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FROM FORDISM TO LEAN MANAGEMENT: MAIN SHIFTS IN AUTOMOTIVE INDUSTRY EVOLUTION WITHIN THE LAST CENTURY

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Abstract:
The paper outlines the main shifts in production, organizational culture and supply chain management in automotive industry during the last century and underlines key factors in car industry development. Car manufacturers have undergone important changes in production technology and philosophy which have brought about dynamic changes in operations management and organizational culture and have extended to a very complex and challenging supply chain integration. Carmakers face harsh competition and thus strive to improve their overall performance in their attempt to overcome the current slow market revival and remain globally competitive. The paper focuses on the Dacia-Renault case study and uses the case research method to describe how the different shifts in automotive industry have impacted the Romanian brand. Relevant data and indicators for the impact of Dacia's evolution on economic, social and environmental level are analyzed and compared and provide an overview on car market dynamics and future perspectives. Results show that drivers of carmaker competitiveness are mainly related to market specifics, sensible and subjective customer criteria as well as an important brand awareness. The research provides an overview of the features prompted by the different shifts in production systems during the last century and provides recommendations to improve competitiveness and assure sustainable development of car manufacturing companies, automotive industry and their supply chain.

Keywords: production technology, innovation, management, globalization, sustainability

1. INTRODUCTION

Car manufacturing is the heart of automotive industry as it is the source of continuous development both on technological and social level. Its contribution to the global economies and the scale of its implications has made it one of the most important industries during the last century. The high amount of suppliers which work with car manufacturers all over the world has made automotive industry one of the most important employers and sources of a country's well being. Nevertheless the industry has also faced a serious amount of challenges and has had to cope with them in order to remain in a competitive position on the global market. Throughout history carmakers have had to overcome contradictory general tendencies in social and institutional structures due to control problems, lack of adequate anticipation or application of new technology in order to adjust to market dynamics.

Fordism was the first revolutionary concept of car making, with its innovating mechanisms and integrated supply chain Ford prompted the Model T as a landmark in automobile history. Ford's assembly line managed within the first years to always double production, and after only 5 years the Model T production figures went up over 20 times, as the year 1914 marks a total production of 202,667 cars which meant Ford produced more cars than all other competitors combined. A decade later the Model T would surpass the 2 million boundary, before its production was ceased in 1927 (Sorensen, Williamson & Lewis, 2006). 50 years later Post-Fordism would emerge, challenging some of the theories which had previously impacted the car industry and mainly brings about a more market-oriented approach or the use of information technologies. In recent years the Toyota Production System and its key pillars have been inspiring the industry and shaping up the organizational culture of companies through Just in Time, Kaizen or Lean management.

Automotive industry is mainly driven by the competitive spirit of carmakers and their general desire to be the best on the market, an ambition which drives the entire industry. As room for consistent growth on traditional markets has slowed down and these have already reached maturity, car manufacturers will try to boost their sales figures by expanding towards emerging markets whilst however facing strong competition. One particular example of the classic shifts in production philosophy from Fordism to Lean management is the case of Romanian brand Dacia, which had a sudden development after being bought by French car manufacturer Renault in 1999. Now, 15 years after moving on to new principles the SUV model with all options of the brand costs just short of 19,000 euros, the price of a luxury car only two decades ago, which shows the remarkable leap in quality achieved by Dacia. However as prices went up, Dacia lost a significant part of its customers and market share on the national market, Renault built a new Dacia factory in Morocco instead of extending the one in Romania and has decided to manufacture most of the brands' models there, so have the changes lead only to positive implications ?

2. THEORETICAL FRAMEWORK

2.1. Fordism

Henry Ford is the father of what we today call Fordism, a complex production system, which has become a reference in automotive industry due to its numerous principles which have set about the importance of car manufacturing on a worldwide scale.

Among the most important contributions of Fordism is the development of the assembly line, which implied the division of labour both vertically (by separating the design and execution phase) and horizontally (by separating complex operations into small and simple tasks). The main attribute of the assembly line within Fordism was to standardize the end product. This meant that nothing was to be hand-made by craftsmanship, but rather through machines and molds in order to create standard parts that would be fully interchangeable for a standard output: basically the making of identical cars in large amounts (Hudson, 2009).

This was made possible through the use of special-purpose tools and equipment that allowed workers even with low skill levels to operate the assembly lines. The downside was however that each worker did one task over and over and over again, which was a very monotonous and intense activity, as one worker might spend all day every day screwing on doll heads, for example.

