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# **Models and Practices in the Motor Vehicle Industry – contrasting cases from the Portuguese experience**

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## **Abstract**

This paper presents and discusses two case studies in the Portuguese motor vehicle industry – Salvador Caetano’s Ovar Industrial Division (SCOID), a ‘Brownfield site’ with minority Toyota ownership; and Autoeuropa, a ‘Greenfield site’ wholly owned by Volkswagen. Basically, it considers the scope for the meaningful application of ‘Japanese’ organisational methods in these contexts, focusing on the human factor – i.e. as close as possible to the actors on the shop floor. After providing some insights into the Portuguese automotive industry, it profiles both SCOID and Autoeuropa and assesses each of their methods of work, within this balance of commitment between global and local. The main findings reveal the lag that can exist between theoretical models (namely those following a geographical criteria) and the actual practice carried out by manufacturers when tested outside their point of geographical origin.

## **Keywords**

Motor vehicle industry, Lean Production, hybridisation, work organisation, case studies, Toyota, Volkswagen, Portugal.

## **1. Introduction**

It is not surprising nowadays to find, across the whole spectrum of the motor vehicle industry, a Ford plant rather more Volvist than a Volvo plant, a Volvo plant

more Toyotist than a Toyota plant or a Toyota plant more Fordist than a Ford plant, and so on. Boyer (1998: 18) reminds us that production models don't belong to a specific nationality since they travel across different places, therefore progressively distancing themselves from their geographical origin. These models would otherwise become isolated islands bearing no effect on the global company history or on its production methods. In other words, there is no such thing as a purely 'Japanese' production model (nor an 'American' or 'Scandinavian' one).

It's within this framework that we revisit the idea of Lean Production, a source of much controversy in the 90's. This controversy was triggered by GERPISA as a response to the thesis upheld by MIT in its International Motor Vehicle Program (IMVP) and summarised in Womack *et al.* (1990), the 'bestseller that changed the... sociological world', to quote Castillo (1998: 31). Basically, 'Lean thinking' involves understanding what resources are absolutely necessary to create value. Once this is understood, everything else turns out to be a source of waste. But aside from the more technical aspects, there is no consensus on the implications for human resources that result from adopting Lean Production principles. Nevertheless, there is recognition of Toyota Production System's (TPS) innovative concepts such as teamwork, task rotation or the participation of the shop floor workers in *Kaizen* activities. On the other hand, work remains strictly related to production cycles (the one minute cycle being the norm) and work procedures remain highly standardised. Moreover, the self-management of the work pace becomes weakened by conditions imposed by the Just-in-Time (JIT) system. This means that the work teams enjoy some degree of autonomy but this becomes negligible when it comes to the design/control of their own tasks.

Rather than pursuing this theoretical discussion *per se*, it's our aim to

understand how, and to what extent, the ‘Japanese’ organisational methods are adopted in new contexts, focusing on the human factor – i.e. as close as possible to the actors on the shop floor. Within this framework, two automotive plants located in Portugal were studied – Salvador Caetano’s Ovar Industrial Division (SCOID), a ‘brownfield site’ with minority Toyota ownership; and Autoeuropa, a ‘Greenfield site’ wholly owned by Volkswagen.<sup>1</sup> The fieldwork was carried out between 2002 and 2003, and involved a number of complementary research techniques.<sup>2</sup>

After providing some insights into the Portuguese automotive industry (section 2), we’ll profile both SCOID and Autoeuropa (section 3) and we’ll assess each of their methods of work (section 4). Lastly, we’ll be presenting our main findings (section 5).

## **2. Insights into the Portuguese automotive industry**

The vehicle and parts manufacturing industry (i.e. the cluster’s main activity) represented in 1997 around 4.000 million euros in production, over 633 million euros in Gross Added Value (GAV) and around 21 thousand jobs. Adding to these figures, and resulting from the remaining activities of the cluster, there were 1.500 million euros in production, 688 million euros in GAV and around 27 thousand jobs (Cf. Lobo and Melo, 2002: 52). It’s a commercial activity with the power to energise a range of associated sectors (such as the technical textiles, glass, cast iron, painting and

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<sup>1</sup> The case studies were developed under the Project *WorTiS – Work Systems, Time and Space in the Automobile Industry* (WorTiS/POCTI/35275/SOC/2000), financed by the Portuguese Foundation for Science and Technology (Ministry of Science and Technology) and POCTI-FEDER, co-ordinated by Prof. António Brandão Moniz (Faculty of Sciences and Technology, New University of Lisbon).

