Pergamon

Technovation 20 (2000) 665–676

technovation

www.elsevier.com/locate/technovation

# Lean production and supplier relations: a survey of practices in the Aragonese automotive industry

Manuela P. Pérez , Angel M. Sánchez *

*Departamento de Economía y Dirección de Empresas, Centro Politécnico Superior, María de Luna, 3, 50015 Zaragoza, Spain*

Received 28 October 1999; accepted 15 December 1999

**Abstract**

This paper analyzes the main results of a survey to 28 automotive suppliers in the Spanish region of Aragón. It has been found in a regression analysis that the rotation of tasks and teamworking are positively correlated with the training and the use of modular components. Nearly half of the companies cooperate with customers, suppliers, and technological centers to improve their production processes but only two companies cooperate with their customers in component development and design which indicates an underinvolvement of the surveyed companies with the automotive manufacturers. The companies are much more integrated with the automakers in the delivery process, since more than half of the companies have daily deliveries and directly to the assembly line of the automaker. © 2000 Elsevier Science Ltd. All rights reserved.

*Keywords:* Lean production; Flexibility; Automotive supplier relationships

## 1. Introduction

During the last fifteen years the structural changes of the automotive industry have modified the technology and the business organization of the large automakers and their suppliers in many ways (Table 1): reduction and simplification of automotive components; greater flexibility of the organizational structure by technological means; restructuring of the suppliers system; and globalization of the purchases (Womack et al., 1990; Salas, 1996). This restructuring process in the automotive industry has been the object of various studies, most of them on the large auto manufacturers (Hudson and Schamp, 1995; Pallarès, 1997; Layan, 1997).

Table 1
Organizational and technological changes in the automotive industry[a]

| |
|---|
| Reduction in the number of auto components |
| Standarization of manufacturing process |
| Smaller lot sizes |
| Greater variability in the number of models |
| Higher adoption rates of flexible automation |
| Greater externalization of purchasing to the suppliers |
| Reduction of the number of first-tier suppliers |
| Globalization of the purchases and the auto production |

[a] Source: Womack et al. (1990)

However, these organizational and technological changes in the automakers have also influenced their suppliers. The auto manufacturers have increasingly externalized their purchases and their component design to first-tier suppliers, diffusing lean production practices throughout the supply chain (MacDuffie and Helper, 1997). Therefore, more recent studies have focused on the auto supplier industry and its relationship with the automakers. In Spain, these studies are very scarce (Marín et al., 1996; Aláez et al., 1996) and so this paper wishes to contribute to this research area, giving empirical evidence of some lean production practices in the supplier automotive industry of an Spanish region.

The paper is structured in the following way. Section 2 shows the basic economic indicators of the automotive industry in Aragón, the methodology used for the study, and the structural data of the surveyed sample. Section 3 analyzes the technology management and flexible automation on the companies that influence on their lean production system. Section 4 studies some flexibility practices in the workplace. Section 5 is occupied of the flexible relationships with other companies, mainly with

* Corresponding author. Tel.: +34-76-761865; fax: +34-76-761865.
*E-mail address:* anmarzan@posta.unizar.es (A.M. Sánchez).


PII: S0166-4972(00)00011-0

suppliers and customers. Finally, some concluding remarks are included.

## 2. Methodology and sample study

### *2.1. The automotive industry in Aragon*

The Spanish region of Aragón is located in the northeast of the country. In 1982 the auto manufacturer Opel–General Motors opened an assembly plant in Figueruelas, twenty kilometers west of Zaragoza, the main region's city. Since then a small cluster of supplier companies have been located in the area. In 1997 the automotive industry in Aragon occupied 13,858 employees, and generated a production and a value added respectively of 4291 and 969 millions of euros. The percentages of participation of the auto industry in the regional industry are 14.78% for the employment, 32.76% for the production, and 25.11% for the value added.

According to the Industrial Census of Aragón in 1998, there were fifty-three automotive suppliers that gave employment to 5033 persons, 5.37% of the total employment of Aragonese industry. Four of these companies (7.56%) were large companies with more than 250 employees; the rest were small and medium-sized companies: 32 companies had less than 50 employees, and 17 companies had between 50 and 250 employees.

### *2.2. Methodology of the study*

The data for this study was collected throughout a field survey to the automotive suppliers located in Aragón. The names and addresses of the companies were obtained from the Industrial Promotion Service of the Regional Government of Aragón. The survey was made from January to April of 1999. The authors contacted previously by telephone with the Production Director, or equivalent position, to explain the aim of the study and to agree on an interview. Before the interview, the questionnaire was e-mailed or faxed to the company so that the Production Director had enough time to request or elaborate some of the quantitative data that were asked in the questionnaire. The interviews had an average length of three hours. During the interview, the questionnaire was complimented and additional notes were also taken in order to elaborate thereinafter a summary report of the interview. After each interview the authors visited the facilities of the companies.

### *2.3. Sample structure*

There were 28 useful questionaries that could be used for this study after the interviews. This number represents 52.83% of the total population of 53 companies in the region. In employment terms, the degree of representation of the sample is much greater because the number of employees in the surveyed companies are 4593 persons, 91.25% of the total employment in the sector. The 28 companies of the sample have been divided for some sections of the analysis in two subsamples: component manufacturers (16 companies) and subsystem manufacturers (12 companies). The main difference between these two subsamples is that the component companies manufacture products that are delivered to the assembly line of the automaker or are integrated into a subsystem, while the subsystem companies are those that integrate components to manufacture a subsystem of the automobile — brakes system, electrical system, etc — that is later delivered to the assembly line of the automaker.

Table 2 shows the main structural data of the surveyed companies. 39.3% of these companies had less than 50 employees, and 28.5% sold in 1998 less than 6 millions euros. The comparison of the distribution of the companies surveyed in employment terms with the distribution of the total population of companies, indicates that all the large companies are included in the sample, while for the small and medium-sized companies the percentages are 34% and 76%. The smaller participation of the small companies in the sample does not reduce the significance of the sample because the large and medium-sized companies surveyed are all first-tier suppliers in the automotive industry, which according to other studies are more intensive adopters of lean production practices (Bensaou, 1999). Finally, with respect to the ownership of the capital, 10 companies are foreign-owned. Of 16 component manufacturers, 10 are national-owned and 6 are foreign-owned companies, while of the 12 subsystem manufacturers, 8 are national-owned and 4 are foreign-owned companies.

Table 3 shows the sales figures distribution of the surveyed companies, according to the type of customer and the sales market destination. More than 70% is sold directly to the automakers and the rest to other automotive suppliers. The geographical distribution of sales indicates than 63% are made in Spain, 30% in other countries of the European Union and 7% around the world. 67% of surveyed companies had no intention to change their sales distribution, and those that were planning to modify it, had in mind to increase exports to the European Union.

## 3. Technology management and flexible automation

One of the features of lean production is the involvement of first-tier suppliers in automotive component design. There is evidence that the early involvement of suppliers in product development contributes to reduce lead time and to avoid costly downstream production problems (Clark and Fujimoto, 1991), therefore the tech-