One of the most surprising and effective measures implemented by Ford was to double the wages of the workers. This would have a series of positive effects on productivity, as it ceased the massive employee turnover (which could reach even 400% per year) and stabilised the workforce and also was an important incentive to come and work for Ford for other workers. An effect of this decision was that through productivity gains, the cars they produced were getting more affordable and thus they could buy the cars they actually made and helped stimulate the national economy through internal consumption. In this context, productivity gains through economies of scale would render a mass product for the mass market more and more available and affordable (Tolliday & Zeitlin, 1988).

The system used by Ford was what we today call the Push system, that is a system which provides the market with a product that is designed to be absorbed by the market through large consumption, hence “pushing” it from the manufacturer towards the customer. In order to achieve productivity gains, outputs had to always grow and that could only work within a Just in Case supply, which meant having lots of raw materials, from which lots of end products would be made. This activity is however intense and without a stimulating policy as was Ford's salary increase, it would have had only a scarce chance to prevail. Another important principle involved in the success of Ford's mass production was the fact that he decided to operate a fully integrated supply chain, which meant a huge amount of activities and employees. Ford had perfected mass production techniques and could achieve substantial economies by doing everything himself, but it was mainly due to his belief that a direct supervision of all process stages within his own premises could more efficiently coordinate the flow of raw materials, parts and components through production than in the case of a classic supplier-buyer relationship (Chandler, 1977).

2.2. Post-Fordism

After more than half a century when Fordism prevailed, shifts and changes in the market had challenged the paradigm and validity of those theories and had set about a new concept in both carmaking and global economy: Post-Fordism.

It marks the end of an era and the start of a new one, or at least it is characterised by the application of different principles and techniques to achieve desired results. The most important change is related to the emphasis on the different types of consumers in contrast to previous emphasis on social class by the product standardisation introduced by Ford. This change in approach lead to specialized products and jobs being created, that ultimately required different types of equipment and workforce. Thus more skillful workforce was needed to operate multi-purpose equipment as were certain robots and computer numerical control and flexible specialization had become an important asset within car manufacturing.

This brought about the implementation of the economy of scope principle, which no longer praised cost as a deciding factor, but was more keen on competitive advantages through differentiation. In order to do so and respond to market demands more accurately and in good time small-batch production was used. The increased variety of tasks and the different end products lead to new concepts in the industry as was the rise of the service as a complement to the classic end products which would start being offered to the customer and would generally be employed after sale had occured. Moreover a new type of employee was starting to become noticeable, namely the white-collar worker, which was a person in charge of administrative work usually performed in a separate office and was opposed to the classic blue-collar worker, where manual labour was required and implied, which mainly dominated the car industry. Another novelty was the feminization of the work force, which until that point had exclusively been based on male workers (Hall, 1988).

Compared to Ford's Push system, Post-Fordism uses what we today call a Pull system, which has an opposite principle as it is a system which responds to the a firm order generated by the customer. Thus the impulse is given from the market, hence “pulling” the desired product from the manufacturer towards him, an inverse mechanism of offer and demand to that brought forth by Fordism. The pull system came with a new supply philosophy, that of Just in Time, which matched its mechanism and would only deliver materials if they were needed, thus preventing overproduction and inventory. The system would require however a very sound organizational culture throughout the entire supply chain. The supply chain principle is also different, being another important change brought forward by Post-Fordism as it now encompasses individual specialized firms as suppliers for the car manufacturer. This meant that carmakers would not produce all of the needed components themselves, but rather

they would outsource some parts of upstream activities in order to better focus on their core competences. This principle also implied the increasing importance of information sharing and communication as well as the beginning of new information technologies (Bernard, 2000).

2.3. Toyotism

The Toyota Production System (or Toyotism) marks another era in automotive history. The system was developed by Taiichi Ohno and Eiji Toyoda between 1948 and 1975 and gives great attention to management practices within manufacturing and logistics (Ohno, 1988).

Fordism and Post-Fordism both basically emphasize production principles and a specific supply chain design, whereas Toyotism mainly focuses on the aspect of organizational culture and its importance for a car manufacturer's competitiveness. The Toyota production system is not revolutionary, rather it makes very good use of its resources by applying simple organization techniques and discipline in order to make end products with the best possible efficiency. This is confirmed by sales figures too, as Toyota has been the world number one in car sales for the past 3 years and in 2014 the Japanese company managed to break the 10 million milestone by selling 10,23 vehicles last year. Volkswagen with 10,14 million came in second, whereas General Motors only sold 9,92 million cars in 2014, losing second position to its German competitor.