<sup>2</sup> There were no previous scientific studies of SCOID within Industrial Sociology. For that reason, we carried out several research techniques – site visits, gathering and analysis of documentation, methodical observation of work procedures and especially semi-structured interviews amongst various hierarchical levels. We visited the plant in three different occasions and did 10 interviews, half of which to shop floor workers. Our approach to Autoeuropa focused less on interviewing techniques as we had previously accumulated a substantially bigger amount of knowledge (through projects and publications) and had had the chance to apply the technique of participatory observation.

enamelling). In 2003, the automobile industry represented 0,6% of national GAV (3,3% of industrial GAV) and 0,41% of employment (2,1% of industrial employment) (Cf. GEE, 2004: 1). The volume of export production for that same year represented 96,5% of total production.

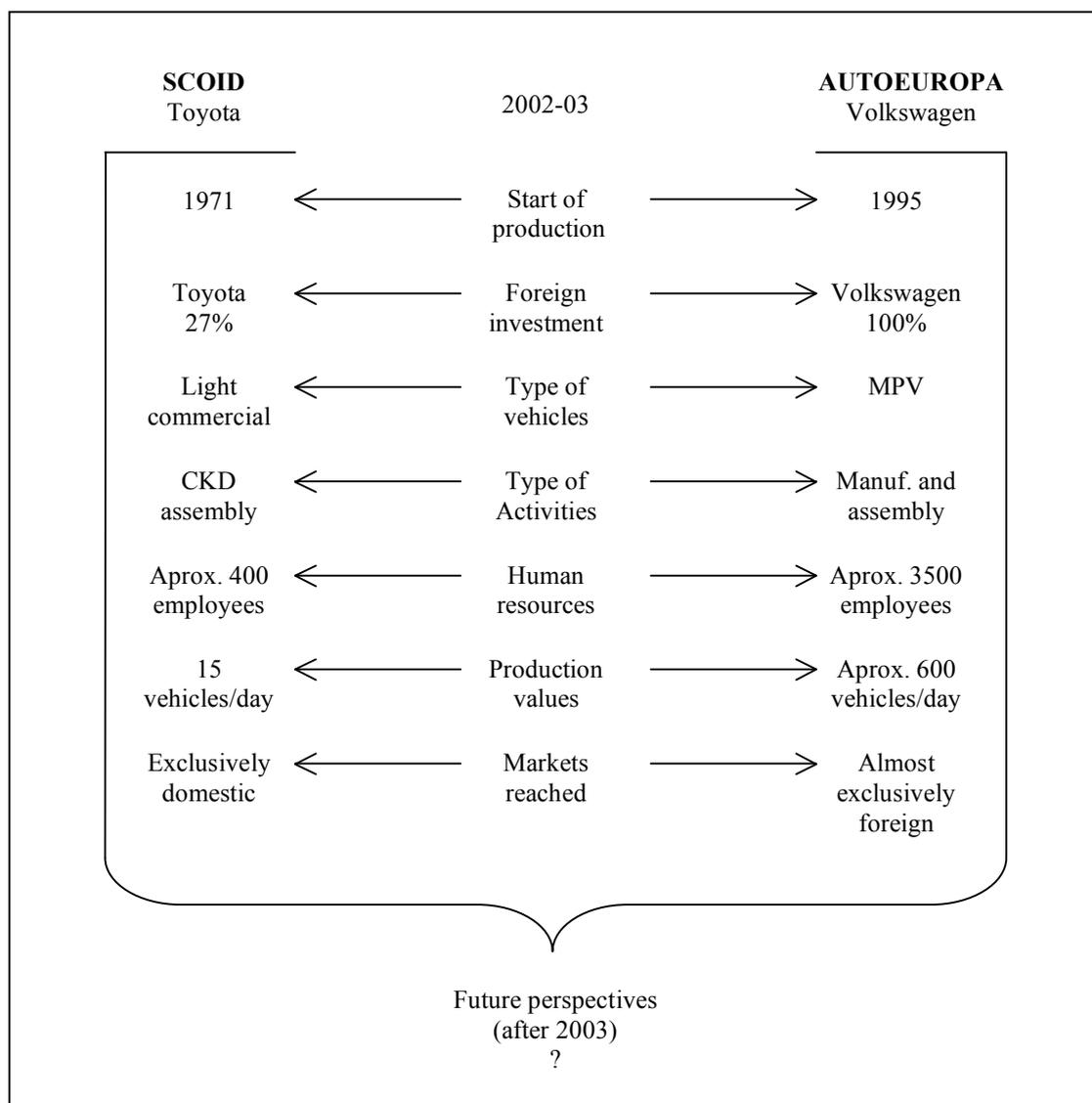
The strengths and weaknesses of the Portuguese economy, its peripheral localization in Europe and its position in the world context were evaluated within the framework of the 2000-2006 National Economic and Social Development Plan (MEPAT, 1999). The Plan mentions the need for carrying out strategies which will enable Portugal to shift from its currently understood 'peripheral position' in Europe into a more central geoeconomical position within the world economy. Actually, when it comes to attracting foreign investment, 'countries like the Czech Republic and Poland add cheap labour to (the not least important) their geographic proximity to the large European markets which immediately results in lower distribution costs. Thus, Eastern European countries become home to new projects and block the attraction of foreign investment in peripheral regions.' (Machado, 2000: 64).

