Almost fifteen years ago, we wrote a synthesis of the works realized by the GERPISA members during the first international research program, called "Emergence of new industrial models?". The synthesis was published in various forms and in many successive versions, but finally we concluded and condensed it in a book entitled *The productive models. The conditions of profitability*.

We resumed the collective conclusion of the participants of the program that was: there is no convergence of car manufacturers towards a single productive model that would be the condition for their survival in the new world environment, as claimed many people, namely the developers and apologists of “lean production”. We observe in fact diversity, limited and periodically renewed of productive models, that allow some firms to be profitable, at least for a period of time, while others do not achieve to overcome their difficulties at the same time.

If the first GERPISA program participants agreed to this essential conclusion, they did not achieve collectively to characterize the identified productive models. Were they national models? Were they strategic models? Were they cultural models? Were they hybridization of a canonical model, or local implementations of common general principles? Were they different product architectures? These different ways to characterize the models coexisted in GERPISA at that time, less because of irreducible theoretical or disciplinary divergences, than because of practical impossibility to find the necessary time to pursue together the work. At the suggestion of the Steering Committee, Robert and I, we decided to try to elaborate an analysis schema of productive models, and we proposed it at GERPISA members some time after. It is the analyses schema exposed in our the book.

Fifteen years later, we can evaluate the ability of this schema to help us to better understand the transformations of the past and recent automotive industry, and we can draw new prospects. To share with others this assessment, we must, not only remember what it is, an investigative tool, but also know how to use it. A tool, without the expertise it requires to handle it, is useless. One way to transmit this know-how is to tell how and why the tool was initially manufactured. This is the first time we do it.
The analysis framework of Productive Models can be summarized in some sentences. The profitability of firms depends on several “sources of profit”. We have identified six, in the automotive industry: economies of scale, diversity of offer, quality of product, innovation, flexibility and reduction of costs at constant volume. But firms do not give the same importance to each one of these profit sources. Their different preferences are "profit strategies". We called them by the preferred sources: volume, volume and diversity, quality, innovation and flexibility, diversity and flexibility, permanent reduction of costs at constant volume.

Two general conditions must be fulfilled simultaneously, so that a profit strategy effectively brings the expected profit. In other words, there are two main conditions for sustainable firms profitability. The first of these conditions is that the privileged sources may be exploited in countries, where the firm is established commercially and / or industrially. One can even say that a firm favours such sources rather than others, precisely because they appear exploitable where the firm is installed, and first in his home country. And they effectively are, when the automobile demand is more oriented to the types of vehicle corresponding to the chosen sources (mass market vehicle, premium car, SUV, innovative cars, low cost vehicles, cars at competitive price and just necessary quality, etc.), and when the company can recruit the kind of labour of which it needs to produce the previous types of vehicles (unskilled, semi-skilled, professional workers, etc.). The volume and structure of the automobile demand and of labour to recruit depend on the main factor of growth of concerned countries (consumption, or investment or export etc.) and on the form of distribution of national income (competitive, moderately hierarchized, unequal or restrictive).

The second condition is that by using means both consistent and acceptable by the key stakeholders, each firm could fulfil the specific requirements of implementation of its own profit strategy. To obtain that, it is necessary to build an "enterprise government compromise” between the key stakeholders. Therefore, a "productive model" can be defined by a “corporate governance compromise”, that allows bringing coherence between product policy, productive organization and employment relationship and the chosen profit strategy.

That is neither the lean manufacturing, or best practices, or the "disruption", or the benchmark, or the service or financial activities, or the new economy", or new mobility nor the factory 3, 4, 5, 6.0 … nor any miraculous solutions that are announced periodically, that can make profitable companies durably 1, but the relevance of their own profit strategy, pursued in countries where they carry out their commercial and industrial activities, and the consistency of the productive models they build to implement it.

The Productive Models schema was born of the need to understand surprising facts that the investigations realized by Gerpisa members and others researchers had highlighted:
- a carmaker can be profitable with a low productivity, and vice versa
- the constantly profitable carmakers did not privilege the same sources of profit
- a carmaker with a clear profit strategy can be profitable in a country and not in another
- a carmaker with a relevant profit strategy in a country could be unprofitable

1 These means are efficient, only if they contribute to fulfil the requirements of the chosen profit strategy.
1. First fact: a firm can be profitable with low productivity, vice versa. Hence the choice of profitability, not productivity, as the criterion of performance of firms

The issue of the competitiveness of automobile firms raised when the competitive positions of US and European car producers were challenged and shaken at the turn of the 70-80’s on the international market by Japanese manufacturers, so far little or not known before in America and Europe. Explanations of their higher competitiveness due to low wages, currency rate of yen, level of automation, or even specific cultural behaviour, etc. were made, but were invalided by results of several researches. So, it seemed in that time that there was only one explanation as possible: a higher productivity of labour. And the field surveys of the International Motor Vehicle Program of MIT seemed to confirm this point of view.
But the differences of productivity level were not the main problem, because an automobile company can be profitable with low productivity and vice versa. High productivity does not necessarily translate into higher profits. Historical examples abound, starting with Ford of which productivity was then unequalled, and yet since 1918 went from one crisis to another, and which was surpassed first by GM then by a newcomer: Chrysler. Conversely a low productivity can nevertheless result in strong profitability: evidence in particular by Porsche, which, with fewer than 200,000 vehicles/year, has, since many years, the highest profit rate in the automotive sector and a level of profit envied by many generalist manufacturers.

In fact, profitability is the fundamental criterion of performance for all the firms governed by the capital-labour relation. It is the condition for their sustainability and development. Not to prejudge the explanation to give, it was necessary for us to know the only worthwhile result for a capitalist enterprise, namely the rate and amount of income. The first question to ask was: which automobile producers were profitable and for how many years?