The production principles introduced by Toyotism were no different than those that already existed, however their implementation was perfected by using simple management techniques: muda, which implied the elimination of any type of waste (transportation, inventory, motion, waiting, over-processing, over-production, defects), the principle of autonomation (jidoka), a combination of autonomy and automatization, which was a supervisory function given to a worker who also had the autonomy to stop the machine and the assembly line in the event of some abnormal functioning. Two other important principles referred to production smoothing (production levelling or heijunka, in Japanese) which had the goal to produce intermediate parts or cars at a constant rate (as much as possible) so that further processing may also be carried out at a predictable, smooth and level rate; and to preventing human mistakes (poka-yoke) by designing processes or certain routine operations in a manner that they automatically prevent any obvious mistake a worker might make at his workplace (Shingo, 1989).

In order to serve the principle of economy of scope, Toyota also used other management techniques to improve its manufacturing activity as were nemawashi, which meant that mutual content has to be reached prior to any implementation of projects as to gather all opinions an give a sense of implication and importance to all involved members, Genba Kaizen, a combination of Genba Genbutsu, which meant going to see on site what was happening in order to properly understand the functioning of certain activities or the degree of some problems, and Kaizen which refers to an approach of stimulating ideas for continuous improvement, and 5S, a very simple method to organise and standardise one's workplace and to keep it clean through individual discipline. The Pull system and the Just in Time principle were supported by the Kanban method which used labels throughout all workstations to signal the need and the flow for parts, while being at the same time easy to watch over and reliable. Another interesting change within Toyotism was that suppliers were no longer seen as “suppliers”, but rather as “partners” which meant a whole new level of confidence, trust and mutual respect emerged between the different links in the supply chain that would also be noticed in the carmakers productivity and in the effectiveness of the supply chain (Ohno, 2007).

3. RESEARCH

3.1. Production system overview

Table 1: Differences in production philosophies

Category/era	FORDISM	POST-FORDISM	TOYOTISM
Production principles	1) standardization of the product 2) special-purpose tools and equipment 3) assembly line 4) division of labour	1) specialized products and jobs 2) multi-purpose equipment 3) flexible specialization 4) new technologies	1) eliminate waste (Muda) 2) Autonomation (Jidoka) 3) Heijunka 4) Poka-yoke
Organizational culture	1) workers are paid with higher wages 2) economy of scale 3) mass product for mass market	1) service and the white-collar worker 2) economy of scope 3) small-batch production	1) Nemawashi, Genba Kaizen, 5S 2) economy of scope 3) Kanban production principle
Supply chain	1) Push system 2) Just in Case 3) fully integrated supply chain	1) Pull system 2) Just in Time 3) individual specialized firms as suppliers	1) Pull system 2) Just in Time 3) individual specialized firms as partners

3.2. Lean management

Although Lean management tends to be mistaken with Toyotism, it is actually one step further than the Toyota Production System. It adds further management techniques like the SMED (Single Minute Exchange or Die) principle to rapidly adjust machines for their changeover, the Ishikawa diagram (or cause-effect diagram) for solving different issues which can occur related to product faults or VSM (Value Stream Mapping) which shows the flows within a value chain. However lean management is different because it does not merely apply these techniques relentlessly, rather it creates a special organizational behaviour which stimulates the entire company to think and to act “lean“. This means a voluntary commitment of all workers, managers and staff to continuously try to find improvements within current activity, to reduce waste and to focus only on activities which add value to the customer. There is no pressure to make profit or to apply certain tools, it is a more relaxed way to enjoy being committed towards bringing value and ultimately a competitive product for the customer through a common working philosophy. Even though profit making is not emphasized, this approach is supposed to also improve the financial end results through the quality of the workers output (Liker, 2004).

