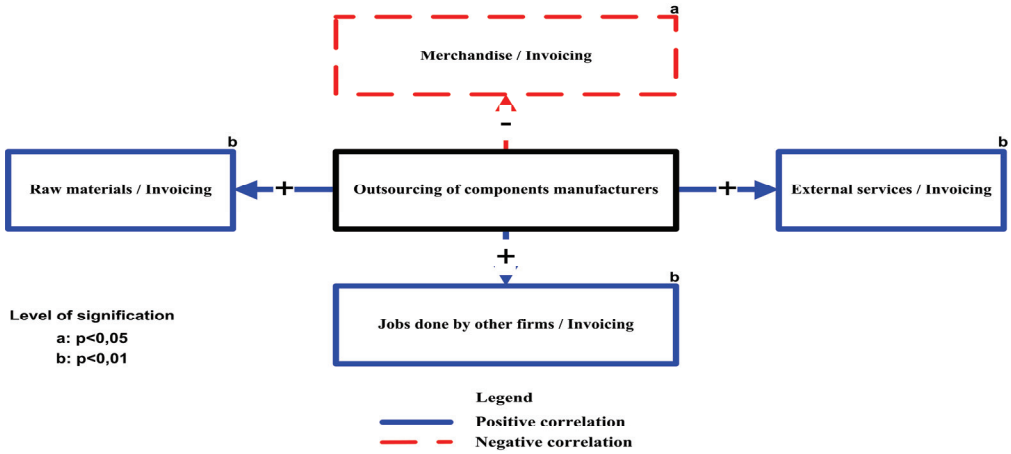
Table 5: Significant results among the variables used in the calculation of outsourcing

Denomination	Raw materials	Merchandise	External jobs
Raw materials	-	-	-
Merchandise	-0.34**	-	-
External jobs	0.89**	-0.59*	-
External services	0.84**	-0.57*	0.82**

Correlation with respect to the absolute value / Invoicing; Level of signification: 5% (*); 1% (**).
Source: Authors

Figure 4 represents the results obtained from applying the linear ordinary least squares regression statistical technique (p-value and correlation coefficient r) between outsourcing index (OT, Table 4) of components manufacturers and purchases of raw materials, merchandise, external jobs and external services.

Figure 4: Relation between outsourcing of components manufacturers and purchases of raw materials, merchandise, external jobs and external services.