How to know it? The profit of a business is always composite, as an automobile company is composite herself. Its perimeter is more or less bigger, according to the definitions we give. Its activities are not limited to the automobile. The automotive activity, itself, present many aspects, if one wants to grasp in its entirety. So we chose the group level, including all subsidiaries whose accounts were consolidated in the balance sheet. Then we retained within the Group, and as much as possible, the only activities related to the automobile, which therefore include the design, manufacture and marketing, including credit, after-sales and used vehicles. Were excluded, as far as possible, the profits or losses related to activities unconnected with the automobile, the taxes, the extraordinary income and income from non-consolidated companies on the balance sheet. This choice forbid us to take as indicators of profit the net income or the operating income. The operating margin was close to what we wanted, but had the disadvantage of having to be related to turnover. We preferred to take the break-even point, that is to say, the recipe level where the expenditures, such as payroll and depreciation, are covered and exceeded. This indicator is very sensitive to changes in enterprise efficiency, often attenuated or masked by the other classical indicators.

The statistical compilations and calculations we have made with the valuable help of Bruno Jetin over the period 1975-1995, showed that only three manufacturers had been consistently profitable: Toyota, Honda and Volkswagen. All the others, including other Japanese, Nissan, Mitsubishi, Mazda, had experienced loss episodes and crises. This result, contradicting the supposed superiority of Japanese manufacturers and the delay of all European and American manufacturers, has had important consequences for the continuation of our work.

For earlier periods, for which we could not have comparable series or even just data, we relied on the work of historians and statements of actors of the time, to see who was, at a time or another, in crisis and why. That said, the statistical work is to be done, and we call on courageous historians or others to do that.

Since 1995, an additional period of 20 years, has the ranking changed? Yes, partly. The changes are very interesting to analyse. From the three manufacturers that were consistently profitable during the 74-95 period, only two, Honda and VW, continued to make profit each year and at the highest levels. Hyundai and BMW joined them. In contrast, Toyota, the emblem of the lean production, fell heavily and brutally in 2008 and took three more years to recover its previous profitability levels. Nissan became again
profitable, after passing under Renault's control in 1999. It made heavy losses in 2008, such as Toyota, but it found again immediately, the following year, its previous profit level. Mazda and Mitsubishi are still struggling to be profitable. Kia, Samsung, Daewoo, Songgyang were absorbed by others, as a result of the Asiatic crisis in 1998. The Big Three Americans were in big difficulties or bankrupt in 2008. Ditto PSA in 2013. Fiat and Renault have not managed to become consistently profitable. Ford sold Volvo to Chinese manufacturer Geely. As for Daimler, despite the growth in demand for high-end cars, made losses three times.

2. Second fact: the constantly profitable car manufacturers did not choose the same ways. The identification of several sources and profit strategies

The second notable fact was that the consistently profitable car manufacturers were so for different reasons. They had not used the same sources of profit. This was well documented since long time concerning Ford, GM and Chrysler for the period before World War II. Ford was focused on economies of scale by producing only one car model, declined in several versions, by a workforce without qualification. GM had supplanted Ford by offering a range of vehicles of different brands sharing the same platforms, produced by polyvalent workers. Chrysler had been able to get a place between Ford and GM with innovative cars and a flexible organization.

Similarly, for the period 1975-1994, the three profitable builders have not been profitable for the same reasons. The works of Takahiro Fujimoto and Koichi Shimizu on Toyota showed that the reduction of costs at constant volume was the organizing principle of the enterprise. The books of Koichi Shimokawa, and many others, learned us that Honda, new entrant in the late sixties, had managed to become car producer launching, particularly in the US market, an innovative model by its low consumption engine and its design, the Civic. Finally, the works of Patrick Fridenson, Ulrich Jurgens, Ludger Pries and others explained how Volkswagen had succeed to pass from a product policy essentially based on one model to a product policy offering several complete car ranges sharing a limited number of platforms. From these observations, one could conclude that to be profitable, there was no need to privilege the cost reduction at constant volume in all circumstances as Toyota made it and as advocated so many consultants.

2.1. The identified sources of profit et their definition

At this stage of research, the priority task was therefore to identify all sources of profit which had been used in the automotive sector, define it and rank builders, period after period, based on the different sources of profit that had their preference. Revisiting all the car industry history, we found six sources of profit. Besides the four sources of profit already mentioned, (that are the volume sold, the diversity offered, the product innovation, the cost reduction at constant volume), we also retained two other: product quality and production flexibility. Quality was the preferred source by premium car manufacturers. As for production flexibility, it was currently used by European and Japanese manufacturers of the interwar period, when they were still not able to make volume.

After, we had to make a precise definition of each of the identified profit sources. Economies of scale are realized when you can distribute fixed costs of production over
a greater number of identical products, for as long as possible. The diversity of offerings broadens costumer number, meeting the specific expectations and possibilities of the different categories potential buyers. Quality provides an advantage, while often allowing a higher price justified by reliability, by equipment, comfort and above all the social distinction it provides. The commercially relevant innovation offers a great competitive advantage, as long as it is not imitated by competitors. The flexibility allows adapting without delay production and spending to variations in purchase volume and customer expectations. The reduction of costs at constant volume profit strategy has the aim to do just what is necessary, as well in the design product than in the organization of production, notably by eliminating wasted time, and waste of tools and materials.

2.2. Were all profit sources identified and correctly defined? A source of profit cannot be considered as such, if it is not totally independent

None of these sources explicitly mentions the work, yet is the only one to cause the surplus of any activity. And indeed, the identified sources of profit are really just different ways to exploit the work. The work is neither forgotten nor ignored. It must be formatted in order to generate value in the capitalist conditions of production and sale.

Had we identified all sources and profit strategies? Further analysis, or analysis extended to other industries probably will identify other sources. But it is a source of profit that is blindingly obvious and that is not in our list: it is the financial activities of car manufacturers. Why have we ignored it? It was hotly debated within the Gerpisa. Instead of so-called Japanese lean production, a new "model" was indeed coming from the United States and Britain, late 90s, called "new economy". American manufacturers adopted officially "new economy". They had sold their supplier subsidiaries. They had externalized at maximum the production, definitely considered too unprofitable, and on the other hand they had developed their financial services and after-sales services, the only activities, according to what was said then, to be able to ensure sufficient profits for shareholders with attractive rates.