3.3. Dacia case study

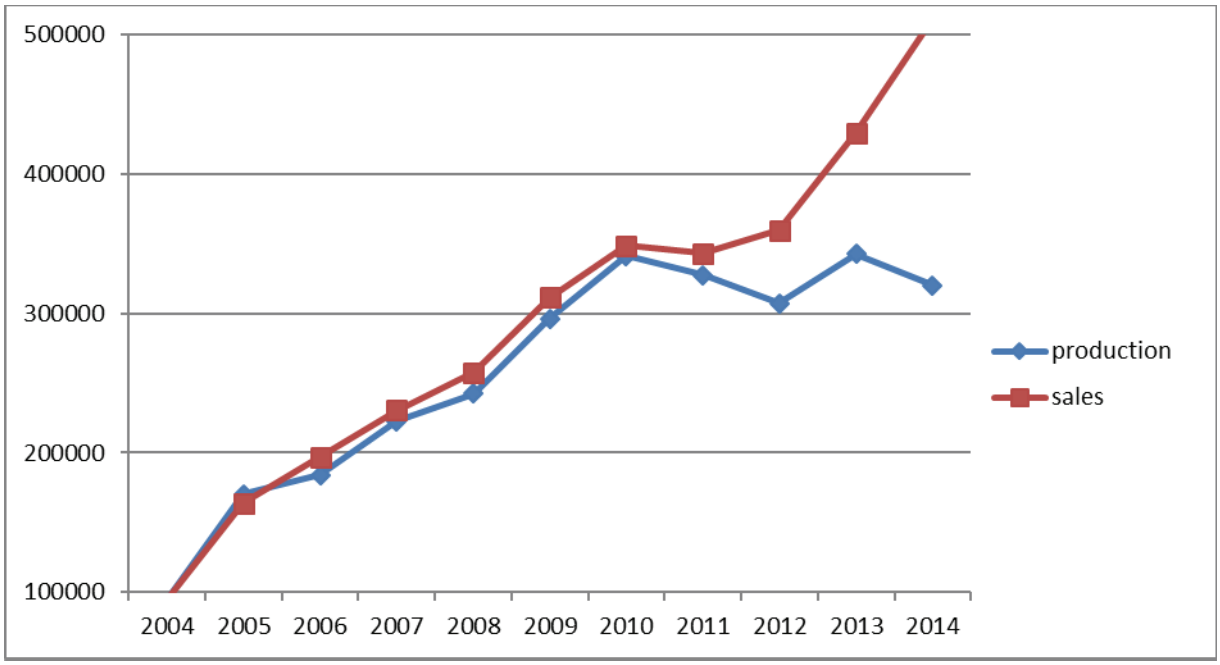
Since the founding of the Dacia plant in Pitesti in 1966 and the first year of its produced vehicles (1968) the Romanian brand had always enjoyed collaboration with French manufacturer Renault, but it was not until Renault decided to actually buy the factory that this collaboration would start to bring important benefits. For almost 30 years Dacia produced a standard basic car (Dacia 1300), with scarce technical, technological or design advancements. It’s was literally a mass product for the mass market and until 1981 it was the only car produced in the country and had a reputation of breaking down. Spare parts were easily available, but they were also low on quality, as was the overall car which was also short on extras. This very basic vision of Fordism would be challenged by the factory in Craiova where Citroen had collaborated for the Oltcit for 10 years during the 80’s years before Daewoo produced a larger range of models between 1994-2005. Dacia managed to design the first car on its own in 1995, the Dacia Nova, which was 33% more expensive than its classic model. Progress overall was however slow and the factory needed investments to be able to overcome its structural issues.

Renault bought the Dacia factory in 1999 and by the year 2001 it already made an impact by fitting the Dacia Nova with a new engine, gearbox and improved interior design and renamed the car to Dacia SupeRNova. Just two year later they would improve the exterior design as well and make some other

changes and launch the Solenza model, the first ever Dacia model to have a choice of engines (1.4 petrol and 1.9 diesel) along with the Pick-up. The Post-Fordism era of Dacia would be thus characterised by more specialized products, the emerging of the white-collar workers or the small batch production. This period would not last more than five years as Renault had an idea in mind to replace these models with a new model, more affordable and with an overall better quality and market adaptation.