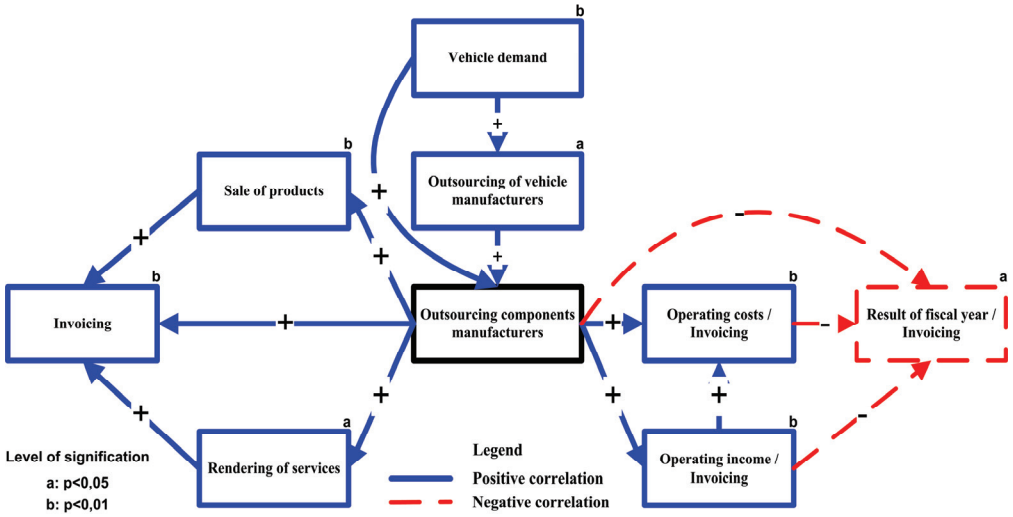


Source: Authors

As can be seen in Figure 4 and in Table 5, as the value of outsourcing index grows, so do the purchases of raw materials, which are the products that greatest added value give to the product, while merchandise purchasing decreases. In turn there is growth in terms of external jobs, where the firm devotes more resources to raw materials, and external services grow meaning that the components manufacturers, due to the fact that they lack the necessary resources, acquired knowledge, people with adequate training and so on mainly stimulate cooperation with its suppliers for product / service development. The purchases of merchandise with the external jobs and external services are correlated negatively, which explains why components manufacturers invest fewer resources in cooperating with their suppliers in the development of these products.

Figures 5, 6 and 7 represent the results obtained from applying the linear ordinary least squares regression statistical technique (p-value and correlation coefficient r) between the value of the outsourcing index (OT, Table 4) and the value of the variables / invoicing, representing the significant variables and their relation with the variable of outsourcing, (all variables are included in Table A.1.4 in Correlation Tables Appendix A.1). Figure 5 represents the relation between outsourcing of vehicle manufacturers and outsourcing of components manufacturers.

Figure 5: Relation outsourcing index manufacturers-outsourcing components.

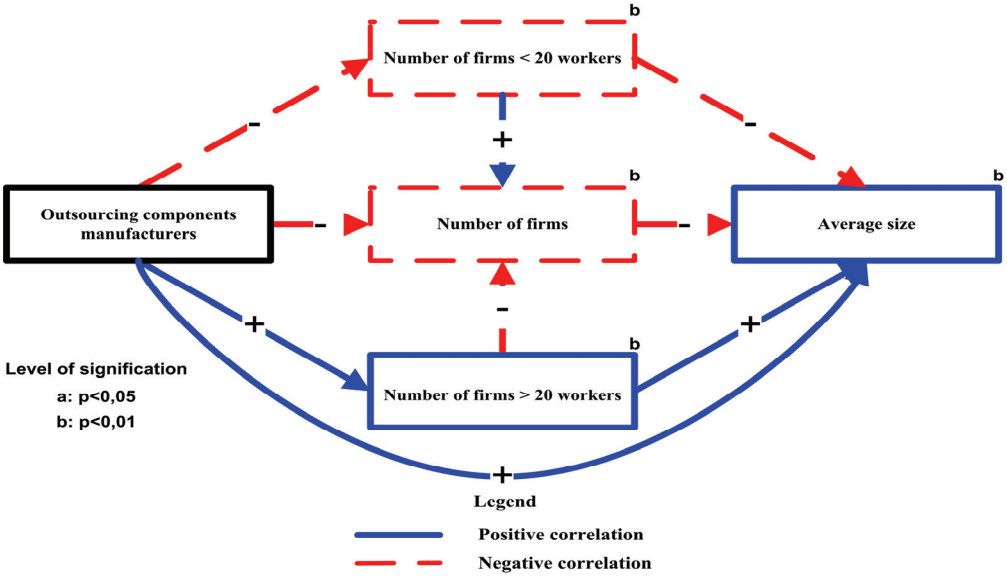


Source: Authors

As can be seen in Figure 5, outsourcing of components manufacturers is determined by vehicle demand. This prompts vehicle manufacturers to outsource in the auxiliary components industry; it causes components manufacturers to do so with their suppliers. Because vehicle manufacturers increase their outsourcing, components manufacturers increase their invoicing owing to the increase in sales of products and rendering of services to vehicle manufacturers.

By analysing Figure 5 and Table A.1.2 in Correlation Tables Appendix A.1 which presents the results obtained by applying linear regression between operating income and operating costs. Operating costs increase at a higher rate than operating income with respect to the invoicing, owing largely to the increase in the price of raw materials (more specifically to the price of steel) and of energy. Since 2003, steel prices have risen owing to the large demand for emerging countries such as China and India. This causes margins and profitability to reduce as invoicing by components manufacturers increases. Figure 6 shows the relation between outsourcing index of components manufacturers (OT, Table 4) and in the number of firms of the auxiliary automotive industry in Spain.

Figure 6: Relation between outsourcing and number of firms.