Manufacturers had always had credit subsidiaries. Sales by credit was even one of the essential mechanisms making mass production possible. But what was new, among US manufacturers, was unbridled credit policy and diversification of their banking subsidiary towards risky short-term financial investments. The diffusion of "new economy", which appeared as an irresistible trend, as well as lean production ten years before, depended on its conditions of possibility and viability. American manufacturers were the only ones to outsource at all costs. Others, particularly Toyota and Volkswagen, remained much prudent and ensured to keep control of their capital. The forging ahead of the Big Three could not last for two reasons. Unless abandon the car sector, it was necessary that their products remain or become again attractive to sell credit, insurance and other related products. Automotive demand could not be artificially inflated indefinitely. In fact, when the Internet bubble burst in March 2000, the financial gains collapsed. Ford immediately drew lessons from its mistakes and could narrowly avoid bankruptcy during the great crisis of 2007. GM and Chrysler continued however in the wrong direction until their financial collapse. Because finance cannot be out of ground, it must be connected with profitable activities in themselves.

Another source of profit, not included in our list, was discussed in Gerpisa. It is the extra profit that a dominant firm obtained by not lowering its prices to the level it could do it, but fixing them at tolerable levels for its competitors. Through this practice, the
dominant firm keeps alive its competitors, while depriving them of the opportunity to become again really competitive. The dominant firm accumulates record profits ... up to a point, however. The extra profit is not an independent source of profit. It is possible to obtain it only if the profit strategy is relevant and the productive model coherent. But if the relevance or the coherence becomes insufficient, the dominant firm loses its dominant position. That has happened to American automakers in their home market, when they no longer are able to make dependable sedans at affordable prices, to the benefit of the latest newcomers, Japanese manufacturers.

An extra profit can also be obtained by capturing a portion of the profit produced throughout the value chain, from mining to after sales service. For that one firm of the chain has the capability to do so, it is necessary that it is able to impose its profit strategy on others. One may also ask whether the customer loyalty can have the status of source of profit? Loyalty can be increased temporarily by trade expedients, but it cannot continue, if the product, after-sales included, is part of a profit strategy and product policy that loses in relevance and in consistency.

We could identify the six independent sources of profit because they appeared at different times of the development of the automotive industry and because the manufacturers unevenly exploited them. In what proportion?

2.3. From “profit sources” to “profit strategies”

The ideal would have been to know how much profit was directly attributable to the various sources of profit. Since the adoption in 2000 of the new international accounting standards, companies are required to publish the source of profits. This is theoretically an enormous progress. Unfortunately, firms do not use the same categories and they often mix several sources. So we are always forced to use indirect indicators, as we have done for the 1965-1995 periods, with again the precious help of Bruno Jetin.

The work of Marie Claude Bergouignan, Gérard Bordenave and Yannick Lung, on the supposed Japanese variety, showed us the way. The volume per platform gave us the level of economies of scale achieved; the number of models gave us the degree of diversity of supply. We then looked for quantifiable indicators for the four other sources of profit. For quality, we took, for various practical and theoretical reasons, the percentage of defect-free vehicles in the first technical control after purchase. For innovation, we constructed a typology of innovations according to their recognized impact on sales. For the productive flexibility, we calculated the difference between the expenses that should have been observed in year \( t + 1 \) by multiplying the volume of production by the unit cost per vehicle of the year \( t \) and the actual expenditures. For the cost reduction, the difficulty has been to evaluate it, all things being equal, that is to say at constant volume, diversity, quality, innovation and flexibility. That being impossible, we compared the evolution of the costs of the car producers belonging to the same class of volume and diversity. The sources of profit of each firm were calculated by comparing their score to the average scores of all firms, each 5 years. What matters, indeed, this is not the level reached in itself, but the gap to the average of other car manufacturers on the same profit source ².

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The statistical study came objectify the differential exploitation of sources of profit by manufacturers. It also clearly shows what historical inquiry suggested: some car manufacturers favoured, not one source of profit, such as quality by specialist car manufacturers, such as volume by Ford before the second world war, by Volkswagen from 1949 to 1974, such as permanent reduction of costs at constant volume by Toyota, but two sources in combination: volume and diversity, in the case for example of General Motors, diversity and flexibility in the case of several European manufacturers of interwar period, innovation and flexibility by Chrysler since the 30's or Honda since 1968, by Renault since 90's intermittently. We were then able to trace the profiles of the six profit strategies, and the performances, each five years, between 1975-1994 of the firms (here the three profitable, and three unprofitable).

Figure 2: Profit strategies profiles and results of some carmakers comparatively to the profile of their profit strategy
2.4. Automakers according to their choice or ... not of a profit strategy

The car manufacturers classification by profit strategy that we got after calculation and analyse of documents and of historical books is the following