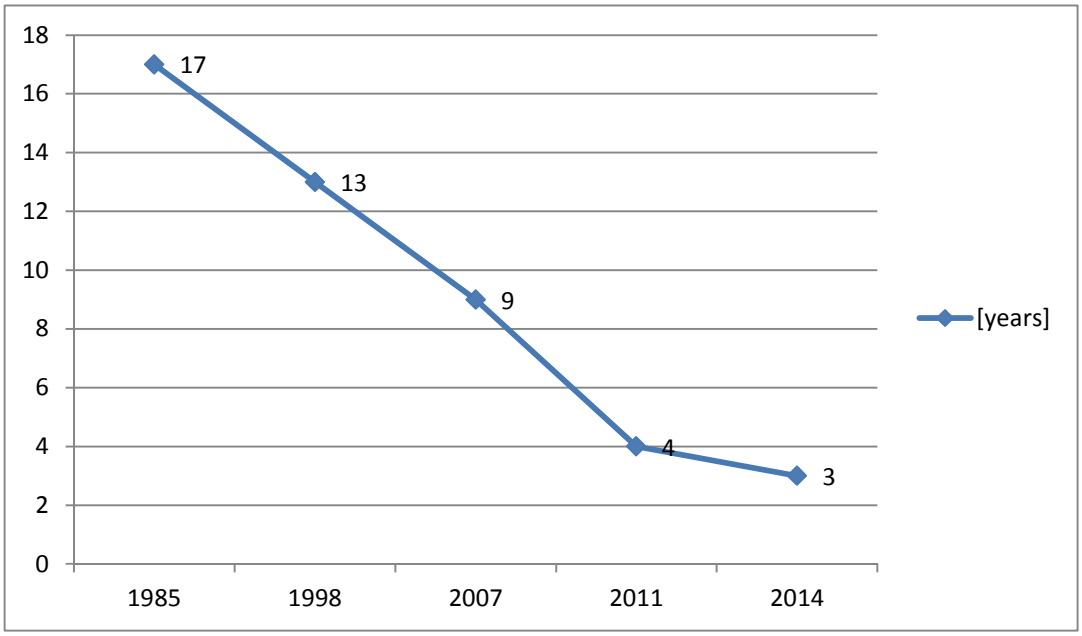
Dacia enters Toyotism in 2004 as the Logan model is launched, a model with huge success both on national and international markets. The Muda principle made the Logan the cheapest new car available with a very good quality-price ratio and would set an example to car manufacturers around the world of efficient production. The economy of scope at Dacia was just beginning, partnerships with suppliers would be on their way, as were the investments of the French manufacturer in the Pitesti plant. After 10 years since launching the Logan, the Dacia plant is a modern car factory, producing a large range of models, even an SUV model, the number of employees has doubled, wages have quadrupled and almost 95% of production is being exported. Production levels in Romania are at their highest level ever due to the 2,2 billion euro investments by Renault in the factory, with an average level of 92% of maximum capacity within the last six years, while twice being very close to attaining maximum capacity, in 2010 and 2013. Within the last 11 years production levels have increased more than 3.5 times whereas sales have grown by almost 5.5 times. Due to these growing figures, production of Dacia models in Renault factories around the word is being increased as well.

Figure 1: Evolution of internal production and worldwide sales at Dacia



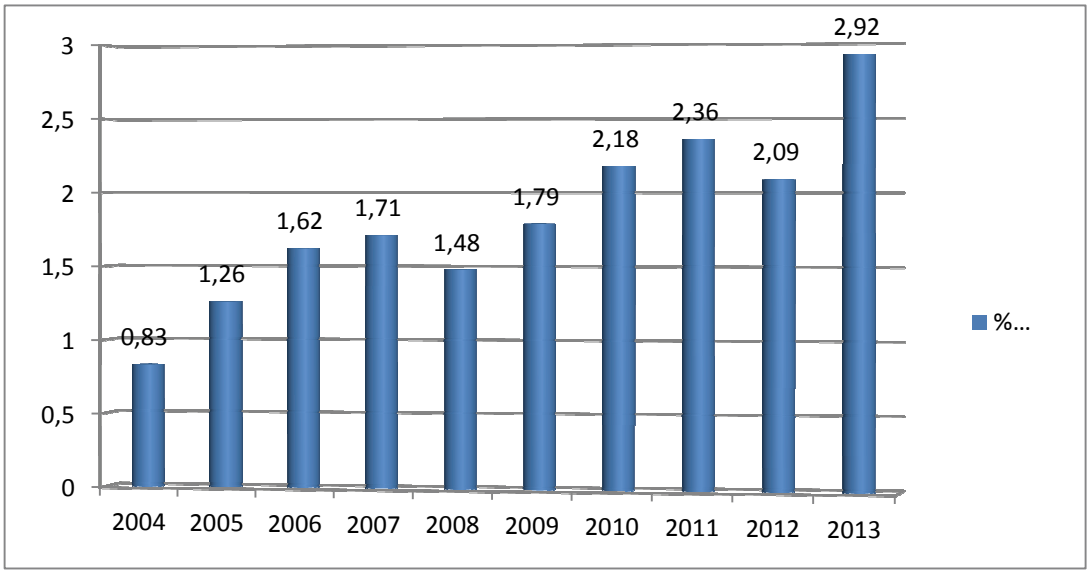
Productivity has been one of the key elements in the recent worldwide success of the Romanian brand as the timespan of producing one million vehicles has been reduced from 17 years (1985) to just 3 years (2014), almost six times faster than before and three times quicker than seven years ago, due to Renault investments and workers efficiency at the Dacia factory. The rise in productivity is also due to the training programs provided by the French manufacturer for the Dacia workers and to the strict conditions required for them to meet at their workplace, as well as several other benefits as free warm meals at the factory. Wages have accordingly been increased and are today twice the national average salary, showing the impressive performance of the car brand.