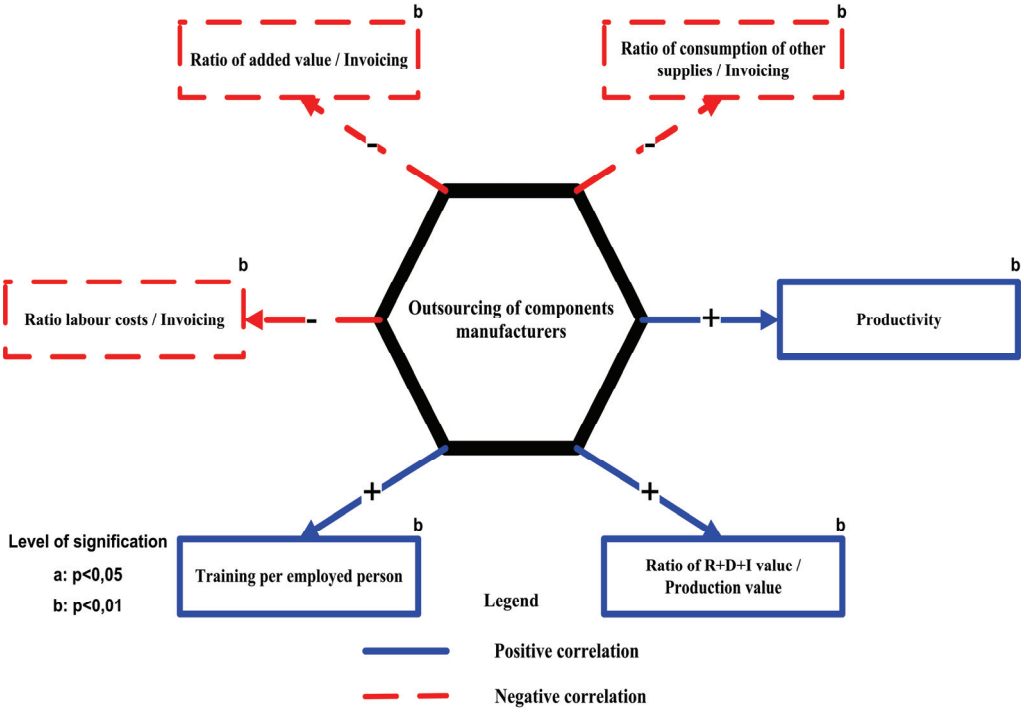
Source: Authors

As the Figure 6 shows, as the value of outsourcing index increases, the number of firms making up the sector decreases because the majority of firms making up the auxiliary sector have fewer than 20 workers. The number of firms with fewer than 20 workers decreases and the number of firms with more than 20 workers increases. This is for the most part due to three reasons: 1º As has been shown, the rise in the value of outsourcing index increases invoicing yet profitability and margins are reduced, resulting in processes of purchases, acquisitions and strategic alliances in order to obtain economies of scale, reduce operating and structural costs in exchange for increasing profitability and margin and avoiding a possible temporary receivership or bankruptcy. 2º The increase in the value of outsourcing index of vehicle manufacturers, raises the value of outsourcing index of the components manufacturers as represented in figure 5 (outsourcing chain) causes cooperation among the firms to increase and firms have to have some minimum resources (knowhow, staff, assets, R+D+I, patents, etc) in order to develop products / services both upstream to their buyers and downstream to their suppliers, meaning that acquisitions, purchases and strategic alliances take place in order to have these resources available, since the level of competition in the sector increases and the firms increase the level technological of the products/services for the purpose of differentiation. 3º To reduce the overlapping of the product offer by components manufacturers existing in the market. If the vehicle demand is low, then there is a glut of production in both the vehicle

manufacturer sector and the auxiliary sector, meaning that purchase processes, mergers and strategic alliances take place in order to eliminate this capacity glut and adapt the offer to the demand.