Table 1, Carmakers by profit strategies and period

<table>
<thead>
<tr>
<th>Strategies</th>
<th>Automobile producers</th>
<th>Period</th>
</tr>
</thead>
<tbody>
<tr>
<td>Volume</td>
<td>Ford</td>
<td>1909-1957</td>
</tr>
<tr>
<td></td>
<td>Volkswagen</td>
<td>1949-1974</td>
</tr>
<tr>
<td></td>
<td>Renault</td>
<td>1949-1955</td>
</tr>
<tr>
<td></td>
<td>Fiat</td>
<td>1949-1955</td>
</tr>
<tr>
<td>Volume and diversity</td>
<td>General-Motors</td>
<td>1926-20...</td>
</tr>
<tr>
<td></td>
<td>Ford</td>
<td>1967-20...</td>
</tr>
<tr>
<td></td>
<td>Renault</td>
<td>1954-1996</td>
</tr>
<tr>
<td></td>
<td>Fiat</td>
<td>1950-20...</td>
</tr>
<tr>
<td></td>
<td>Volkswagen</td>
<td>1975-20...</td>
</tr>
<tr>
<td></td>
<td>Hyundai-Kia</td>
<td>1994-20...</td>
</tr>
<tr>
<td>Quality</td>
<td>Mercedes</td>
<td>1949-20...</td>
</tr>
<tr>
<td></td>
<td>BMW</td>
<td>1953-20...</td>
</tr>
<tr>
<td></td>
<td>Porsche</td>
<td>1950-20...</td>
</tr>
<tr>
<td></td>
<td>Volvo</td>
<td>1960-20...</td>
</tr>
<tr>
<td>Diversity and flexibility</td>
<td>Austin</td>
<td>Inter-war period</td>
</tr>
<tr>
<td></td>
<td>Morris</td>
<td>1945-55</td>
</tr>
<tr>
<td></td>
<td>Renault</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Peugeot</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Toyota</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Nissan</td>
<td></td>
</tr>
<tr>
<td>Permanent costs reduction at constant volume</td>
<td>PSA</td>
<td>1945-1976</td>
</tr>
<tr>
<td></td>
<td>Toyota</td>
<td>1950-20...</td>
</tr>
<tr>
<td>Innovation and flexibility</td>
<td>Chrysler</td>
<td>1924-1945</td>
</tr>
<tr>
<td></td>
<td>Chrysler</td>
<td>1984-1995</td>
</tr>
<tr>
<td></td>
<td>Citroën</td>
<td>1949-1960</td>
</tr>
<tr>
<td></td>
<td>Honda</td>
<td>1968-20...</td>
</tr>
</tbody>
</table>

One can see, after reading this table, some manufacturers are not in the list, at certain periods. The reason is that during those periods, those manufacturers had not a clear strategy. They hesitated between several options. They were unable to choose, or they thought they could do this and that, at the same time. This was the case in particular of the following car manufacturers:
2.5. Why we named the preferences for some profit sources: “profit strategy”? 

Several precisions are to be made to it. The strategy pursued by a firm must not be imagined as the result of a well-considered choice. It is made often initially by chance, groping. Its relevance appears ex post. It usually becomes explicit only after, when the practice has shown that micro-decisions, often taken for reasons unconnected to each other or apparently contradictory, could be generalized, after adjustments to be coherent. It was clearly the case for volume strategy, for volume and diversity strategy and for permanent reduction costs at constant volume strategy.

The preference for one or two sources of profit leads to specify them. For example: the choice of quality strategy by specialist car manufacturers does not simply consist to do better than others in terms of reliability, technical quality, and performance, but to bring the quality to the point where the quality becomes socially distinctive, including by the high price of the vehicle. The choice of volume and diversity strategy does not consist only to have platforms from which one could put an indefinite models number, but to find the right balance between platforms and models: an excess of models greatly reduces the economies of scale obtained by the common platforms.

2.6. Is the ranking of firms reliable?

The obtained ranking has raised several questions. All generalist manufacturers have a premium brand. Do they pursue also the quality strategy? There are two cases to consider. The generalist car manufacturers, who were able to have a premium brand durably profitable, like Volkswagen with Audi, are those that use the same platform for all their brands, including the premium brand. How that is commercially possible? Our hypothesis, we have yet to fully check, is that affluent and wealthy clientele who agree to share the bulk of the vehicle with buyers of lower social classes, is not the core of the premium market, but its lower segment. As for generalist carmakers such as Renault, PSA and Fiat, which have sought in the past to have top-of-the-range models with their own platform, they rarely were able to make the necessary investments to do that efficiently, and have lost market share.

The second issue that arose was what we called in French "descente en gamme", descent in range, of specialist car manufacturers. Was there a convergence of generalists and specialists to similar car ranges? The question was legitimate, when we saw BMW to absorb Land Rover and Rover, and Daimler to do the same with Chrysler and Mitsubishi, in the 90s! Many leaders believed in that time that the climax of a car manufacturer was reached, when it was able to produce and sell any type of motor vehicle. Obliged to renounce to these dreams, specialist manufacturers have conceived their new
ranges, taking into account the only tangible fact: the existence of a demand for small and middle vehicles, but high-end, that is to say socially distinctive. But, in the same way that generalists had difficulties to make true high-end sedans, the specialists had difficulties to make top-of-the-range small and medium vehicles. They had not acquired the skill. A high-end small or middle vehicle is not a reduced premium sedan. They require specific design. Aside BMW hand who managed to offer a real little high-end vehicle very profitable, the Mini saved from Rover disaster, Daimler is still struggling to make profitable Smart and Class A, and had to appeal to Renault.

Third question: why some carmakers sometimes announce strategic orientations different of those of their effective profit strategy? For example, cost reduction appeared to be a strategic axis common to many manufacturers, from 90’s. A closer look shows that the use of the terms "cost reduction" has always covered and re-covered in fact different objectives and very different practices. We find at least four different meanings and realities of cost reduction.

The (drastic) reduction of costs is announced and applied when it comes necessary for a firm to correct a financial situation, compromised by a decline in sales or as a result of continuous rises of its costs, in other words when it comes necessary to lower the break-even point through downsizing, closures of plants, disposal of assets, blocking or decreasing wages, etc. Many car manufacturers have done it, at one time or another, often repeatedly, since the late 70s, but in order to revive their earlier profit strategy from a financial position improved. Cost reduction in those cases is temporary and here does not imply a change of the profit strategy.

Carmakers also talk about reducing costs, when exercising a pressure on suppliers to lower their prices. A firm can get it by requiring its suppliers to adopt its own profit strategy, even its own productive model, as Toyota does, or either authoritatively setting a purchase price, or by choosing the lowest bidder.

For many other manufacturers, the "cost reduction" is just the result of scale savings. Lowering the unit cost of vehicles comes from longer series and not from lowering of the cost of each piece by saving time, material, means, spaces and fluids, as in the "permanent reduction of costs at constant volume" strategy of Toyota.
light trucks. Hyundai applies a strict volume-diversity strategy, since the take-over of Kia and it was one of the best performers during 2000-2015 period.