It is acknowledged that the Portuguese development model has run out of potential. The matter now centres on the need to evolve from a situation of comparative advantage mainly based on costs into a new cycle. The present day motor automobile is a highly competitive, oligopolised, and most of all, globalised reality. In view of these characteristics, the new cycle should involve the development of a number of features focusing on greater knowledge and on product conception and innovation, towards the establishment of a true Portuguese motor vehicle cluster (Selada and Felizardo, 2004).

### 3. Two car plants under analysis

In Portugal, there were 21 automobile assembly plants in 1975, 14 plants in 1985 and 8 plants in 1995. Presently, there are 5 plants: Autoeuropa (representing 45,7% of total national production in 2003), Opel Portugal (28,8%), Citroën Lusitana (22%), Mitsubishi Trucks Europe (2,5%) and Salvador Caetano (1%). Most of the multinationals' subsidiaries assemble commercial vehicles, less demanding both technically speaking and in terms of the economy of scale (Vale, 1999). Fig. 1 summarises some information about the two car plants under analysis.

Fig. 1 – Profile of SCOID and Autoeuropa



The northern SCOID (in Ovar, nearby Porto) began its activity three years before the Revolution of April 1974 amidst the fall of a dictatorial regime. Presently, the foreign investment in SCOID amounts to a 27% share by Toyota. This plant receives completely knocked down (CKD) modules and assembles light commercial models – Toyota Dyna and Hiace. No more than 15 vehicles per day are assembled. Concerning market output in 2003, SCOID produced exclusively for the small sized domestic market. This plant directly employs around 400 workers.

To fully understand SCOID's case we must put this plant into the context of the plants that assemble the same models around the world. Fig. 2 provides such information.

Fig. 2 – Toyota Worldwide Operations 2004 (Dyna and/or Hiace models)

<b>Country</b>	<b>Plant</b>	<b>TMC-related equity</b>	<b>Products</b>
Indonesia	PT. Toyota Motor Manufacturing Indonesia	TMC 95%	Avanza, Camry, Dyna, Kijang Innova, TUV, engines
Kenya	Associated Vehicle Assemblers Ltd.	TMC 0%	Dyna, Hiace, Hilux, Land Cruiser
Malaysia	Assembly Services Sdn. Bhd.	UMW Toyota 100%	Camry, Corolla, Hiace, Hilux, Vios, TUV, engines
Portugal	Salvador Caetano I.M.V.T., S.A.	TMC 27%	Dyna, Hiace, Optimo
South Africa	Toyota South Africa Motors (Pty) Ltd.	TMC 75,0%	Corolla, Dyna, Hiace, Hilux, TUV, Heavy-duty trucks, engines
Taiwan	Kuozui Motors, Ltd.	TMC 51,7%	Camry, Corolla, TUV, Hiace, Vios, Wish
Venezuela	Toyota de Venezuela Compania Anonima	TMC 90%	Corolla, Dyna, Land Cruiser, Terios
Vietnam	Toyota Motor Vietnam Co., Ltd.	TMC 70%	Camry, Corolla, Hiace, Land Cruiser, TUV, Vios

Source: adapted from Toyota Corporate Information (2004).