Therefore, in an environment where operating costs are on the rise (chiefly raw materials, energy and labour costs), there is a lack of supply, and operating costs increase at a higher rate than the operating income when invoicing increases, in order for an auxiliary sector to be independent and not have to resort to mergers or takeovers has to be included in a zone in which the value of the bottom limit is determined by low vehicle demand, which triggers a glut in production, and a top limit value that is determined by a high vehicle demand which causes firms to merge or be taken over in order to achieve economies of scale. Figure 7 shows the relation among outsourcing index of components manufacturers (OT, Table 4), cost reduction, investment and productivity.

Figure 7: Relation among outsourcing, cost reduction, investment and productivity.



Source: Authors

4. CONCLUSIONS

4.1. Vehicle manufacturers

Having applied the methodology presented in this article, the key indicator in the practice of outsourcing is **vehicle demand**, which causes competition in the sector to increase. With increased competition, vehicle manufacturers focus on the activities in the value chain that incorporate the greatest added value to the final product and make the market have more differentiated products among the vehicle manufacturers.

Outsourcing has several effects and consequences:

- Entry barriers: There are fewer entry barriers in the vehicle manufacturer sector, which makes the number of firms increase for several reasons. A transfer of knowledge and technology takes place from the vehicle manufacturer sector to the components sector, meaning that the components sector becomes specialised, increases competition in the components sector and offers a greater range of products and services to the vehicle manufacturer sector. The activities in the value chain that contribute the least added value to the final product or are very labour-intensive are externalised to the components sector, some fixed costs become variable costs and less investment is needed in assets and working capital.

- Economies of scale: With increased competition among vehicle manufacturers, prices are more fixed and margins are reduced; to compensate for this margin reduction vehicle manufacturers outsource, making the components sector become specialised, bringing about economies of scale in the components sector and causing the products and services offered by the components sector to be more reasonably priced than if they were produced by the vehicle manufacturers.

- Activities with greatest added value: With increased competition, vehicle manufacturers contribute greater value to the final product in order to be able to compete and stand out from their competitors and are focused on the activities in the value chain that contribute most to the final product. As seen in figure 3, there is an increase in investment in the firm's staff training, machinery and equipment.

- Increase in products of greatest added value: An increase takes place in the components that add greatest value and differentiation to the final product such as raw materials and while a decrease is seen in merchandise that consists of undifferentiated products among vehicle manufacturers.

- Cooperation between vehicle manufacturers and the components sector: With the increase in the outsourcing value, cooperation between vehicle manufacturers and components manufacturers increases, which enables firms to conserve resources, share risks, obtain information, access complementary resources, reduce product development costs, improve technological capacities and so on. This causes vehicle manufacturers to make exclusive R+D+I alliances with their most innovative suppliers in order to ensure an adequate differentiation level in the products. As vehicle manufacturers depend to a greater extent on the suppliers' capacity to innovate, they have to devise much more sophisticated strategies for managing the suppliers.

- Raw materials: A vehicle is 55% made of steel (Source: World Steel Association) in its various components: bodywork, engine, transmission, etc. The steel consumption allotted to the automotive industry vacillates from 15% to 20% of the world production (EUROFER) and it is the number one consumer of the world's production of flat bar steel. The evolution in steel prices since the 1990s has been on the rise due to the large demand by emerging countries such as China and India. By outsourcing, vehicle manufacturers transfer the risk of price variability and increases in raw materials, energy and labour costs to the components sector.

- Contract manufacturing: At present vehicle manufacturers tend to focus their activity on the manufacture of engines and main subgroups, vehicle assembly and design, vehicle marketing and customer relations. By outsourcing, vehicle manufacturers transfer knowledge, knowhow, skills, technology, R+D+I, etc to components manufacturers. In this way, components manufacturers are in a position of seeing to most of the products and services that the vehicle manufacturers do, becoming contract manufacturers. The vehicle manufacturers will tend to externalise vehicle assembly to the contract manufacturer which, combined with knowhow will make it possible for the contract manufacturer to create its own no-name brands that it will distribute among the major distributors, becoming a direct competitor of the vehicle manufacturer and completely changing the structure of the automotive sector. The dangers to vehicle manufacturers in terms of the contract manufacturer are the filtrations of intellectual property that might take place. A contract manufacturer can acquire and exploit for its own benefit the knowledge gained through working with the vehicle manufacturers or transferring this knowledge legitimately or illegitimately to other vehicle manufacturers. To protect oneself from such dangers, the key processes, activities, products and services should not be externalised or proper control should be exerted over them.