2.8. How did arose the idea of distinguishing profit strategy and productive model? The relevancy conditions and the implementation requirements of the profit strategies

Why separate the strategy from productive model? Does not a model precisely be characterized by some general principles, including strategic? Was not mass production and unskilled worker that characterized the model called Taylorist-Fordist? As the documents of Gerpisa attest, we did not distinguish them immediately. We started by listing the characteristics, that seemed distinguish the socio-productive configurations between them, as one does conventionally, when building a typology. We roamed for a while, not knowing whether we must retain such feature or not, because it can have different meanings depending on the socio-productive configuration in which it was observed. It was the case for instance of teamwork. Long established as a distinctive sign of the lean production model, it was, in fact, used very differently by companies, as shown by the Gerpisa Book's surveys: Teamwork in the automobile Industry. Radical Change or Passing Fashion, Macmillan, London, 1999.

But we could not go and check if all features sent back to the same realities and vice versa. To break the deadlock, we took the approach by logical questioning from established facts. Among the firms that had suffered losses several times, there were logically those who had not been able to choose a clear strategy. But we also found some others that had a clear strategy. The question then became: what are the conditions of possibility and of viability, so that a profit strategy is actually profitable? We have build a table indicating the logical relevancy conditions and the logical implementation requirements of each profit strategy, in the aim to find the countries and the enterprises that fulfilled them.

Table 2, Profit strategies

<table>
<thead>
<tr>
<th>Profit strategy</th>
<th>Characteristics</th>
<th>Conditions of relevancy</th>
<th>Implementation requirements</th>
<th>Company governance component</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diversity and flexibility</td>
<td>Profit margins based on a response to new expectations, direct adjustment of costs to variations in demand</td>
<td>heterogeneous, even balanced, even feasible to unfeasible</td>
<td>models with few parts in common, targeting different positions in the market, a plan that is not flexible</td>
<td>design new models, rapid and low-cost research, strategic management of the enterprise, implementation of the new model, differentiation of competent and flexible employees, guided by teams and competitive behavior</td>
</tr>
<tr>
<td>Quality</td>
<td>- Production volume-oriented in the range of luxury goods - Commercialization of the product in the international market</td>
<td>well to do and different consumer - International</td>
<td>located, existing, new strategy or in a new market position, differentiation of the brand and the different clientele</td>
<td>offering models that reach the new and existent position of the brand and the different clientele</td>
</tr>
<tr>
<td>Volume and diversity</td>
<td>- Excessive of stocks through increasing quantity of standard models</td>
<td>heterogeneous - rational, then irrational</td>
<td>standard, popular and mass produced</td>
<td>allowing for a product that satisfies the individual needs</td>
</tr>
<tr>
<td>Innovation and flexibility</td>
<td>Profit margins based on innovative models that are a response to new expectations, direct adjustment of costs to variations in demand</td>
<td>moderately heterogeneous, with transition from one stage to the next in the product life cycle, dominated by national demand</td>
<td>diversified and personalized</td>
<td>allowing specifically different models with diversified platforms and exclusive, in the market leadership and top of range</td>
</tr>
</tbody>
</table>

Again, several findings put us on the track of what we called then: the two conditions of the profitability of firms.

3. Third fact: A carmaker with a clear profit strategy can be profitable in a country, and not in another. From the idea of national context to the concepts of national growth strategy and model

3.1. The first condition of profitability is the relevancy of profit strategy of carmaker in the countries where the carmaker is located, compared with their national growth strategy and model. What is necessary and sufficient for a source of profit to be exploitable and a profit strategy relevant?

The initial success of Ford in the United States and its failure in Europe and Japan during the interwar, as evidenced by the works of Steven Tolliday, Takahiro Fujimoto and Patrick Fridenson, suggested that national context could constitute a first great condition. Why Ford's recipes did not work outside the US, and, conversely, why local car manufacturers, deemed technically and organizationally latecomers, had been profitable?

To be valorised, any capital requires buyers having ability and willingness to buy, and also employees in sufficient number and skill. The national context must of course offer the two, but in the form required by the adopted strategy.

The approach was to find, what type of automobile demand and what type of labour were absolutely necessary and sufficient, so that the adopted profit strategy could be relevant. For example, to be relevant, innovation-flexibility strategy requires that some practical and symbolic new expectations concerning the automobile appear regularly in the population, and that a creative and reactive workforce could be available. These conditions are more frequent when the national income distribution is competitive, that is to say when the national income is distributed according to balance of power at local and social levels, and according to financial opportunities. Inversely, new expectations and reactive people are less frequent when the distribution of national income is moderately hierarchized and predictable, as was the case in some countries during the 50s-80s, or when the distribution is inequalitarian.

We have revisited the story of car manufacturers and of countries with this idea. We were thus able to establish that there is a link between profit strategy, volume and structure of automobile demand, characteristics of mobilized workforce, and national growth modes: that is to say the engine of growth and the national income distribution mode.

A typology of eight national growth modes was built, combining the three possible engines of growth (investment, consumption, export) and four modes of redistribution of national income (competitive, moderately hierarchized, unequal, restrictive). Each national growth mode is more favourable to some profit sources than to others, and therefore to some profit strategies more than to others.

The table reads as: for instance, the quality strategy requires a segment of the population sufficiently wealthy to pay the price of the social distinction, and a labour professionalized enough to produce the required quality. This strategy is particularly relevant when inequalities are increasing and when the training of necessary qualified employees is ensured. For volume strategy, it is necessary to have a large part of the population
able to buy a cheap basic car, and an abundant labour accepting repetitive production, etc.