The first thing to note concerns the weak share in Salvador Caetano held by Toyota. We believe that if Toyota were the major shareholder in this plant at Ovar, SCOID would have had a five to ten year strategic plan drawn up. If we then look at the group of countries assembling Dyna and/or Hiace models we find a common trait – rather cheaper labour, a competitive advantage which, as mentioned earlier, we find is becoming increasingly weaker within the more globalised context. Plus, Toyota’s priority for Europe doesn’t seem to be the production of commercial vehicles. In fact, it’s been suggested to us that dealers would be less inclined to sell this type of product.

A former domestic market leader in light commercial vehicles (the Hiace model), SCOID is currently functioning at its technical and economic limits. There are clear deficiencies (for instance, the plant relies heavily on labour in every production stage without the existence of a single robot). But even throughout a continuous crisis the (maintaining of) employment has always been a clear priority as SCOID both ‘stubbornly’ and strongly upholds its social responsibility. And the truth is that the plant still inspires a lot of confidence amongst its employees, which is a rare event in today’s industrial context – at a time when a number of factories are declaring themselves bankrupt and shutting their doors (often opening up a new business right next door) there is the widespread belief that this plant has a future. It seems that importing completely built up (CBU) vehicles would become cheaper than assembling them in Ovar. However, as the human resources director pointed out, this plant resists *‘Not exclusively but fundamentally due to a very strong concept of social responsibility that’s been long upheld by this company, aided by the conviction that a solution will be found for the future.’*

The Southern Autoeuropa (in Palmela, near Lisbon) began its activity in 1995.

The plant is 100% owned by Volkswagen since January 1999, resulting from a joint-venture between Ford and Volkswagen. Autoeuropa manufactures and assembles Multi-Purpose Vehicles (MPV) – Volkswagen Sharan, Seat Alhambra and Ford Galaxy, all the three sharing a common platform (a recognisably typical strategy followed by the German group). This plant produces nearly 600 vehicles per day. Concerning market output in 2003, it produced almost exclusively for the foreign market (we should note that this corresponds to approximately 7% of the total volume of national exports, which is a clear sign of the importance of the German plant in the Portuguese economy). Autoeuropa directly employs around 3500 workers.

Autoeuropa was born in the Setúbal Peninsula as the largest Portuguese car plant and one of the most modern in Europe. In the field of components production, the project's social and economic impact has turned out to be equally decisive. And in addition to the high figures (of thousands of jobs created, more than a million vehicles produced, nearly 2,0% share of Gross National Income) this plant also benefits from a number of characteristics without parallel in the rest of the country, regarding its organisation, culture and logistics. In the beginning of the 90's, the European Commission noted that the effects of the economic development of this project would grow from a regional to a national dimension due to its magnitude, its cutting edge technology and the fact that it is trading largely with foreign markets. Indeed, Autoeuropa's national significance is irrefutable today.

Regardless of all the differences between the two plants, SCOID and Autoeuropa shared a common worry throughout 2003 which was the uncertainty about the near future. SCOID thought its continuity hinged on the need for a new and more ambitious investment from Toyota, opening them up for exports to foreign markets. Autoeuropa awaited Volkswagen's decision about which car plant from the

Group would be chosen to make its new niche vehicle.

#### **4. Work organisation**

One would assume that a plant (partially) owned by Toyota would naturally be more influenced by TPS methods than its German counterpart. But things aren't that simple. Firstly because whilst SCOID carries the weight of its 30 years of industrial activity, Autoeuropa started trading towards the turn of the century. Secondly, because the design of the organisational methods results from a vast number of variables such as product characteristics, volume of production and markets to hit. It's within the balance of commitment between global and local that we find it relevant to study the specific work methods of each plant, regarding their format, virtues and contradictions. With this aim in mind, we have selected a group of criteria to guide our empirical work – teamwork (subsection 4.1), autonomy (subsection 4.2), multi-skilling and job rotation (subsection 4.3), and time and pressure (subsection 4.4).