- Purchase function: To boost the outsourcing value, the purchase function takes on greater importance, which prompts greater use of e-procurement, as this is a solution to the complex, inconvenient processes of purchases involved in the automotive industry. The vehicle manufacturers and their suppliers have to determine the categories of products that are truly adequate for this means and to train their purchasing and sales staff to manage the online offer process in an efficient manner.

- Limits to outsourcing: Understandably, outsourcing has an upper limit and the upcoming lines of research will involve discovering the possible evolution of outsourcing; the appearance of a large volume of contract manufactures; which activities will have the greatest added value of those currently being carried out by vehicle manufacturers and which will be externalised; what consequences it has for the organisation; new ways of managing and finding suppliers; the effects on the components sector; why some vehicle manufacturers resort more to outsourcing than others and so on.

4.2. Components manufacturers

The key conclusions in the automotive auxiliary industry are the following:

- The chief cause of outsourcing of components manufacturers is vehicle demand.

- To boost the value of outsourcing, components manufacturers increase cooperation with their suppliers for the development of products / services.

- The components manufacturers increase their invoicing as a result of the boost in sales of products and rendering of services to the vehicle manufacturers.

- By increasing the value of outsourcing, the number of firms making up the sector decreases.

- In an environment in which operating costs are on the rise, there is a supply shortage and operating costs increase at a higher rate than operating income when invoicing increases. In order to be independent and not have to either merge or be acquired by another firm in the auxiliary sector has to be in a zone where the value of the lower limit is to be determined by low vehicle demand, which prompts a production overcapacity or glut, and an upper limit value that is determined by a high vehicle demand which causes firms to merge or be taken over for the consecution of economies of scale.

- Labour costs and the costs of other supplies with respect to invoicing decrease, productivity increases, staff training and the ratio value of the R+D+I / production value increases owing to increased demand for raw materials.

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Appendix A.1 Correlation Tables

Table A.1.1 Correlation coefficient of inputs-invoicing value

Denomination	Manufacturers	Components
Raw materials	0.76**	0.99**
Merchandise	0.69*	0.49
Jobs done by other firms	0.24	0.98**
External services	0.95**	0.99**
Production value	0.97**	0.99*

Correlation with respect to the absolute value: Level of signification: 5% (*); 1% (**).
Source: Authors

Table A.1.2 Linear model - operating costs

Denomination	A
Linear model	Go = -0.69 +1.61*Io
Significance	0.928**

Level of significance: 5% (*); 1% (**) ; Go= Operating costs; Io= Operating income; A: Correlation with respect to the absolute value.
Source: Authors

Table A.1.3 Correlation coefficients vehicle manufacturers

Denomination	A	B	Denomination	A	B
1	0.63*	0.38	23	0.59*	
2	0.58	0.44	24	0.84**	
3	0.58*	0.54	25	0.32	
4	0.62*	0.62	26	0.17	-0.31
5	-0.8**	-0.79**	27	0.8**	0.81*
6	-0.37	-0.53	28	0.82**	0.71**
7	0.47	0.38	29	0.57	-0.034
8	0.62*	0.52	30	-0.31	-0.27
9	-0.4	-0.27	31	0.12	-0.23
10	0.76**	0.71**	32	0.3	
11	0.03	-0.76*	33	-0.7*	
12	0.5	-0.009	34	-0.28	
13	0.74*	0.71*	35	0.34	
14	0.7*	-0.41	36	-0.56	
15	0.53	-0.44	37	-0.67*	
16	0.001	-0.69	38	-0.72**	
17	0.63	0.76**	39	0.63	
18	0.76*	0.47	40	0.87**	
19	-0.32	-0.27	41	0.27	
20	0.17	-0.42	42	0.25	
21	0.15	-0.38	43	0.056	
22	0.76**		44	0.61*	

Level of signification: 5% (*); 1% (**)

A: Correlation with respect to the absolute value; B: Correlation with respect to the absolute value / Invoicing. Source: Authors