Table 3, The national growth modes

<table>
<thead>
<tr>
<th>Modes</th>
<th>National income</th>
<th>market</th>
<th>labour</th>
<th>Countries</th>
<th>Favourised profit strategies, in descending order</th>
</tr>
</thead>
<tbody>
<tr>
<td>« competitive and competed »</td>
<td></td>
<td></td>
<td></td>
<td>United Kingdom</td>
<td>1. Diversity-flexibility 2. Quality</td>
</tr>
<tr>
<td>« competitive and price export-oriented »</td>
<td></td>
<td></td>
<td></td>
<td>Republic of Korea, 1980-20… Spain, 2005-20… Central Europe, 1995-20…</td>
<td>1. volume-diversity 2. permanent cost reduction at constant volume</td>
</tr>
<tr>
<td>« co-ordinated and price export-oriented »</td>
<td></td>
<td></td>
<td></td>
<td>Japan 1955-20…</td>
<td>1. permanent costs reduction at constant volume 2. Volume and diversity</td>
</tr>
<tr>
<td>« Inequalitarian and rent-oriented »</td>
<td></td>
<td></td>
<td></td>
<td>Brazil Mexique</td>
<td>1. quality 2. Volume-diversity</td>
</tr>
<tr>
<td>« shortage and investments-oriented »</td>
<td></td>
<td></td>
<td></td>
<td>SSRU 1930-1990 Europe</td>
<td>1. volume 2. quality</td>
</tr>
</tbody>
</table>
3.2. The testing of the relevance of profit strategies according to growth modes

We were then able to test the three hypotheses that had guided us. Do firms that have had irrelevant profit strategies, according to our analysis schema, had experienced difficulties? Conversely, has the crisis of some growth modes led the carmakers of correspondent countries to fall also in crisis? Do the structure of auto sales and the professional structure of employees of sector, actually correspond to those we have supposed, given the growth mode?

Concerning the first question, we can answer: yes. In countries that had adopted a coordinated and moderately hierarchized distribution of income, after the Second World War, carmakers, focused on innovation-flexibility, as were Chrysler or Citroën or on the socially distinctive quality, such as specialist manufacturers, could not regularly profitable or disappeared, contrary to the car manufacturers who had chosen the volume-diversity strategy. Concerning the second question, we can also answer yes. We discovered, not without pleasure, as the result was clear, that the three car manufacturers, remaining continuously profitable over the period, all belonged to countries whose growth mode was driven by exports, namely Japan and Germany. These countries were able to withstand monetary and oil shocks of the 70s, because of their previous extraversion.

Concerning our third question, we can answer with a "yes, probably". To be able to say yes without restriction, we should have access to information over all the period giving data about what categories of people buy what type of vehicle, and that, year after year. We hoped to be able to do it, at least for France. But the project never materialized. Now this point is decisive so that the proposed explanation could be considered as validated. For now, we can accept an assertion that, to date, there are not experienced and visible strong denials.

3.3. Does determinants of automotive demand and of labour reduce to growth mode?

We all know that determinants of demand are always extremely numerous and diverse. Researches very thorough, especially in the Gerpisa, starting with those of Bernard Jullien, have abundantly shown that. The household makes final demand for new vehicles, but also, and increasingly in recent years, by the demand of enterprises, rent-a-car companies, etc. The automotive market is not limited to new vehicles. It also includes used vehicles that make accessible high-end vehicles to modest buyers. The demand also depends on the offer. When the demand in a country is a demand of first equipment, almost all is sold. Demand, in volume and in structure, depends also on the existence or on the absence of alternatives, as rental car services, public transportation, etc., it depends on trade-offs that households are forced to do (between the cost of housing, communications, training, etc.), it depends also on urbanization, demographics, and countless public policies, at sectorial, national and supra-national levels, concerning trade, competition, industries, energy, environment, public safety, urban planning, transport, etc. Do not we observe also a trivialization of the car, which would become a simple means of transport, as self-service cars, etc.

The analyses of some previous determinants show that they modulate the demand, but they do not create the automobile demand. We can think, as long as the vehicle is the subject of an act of direct purchase by households or by companies for some of their employees or their costumers, automobile demand remains basically dependent on the
changing of amount of national income and its distribution mode. We hope the realisation of researches on this point.

Anyway, these determinants exist and must find their place in the schema of analysis. Where can we introduce them in the process of building of productive models? Several proposals were made by Yannick Lung at 2004 Gerpisa colloquium, par Bernard Jullien et Tommaso Pardi at 2012 and 2013 Gerpisa colloquium.

What we must avoid is losing a lot of time searching for the relative weight of the various determinants, which certainly vary from a country to another. In the logic of what has been said previously, it seems that the solution of the problem can be found by distinguishing "national growth strategy" and "national growth model", as we proposed at the 2004 Gerpisa colloquium. How?

3.4. Distinguish national growth strategy on the one hand, and national growth model on the other hand, allows to take into account, dynamically, all the determinants of automobile demand

The growth modes were easily regrouping into three groups, depending on the engine of growth. So there were several income distribution modes for the same engine of growth. This means that a growth source becomes an engine of growth under certain conditions. Indeed, the choice of investment as engine of growth implies that distribution of national income to households is deferred to finance the investments. The choice of consumption implies to distribute national income within the limit of the gains. The choice of export means that exported goods must retain their external competitiveness, either by price or by their specialization. However, there are several ways to meet (or not) to the requirements, as evidenced by the diversity of national models for the same engine of growth.

So, the national growth strategy is based on a choice of growth engine and its own requirement of regulation between production and distribution of national income. The national and sectorial growth model is based on national and sectorial compromises, regulating production and distribution of national and sectorial income.

The track is promising. Multiple mentioned determinants of car demand correspond to sectorial, national or international compromises. These compromises can take multiple forms and contents depending on countries and periods, on condition of not being in contradiction with the requirements of the national growth strategy.

This manner to reason thus avoids considering the determinants as factors, of which one cannot assess the significance and meaning, because they are in fact just descriptive categories. This allows also introducing the dynamics of social relations and the history of their confrontation in the process of Nation's construction and sustainability. Mostly, this manner to raison enrich considerably the representation of decisions making, without to have to postulate an independent political or cultural levels. The last Gerpisa book edited by Bruno Jetin, *Global automobile demand* (2015) opens many tracks.

For instance, the urbanization is generally treated as an independent factor of the car demand, supposing that a level of urbanisation determine a level of demand. In fact at a same level of urbanization, we can observe several levels of demand. Why? Because urbanization is a social process of location of production and distribution, that implies social compromises to be effective.