##### **4.1 Teamwork**

The majority of the work posts at SCOID follow the classic model of organisation – there are two workers, one on each side of the line, each carrying out a distinct task. For example, on the final assembly line there is one worker who assembles the wipers and his colleague stands opposite assembling the bumpers. They are not completely isolated from each other but neither do they fit the usual teamwork situation typically associated with Toyotism (let alone any association with Volvoism).

At Autoeuropa the concept of teamwork is central and permeates the whole internal model of work organisation. The team is indeed the nuclear unit in this plant.

Each team on the shop floor is made up of eight to twelve team members. The team concept was approved by the Company Board back in 1992. Starting with simple team-building policies, the long-term goal was the achievement of self-directed teams (Cf. Peixoto and Schumacher, 1997: 20), which is to say that these organisational units should assume responsibility for their own self-management. One other study on Autoeuropa mentions that ‘whilst working in a cutting edge environment and in constant collaboration, these teams represent a second-generation of semi-autonomous groups within the socio-technical chain’ (Correia, 2000: 745). If one takes the Uddevalla plant (Volvo) as a reference case we can see that these ‘second generation’ semi-autonomous groups have little to do with the first example. In Autoeuropa, unlike Uddevalla’s plant paradigm, the cycle time is kept under two minutes. Thus, the principle stating that it’s the team’s responsibility to best decide on their work organisation tends to melt away in the eminently mechanicist daily routine. Today, ten years after production began, the currently embraced team concept reveals a strong ‘Japanese’ tendency regarding its structure and content.

## **4.2 Autonomy**

As is customary in this industry, step by step procedures for each task can be found at each work post at SCOID. All work is previously designed confirming (what seems to be) a standard norm in the motor vehicle industry – the tendency for prescription. The more freedom an individual is allowed when planning his/her tasks, the greater his/her job autonomy is. What happens in SCOID is that decision-making is generally dependant on the discretion of directly senior management. Another useful indicator to assess a worker’s autonomy is related to the possibility of interrupting the production workflow (which is a possibility under the TPS). At

SCOID, the group leader supported by the head of department takes that decision. Workers will not normally interrupt the workflow except in case of the utmost necessity (for example, if there's a health hazard for themselves or a fellow colleague).

In Autoeuropa the autonomy of the team and its members is clearly weakened by the minutious formalisation of each procedure. In the stamping, body and painting areas, where higher technical levels of expertise exist (for instance in the mixing of paints), the amount of detailed prescription is particularly high. Each worker is guided daily by a document placed at each work post. There they can find information regarding what tasks to accomplish, what timings to achieve and which tools to use. This means that even though the workers and team leaders are invited to make suggestions (subject to validation by their hierarchy) the bulk of the decisions that have a direct effect on the Industrial Engineering Department (IED) has previously predefined their tasks behind closed doors. Furthermore, the IED does not promote delegating decision-making concerning working procedures (it perceives such a choice as a potential cause for several problems, ranging from things like damaging materials to adopting incorrect ergonomically postures). Basically, the emphasis is put on the workers involvement but not on decreasing their degree of alienation (Alves and Pires, 2000), a trait that we understand to be also characteristic of Lean Production. As to the possibility of interrupting the production workflow, the workers are allowed to do it. However, not all of them feel confident enough to do it and that decision is therefore very much down to each worker's own accumulated experience (what really happens is that the worker often chooses to get his/her team leader or supervisor to assess the situation and then act upon it).