Figure 2: Number of years necessary to produce 1 million cars



In Europe not other car brand has had a similar evolution as Dacia within the last decade: even throughout the crisis the Romanian brand continued to make profits and has an average yearly profit of around 70 million euros within the last 10 years. As the brand started being sold in Western Europe, customers have been more and more aware of the models produced by Dacia and demand is rapidly increasing. Since 2012 sales on international markets have increased by more than 40% from 337,674 to 481,840 cars sold last year and if the amount of production exported was only 16% in 2004, today the factory in Pitesti exports around 95% of its production to foreign markets. A decade ago Dacia sold just over 15,000 cars outside of Romania, today it sells 32 times more, meaning daily exports of 17-18 million euros and a share of almost 10% in national exports. Moreover a car manufacturer usually generates around 6 more jobs within the automotive industry for each own employee, Dacia however surpasses the ratio as around 125,000 people are employed in the car industry in Romania, meaning a ratio of 8 employees for every job at the Pitesti plant. This in turn brought about an increasing contribution toward the country's economic growth, if in 2004 Dacia contributed with less than 1% to the Gross Domestic Product (GDP), in 2010 its contribution surpassed 2%, while in 2013 the car manufacturer came just short of a 3% contribution to Romania's GDP.

Figure 3: Dacia's contribution to Romania's GDP



Dacia also gave special attention to environmental issues and by investing around 25 million euros in technologies the brand managed to reduce the consumption of its vehicles by more than 15%, while at the same time reducing CO2 emissions by almost 20%. As these two could also be seen in the light of European Directives, the factory managed to reduce overall amount of overhead required to build a vehicle by almost 70% and managed to reuse waste by 96,6% within the last 11 years.

4. CONCLUSIONS

During the last 15 years Dacia has managed to undergo significant changes and its progress and performance have stunned the automotive industry similar to shifts brought forward from Fordism to Lean management. The Romanian brand has managed to impressively develop on international markets thanks to a “smart buy” opportunity ceased during the recent economic downturn and is today the leading brand on the low-cost market.

The current car market structure in Romania, customer behavior and swift orientation towards second hand imports since a couple of years and a lack in vision and strategic development policies by the government have however contributed to the weakening of the Dacia sales and its overall position on the national market. This lead to a new factory being built in Morocco instead of enlarging the one in Pitesti and currently most of the Dacia models are built in North Africa for a better benefit to cost ratio overall efficiency.

If the Romanian market does not evolve towards better results within the following years, the Dacia brand, although born and made successful by the workers at the Pitesti plant could soon be mainly transferred towards the factory in Tangier and paradoxically Dacia’s own success on foreign markets can soon be the cause for continuing expansion and maybe significantly relieving production from Pitesti in the future. As harsh as this may be, currently Dacia’s main market is outside its own country where it only sells 5% of its production volume, therefore being “lean” implies getting closer to the main market despite having to cut production or maybe even reduce workforce from the source of this achievement.

Fordism, Post-Fordism, Toyotism and Lean management have all brought about changes in the way car manufacturers lead, organise and carry out their activities which have evolved very much within the last century. Neither of them can however independently improve performance of carmakers as this is only possible when combining the advantages of each of them in order to match the target market’s specificities as adequately as possible by providing added value to the customer.

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