It seems the various determinants of automobile demand can take place in the following general schema of the strategy and of the model of national growth. We have al-
so to add the determinants of the volume and structure of labour that can be mobilized. We cannot develop here this way, but it opens a huge survey!

Figure 3. The engendering of national growth strategy and model

Finally, the growth mode of national income of the figure “the productive model in its environment” can be replaced by the schema of “strategy and model of growth”.

3.4. The changes in 25 years

Since the 90s, the national growth models have evolved, because of their own dynamics and the free movement of capital. There have been four significant phenomena: rising inequality in some countries, mainly the United States, the economic take-off of countries-continent, mainly China and India, the creation of two economic regions partly integrated, the NAFTA and Europe, a succession of violent crises, spreading quickly to all or part of the world. There have been at least four major: 1990, 1997, 2000, 2007... until the next.

Have major producer and consumer countries of automobiles changed their strategy of growth and their national model? What are the growth strategies of the so-called emerging countries? Does certain profit strategies become more relevant than others?

Over the past twenty-five years, national growth strategies have evolved, because of their own dynamics and of the development of the free movement of capital. We can note an increasing of inequalities, but no radical changes of national growth models, except concerning United States of America and Spain. USA has clearly changed its national model. The moderately hierarchized distribution was replaced by a competitive distribution, and more recently by an unequal distribution. Spain changed, not only its moderately hierarchized distribution by competitive distribution, but also its growth engine: from consumption to exports-price. Great Britain has retained its "competitive-
competed" model. Germany and Japan are basically exporting countries, and their distribution remained moderately hierarchized, although inequalities increased. France and Italy have not changed basically their strategy and their model, at least until now: their growth engine is always the consumption, and the distribution, despite various attacks, remains roughly moderately hierarchized. The Republic of Korea, which has emerged as a major country in automotive construction, remains an "exports-price" country with competitive distribution. Brazil and Russia, of which some people thought that they would emerge from a growth based on mining and oil rent, and on inequalities, have not managed to do so far.

4. The fourth fact: A carmaker, with a relevant profit strategy in a country, could be however unprofitable in this country. From generic productive models, to different national productive models implementing the same profit strategy.

4.1. The second condition to profitability: build a "company governance compromise", which allows to implement the chosen profit strategy, using coherent and acceptable means by stakeholders, that is to say to build a productive model

The profit strategies have conditions of possibility, as we have seen, but also requirements of implementation. The strategy of "socially distinctive quality" requires the ability to develop car models expressing the distinctive social positions of affluent and wealthy social classes, an organization of production and of sales that guarantees the prestige of the product, a workforce renowned for its professional competence. The "volume" strategy means that the company must be able to design a multi-use and robust standard car, to develop a mass production and to find employees that accept repetitive work. The strategy "volume and diversity" requires moderately differentiated products, productive organization rendering manageable variety, and polyvalent employees. The "innovation and flexibility" strategy involves the ability to perceive the new expectations of all or part of customers and offer products that meet these expectations, a productive organization quickly convertible, following the success or failure of the innovative cars, and finally a creative workforce and reactive. The "reduction of costs at constant volume" strategy requires to offer a range of products, of which variety, quality, delay of delivery and price are what is commercially just needed, an organization improvable step by step, and employees agreeing a continued reduction of costs.

4.2. Designing a productive model as a compromise to meet the requirements of a profit strategy is a way of thinking that solves many research problems

Make inquiry, from the requirements of the chosen profit strategy, presents two advantages. This will select, among the numerous features under which the firm appears, those are essential to define a possible productive model. This frees from less rigorous approaches, as what we can called the "tinkered modelling" and the “calculating of statistical constellations." Second advantage: we can classify the socio-productive configurations of firms depending on they meet or not the requirements of the strategies pursued, and thus classify firms depending on they have managed to build a productive model or not.
Effectively, a careful analysis of product policy, of productive organization and of employment relations of car manufacturers has shown us that the means employed were not always coherent with the strategy pursued, including when the strategy was relevant. That was the case of GM, Ford and PSA, for example, during the 1975-1990 period. The non-coherent ways were the clear results of the debates and conflicts between the company's stakeholders. Conversely, the construction of a company governance compromise had been particularly explicit and clear in the three profitable firms, during the same period.

Taking up again the history of the automotive industry, we have identified six of these compromises and the productive models that they had permitted to build. Two models, for the implementation of the strategy "diversity and flexibility", the "Taylorian" model and a model that we have discovered, that we called "Woollardian", in honour of the English engineer who had designed it, in Austin during the 30's. The "Fordian model" for the volume strategy, the "Sloanian" model for the "volume and diversity" strategy, the "Hondian" model for the strategy of "innovation and flexibility", the "Toyotian model" for the strategy of "permanent reduction of costs at constant volume".

Table 4, Productive models

<table>
<thead>
<tr>
<th>Models</th>
<th>Profit strategy being implemented</th>
<th>Components of the model</th>
<th>Dynamics Risks Contributions</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td><strong>Product policy</strong></td>
<td><strong>Productive organization</strong></td>
</tr>
<tr>
<td>Taylorian</td>
<td>Diversity and flexibility</td>
<td>Specific products, varied product offer, medium-sized series</td>
<td>Standard procedures and allocated times, flexibility of equipment and stationary individual workstations</td>
</tr>
<tr>
<td>Woollardian</td>
<td>Diversity and flexibility</td>
<td>Specific products, varied product offer, small &amp; medium-sized series, frequently piece work</td>
<td>Workshops for each product or subsystem, mechanisation and synchronisation of suppliers</td>
</tr>
<tr>
<td>Fordian</td>
<td>Volume</td>
<td>Access to mass consumption vs. acceptance of productive organisation</td>
<td>Production is integrated, continuous, mechanised, timed and broken down into elementary operations</td>
</tr>
<tr>
<td>Sloanian</td>
<td>Volume and diversity</td>
<td>Rising purchasing power vs. mass productivity</td>
<td>Strategic centralisation and operational decentralisation, tools are polyvalent and substituting</td>
</tr>
<tr>
<td>Toyotian</td>
<td>Permanent reduction of costs at constant volumes</td>
<td>Longevity for firms and for employees' and suppliers' jobs</td>
<td>Well-equipped basic model, good quality that is perceptible to the client</td>
</tr>
<tr>
<td>Hondian</td>
<td>Innovation and flexibility</td>
<td>Self-funded, individual promotion vs. responsiveness and initiative</td>
<td>Conceptually innovative and specific models, anticipation of customer expectations</td>
</tr>
</tbody>
</table>