### 4.3 Multi-skilling and job rotation

Only recently a 'multi-skilling matrix' has been developed at SCOID displaying each worker's skills to accomplish one or more jobs. This can be seen as an interesting management tool: (a) for the company, because by promoting multi-skilling the company is trying to avoid bottlenecks in the production flow caused by the inability to swiftly allocate workers to different jobs; (b) for the workers, because it'll be contributing towards a less mechanical daily work routine. But job rotation is far from being systematically implemented. It's mainly used when trying to make up for unexpected absences, as confirmed by a worker on final assembly – *'We change work posts when someone is absent and someone is absolutely required to replace them or else the group leader steps in. [What if there are three workers absent?] Then, there's no chance. Things end up getting sorted very slowly or production stops.'* It's obvious that this process is in need of a better-structured strategy. At present, the expected length of time before a worker moves to a new job is two to three... years. If, in theory, this length of time is already too long to bring about some functional elasticity, in practice this period is apparently even longer. One can take this example from the point of view of a worker at the final assembly as he stated that *'I've been assembling windows for about seven or eight years now. I've been on a different post for another four or five years. There should be job rotation so we would be able to do all jobs. It becomes very difficult to learn another job if you're several years in the same post, stuck with the same every day.'* It generally seems to be only possible for 'blue collars' to rotate within the same working area. The decision about job rotation between different areas is confined to management. But the management executives seem to be those who mostly oppose job rotation since they are reluctant to pass on their own area's best workers.

There are four levels of technicians in Autoeuropa, each holding different degrees of expertise, experience and training. The fourth level involves those workers who have been specifically trained (in equipment maintenance) and who have already acquired the skills to carry out major repairs of equipment. In practice, not all workers have the knowledge to perform every task within their team (that's mostly what happens with the first level technicians, the less multi-skilled ones). There is a 'multi-skilling matrix', a sort of template for the working team, and the team leader can use this tool for redistributing tasks depending on each worker's skills. It's generally recognised that job rotation can be particularly useful when filling in unexpected absences. And Autoeuropa goes even further on this – team members usually rotate tasks every two hours, taking advantage of the work breaks (mid morning, lunchtime and mid afternoon); in theory, at the end of each shift, each one of these team members will have been on four different work posts. This is the general practice for the various stages of Autoeuropa's production system with a slight change in the stamping area. Here, the technical expertise of the job prevents the workers from rotating freely (we should note that this area doesn't have the cyclical nature of the production line). Job rotation occurs mainly within a team or between fellow teams. There is no job rotation between different areas, due to each area's own level of expertise. But, when required, a decision is made to relocate a worker to another area on a permanent basis.

#### **4.4 Time and pressure**

Some changes regarding the methods of measuring performance times have been introduced in SCOID throughout 2002, following a study carried out by Toyota. The suggestion, offered by the Japanese and accepted by the locals, involved adopting

Toyota's standard times, i.e. faster times than those practised by SCOID workers. As the group leader in the painting area commented, *'There was a report for a job role in the final assembly which would take, let's say, 20 to 25 minutes to carry out. And after changing tasks, they [the Japanese] managed to shorten the performance time by... three seconds! You can tell straight away how completely different their mentality is. They often act like this, it's a matter of time, and they count all stages and movements and all that. The Japanese way of thinking is very complex.'* The reasoning behind this new methodology is to disinvest in operations which bring no added value. Within that logic if, for instance, there is a specific prescribed time for a worker to tighten up a screw, *'... I can give him no time to go and fetch the screw'*, explained the production manager. If seen in the light of continuous improvement management, this approach could promote small improvements in the whole production process (in the case above, one could bring the screw nearer to the worker in charge of tightening it) and allow for some waste reduction. On the other hand, such a system could raise other problems when taken at face value, i.e. without a systematic job rotation system in place, when a worker is exceptionally required to carry out another colleague's task(s), it becomes much more difficult to comply as efficiently with the prescribed times (as those will be tighter). In any case, it seems clear to us that the existing 'slack' enjoyed by SCOID shop floor workers is still considerably longer than any 'slack' (is there any at all?) within the TPS. The cycle time of 24 minutes is itself a fair deal longer than the cycle time that results from applying Lean Production principles. Yet there is something peculiar in this scenario. Toyota headquarters thinks that there is not enough (time) pressure put on SCOID workers. They argue that this pressure is needed regardless of the low production volume. This means that, rather than appearing as an inevitable response to market

demands, the need for this time pressure is understood as a management imperative in all circumstances. The latter is in fact a trait of Lean Production which, we should add, is one of only a few of such traits that the Japanese wish to implement in SCOID.