Denomination

1 Net sale of products; 2 Net sale of merchandise; 3 Rendering of services; 4 Net turnover amount; 5 Jobs done for fixed assets; 6 Operation subsidies; 7 Other operating income; 8 Total operating income; 9 Product stock variation; 10 Consumption of raw materials; 11 Consumption of other supplies; 12 Consumption of merchandise; 13 Jobs done by other firms; 14 Staff costs; 15 External services; 16 Profit on redemption for fixed assets; 17 Total operating costs; 18 Investment made in material assets; 19 Result of fiscal year; 20 Workers occupied; 21 Hours worked; 22 Total firms; 23 Total firms with fewer than 20 workers; 24 Total firms with over 20 workers; 25 Land investment; 26 Investment in land and existing buildings; 27 Investment in refurbishment projects; 28 Investment in machinery and equipment; 29 Production value; 30 Changes in stock and finished products; 31 Energy purchase; 32 Invoicing per employed person; 33 Added value per employee; 34% of the costs of staff in production; 35 Average staff costs; 36 Employment growth ratio; 37 Number of people employed by firm; 38 Added value in production value; 39 Degree of specialisation 40 Investment per employed person 41 Staff productivity 42 Productivity per hour 43 Margin 44 Number of vehicles

Table A.1.4 Correlation coefficients components manufactures

Denomination	A	B	Denomination	A	B
1	0.96**	0.73**	24	0.92**	
2	0.69**	-0.36	25	0.95**	0.7**
3	0.91*	0.64*	26	0.52	-0.24
4	0.96*	0.76*	27	0.24	-0.44
5	0.82**	0.57*	28	0.51	0.69**
6	0.81**	-0.57*	29	0.82**	-0.82**
7	0.94**	0.79**	30	0.74**	-0.96**
8	0.96**	0.8**	31	0.96	-0.59*
9	0.062	-0.08	32	0.8	0.77
10	0.97**	0.98**	33	-0.73*	-0.94**
11	0.07	-0.85**	34	0.88**	-0.3
12	0.55	-0.58**	35	0.93*	0.36
13	0.96	0.91	36	0.88*	0.29
14	0.96**	-0.89**	37	0.77*	
15	0.96**	0.92**	38	-0.8**	
16	0.94**	0.15	39	-0.79**	
17	0.96**	0.95**	40	0.76**	
18	0.69**	-0.17	41	-0.93**	
19	-0.43	-0.73*	42	0.052	
20	0.86**		43	0.75**	
21	0.82**		44	0.93**	
22	-0.67*		45	0.93**	
23	-0.85**		46	0.7**	

Level of significance: 5% (*); 1% (**)

A: Correlation with respect to the absolute value; B: Correlation with respect to the absolute value / Invoicing. Source: Authors

Denomination

1 Net sale of products; 2 Net sale of merchandise; 3 Rendering of services; 4 Net turnover amount; 5 Jobs done for fixed assets; 6 Operation subsidies; 7 Other operating income; 8 Total operating income; 9 Product stock variation; 10 Consumption of raw materials; 11 Consumption of other supplies; 12 Consumption of merchandise; 13 Jobs done by other firms; 14 Staff costs; 15 External services; 16 Profit on redemption for fixed assets; 17 Total operation costs; 18 Investment made in material assets; 19 Result of fiscal year; 20 People occupied; 21 Hours worked; 22 Total firms; 23 Total firms with fewer than 20 workers; 24 Total firms with over 20 workers; 25 Production value; 26 Land investment; 27 Investment in buildings and land; 28 Investment in refurbishment projects; 29 Average staff costs; 30 Number of hours worked; 31 Social Security costs; 32 Invoicing of main activity; 33 Invoicing from services; 34 Energy purchase; 35 R+D+I costs; 36 Total employees in R+D+I; 37 Added value per employee; 38 % of staff costs in production; 39 Employment growth ratio; 40 Number of people per firm; 41 % of staff costs with respect to purchases; 42 Degree of specialisation; 43 Investment per employed person; 44 Staff productivity; 45 Productivity per hour; 46 Number of vehicles