A recent decrease in orders at Autoeuropa (from 300 per shift to 270-280 per shift) has caused an increase in cycle times, from 1,46 to 1,70 minutes in three years. The team leaders and supervisors in the areas of both production and logistic planning can have an input in resetting cycle times and the workers are also expected to provide suggestions about this through several ongoing processes of participation (*Kaizen*). But whilst it is true that Autoeuropa has tried to actively promote a culture of participation in its workforce from the start, it is also true that the decision to increase or decrease cycle times (with all its consequences) is *'95% due to industrial engineering itself'*, as the director of the IED explained. Lower production has also caused the workers' workloads to decrease since line balancing cannot be dictated solely by the (reduction of the) production volume – there are constraints (regarding the process, the equipment and the layout of the production line) to take into account. The average 'operator's utilisation rate' dropped from around 90% to 70%. The IED specifies an ideal balance point between workers and machines which translates into around 300 vehicles per shift in the case of Autoeuropa's assembly line – there is a general perception that workers labouring in 'freer' cycles show a certain tendency to shorten their attention span, hence developing less acceptable practices which are in turn reflected in lower quality standards. In a certain way, we're being presented with yet another sign corroborating the thesis that Lean Production is reluctant to renounce the use of (time) pressure.

## **5. Conclusions**

Recent information revealed that SCOID has effectively started production towards exports. We believe that an export oriented strategy can mean more than a breath of fresh air for a plant which, following a progressive downwards path, would otherwise not survive for much longer. It is an investment which literally opens a new horizon for SCOID and can hence mean the turning of a major corner in the history of this plant. On the other hand, new demands will naturally stem from this new opening up to foreign markets which will force the Ovar plant to find new solutions for new problems. The next few years will then tell whether or not the SCOID plant will be able to thrive globally.

Autoeuropa has come through a transitional period. Not that many years ago it was still owned jointly by Ford and Volkswagen. In January 1999, Autoeuropa became 100% Volkswagen and it has been successfully trying to meet the competitive standards of the German group. After overcoming a period of uncertainty in relation to its future, the CEO of the Volkswagen group guaranteed the continuity of the Palmela plant. The first new model to be produced in Autoeuropa is expected to reach the market at the end of 2005 while the production of a second model (in 2007) will hinge on how Autoeuropa manages competition.

Our first finding results from the fact that we are presented with two very distinct plants on every level, both of which have, strangely enough, shared the same worry until not long ago – an uncertain future. In spite of the recent good news, this is still a sign of how volatile the (Portuguese) motor vehicle industry is on the brink of the 21st century.

On the organisational level, we should stress that, without it having ever

subscribed to Lean Production principles, SCOID seems to still be trustworthy for such a demanding manufacturer as Toyota (and just as interesting is the fact that it is also worthy of the trust of those people who work on its production lines every single day). This means that it's not strictly necessary to be Toyotist to be able to assemble vehicles for Toyota. Unsurprisingly, this organisational model has been able to survive by relying on low product demands (commercial vehicles), low production targets (15 vehicles/day) and on local market demands. But the reality is that, even though a few organisational traits which are associated with Toyotism are now being adopted – a new methodology to manage performance times, the gradual elimination of tasks bringing no added value and a few other initiatives within *Kaizen* procedures –, SCOID's case proves that there isn't for Toyota one single production model based solely on TPS. It rather demonstrates that different solutions co-exist in order to respond to distinct historical, institutional and competitive contexts.

As for Autoeuropa, putting the stress on innovation is part of a strategy to respond to a very demanding competitive framework, both in a global market as well as within the Volkswagen Group. And whilst the interpretation of facts can vary, mainly between a post-Fordist and a neo-Fordist view (from where we stand), it is consensual that this plant suffers a strong influence from the Lean Production principles – such as JIT, close cooperation with suppliers, *Kaizen*, task rotation, teamwork or performance stimuli. It also seems this approach won't be essentially changed in the future. This organisational model has proved its ability to respond to high product demands (MPV), high production targets (around 550 vehicles/day) and to global market demands.

After studying the work organisation in both plants, it is clear that the 'Japanese' influence is more marked in the German plant than in its counterpart

(partially) owned by Toyota. The lag that can exist between theoretical models (namely those following a geographical criteria) and the actual practice carried out by manufacturers when tested outside their point of geographical origin is therefore confirmed.

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