So the analysed cases allowed drawing several conclusions. In addition to the plurality of viable models, one could also argue that it was possible to build different models to implement the same strategy, as evidenced by the Taylorian and Woollardian models. The Taylorian model, Fordist and Sloanian, generally confounded, not only were distinct, but they were opposed, and they had had very different destinies. Finally, two models had existed in the Japanese automobile industry: Toyotian model and Hondian, while all opposed them. In addition, one of them, the Toyotian model, had changed profoundly. Toyota had to actually renegotiate its "enterprise government compromise", following a serious labour crisis in 1990.
The firms that had an irrelevant or hesitant profit strategy, and that had not built a compromise to make coherent the employed means, were logically the most troubled firms. What we have been able to verify. They have not transformed their socio-productive configuration in productive model.

The three durably profitable firms, their only common point was to have chosen a pertinent profit strategy in the macroeconomic environment, societal and competitive that was theirs, and to have built a "company governance compromise" between the key players, to implement coherently the profit strategy. In contrast, they differed by their profit strategy and by their company governance compromise. There was no "one best way".

4.3. The previous typology presents, however, two problems

The means employed must meet the requirements of the profit strategy, but the profit strategy does not determine them precisely, given that they are the outcome of a compromise between the stakeholders of the firm. When formulating the analytical schema in 2000, we did not push much further analysis of the construction of this compromise, neither as regards the choice of means, nor as regards the involved stakeholders in this choice. We suggested only that the compromise depended on the history of power balance between the stakeholders, and that the main stakeholders were not the same according to the profit strategy. For example, in the innovation and flexibility strategy, the banks, that have a risk-averse, and the subcontractors, that require long-term commitments, must be neutralized, so that managers and employees can agree on how to be both innovative and reactive. As seen, the stakeholders of a company compromise are not only internal but also external, and they are many more than we imagine. Bernard Jullien and Tommaso Pardi tried to reconstruct the genesis of certain means employed and to develop the concept of company governance compromise.

Today we can say two things. Stakeholders can find means only among those who are possible, tolerated, provided, suggested by the national growth model, and by the sectorial compromises, both in terms of product policy, than of productive organization and employment relationship.

In a country where the branch agreements prevail over those of enterprise, the company governance compromise will have to do with. Ditto, in a country where the security standards and the rules of credit create constrains, both for the design of vehicles and for the purchase of cars. Ditto in a country where the professionalism of the workforce leads to a type of organization less deskillling.

Therefore the investigations would have to reconstitute the process that led stakeholders to modify a means, so that it could be coherent with the others, to finally adopt it or reject it. To illustrate what would have to do, we can remember how Ford finally chosen to integrate production of its cars, from the steelworks until the delivery. Initially, he had no intention of doing so. He seemed to him most profitable, to order at subcontractors and to realise the final assembly of the vehicles in the regions of commercialisation. But, as he could not get deliveries in due time, that is to say as he could not obtain from his subcontractors that they adopt a volume strategy, he decided finally to integrate production in its new plant of Rivière Rouge.

3 This historical fact is important, also because it shows that the production integration is not a necessary trait of volume strategy, of fordism. Conversely, it seems to show that the adoption of a same profit strat-
The second problem of our typology derives from that we write above. If stakeholders are forced to find means consistent with those recommended by the sectors and the countries where their companies are, to implement their profit strategies, then the company must build as many corporate governance compromises than countries where it operates.

Curiously, we have been slow to understand that the strategy of a firm would have to be implemented differently across countries, given the specific characteristics of the market, given the possible outsourcing, given the relationships and social legislation. The product policy, the productive organization and the employment relationship and therefore the company governance compromise cannot be the same in the host country as in the home country. To be profitable, a subsidiary in a foreign country must build a new governance compromise to implement the profit strategy of the parent company.

Why do we struggle to think that, while this is the logical consequence of our definition of the model? Probably due to a researcher reflex, which consists to stick as close as possible to our observations and to the documentation of the companies. Indeed, when a company sets up elsewhere, it tries to transplant devices that company considers to have made its success in the home country. To do this, it assigns at the new plant a reference plant of origin country. So it limits the adaptations of the original model. Hence, we have the impression that the additions or substitutions are in limited number, without reorganization of the whole, without changing the company governance compromise. The changes seem limited to find functional equivalents to devices that cannot exist in the new country. This practice often results in difficulties, as Tommaso Pardi has shown it for subsidiaries of Japanese manufacturers in United Kingdom during many years. The socio-productive configuration of subsidiary must meet the requirements of the profit strategy of the parent company, but differently depending on growth strategy and model of the host country.

For an Automobile Group, to be profitable in all countries where it operates, it is necessary both that its profit strategy is relevant in all these countries and that its foreign subsidiaries build their own company governance compromises for implement its profit strategy.

In this perspective, a huge project is opening to study the building of different company governance compromises in each Group, especially in the subsidiaries and joint ventures of countries that are becoming the epicentre of world automobile industry: China. We have to reconstitute the process that led stakeholders to modify each means, suggested or imposed by sectorial and national levels, so that it could be coherent with the others, to finally adopt it with adaptation or reject it.

That we are coming to say is not a rehabilitation of the notion of the national productive model. Indeed, there is no national productive model valid for all carmakers of a given country, but several national productive models implementing the profit strategy of the carmaker located in several countries. The consequence is, there are several national productive models in the same country. For instance, the productive model of
Honda in Japan is not the same of its productive model in USA. As we have seen previously, it is not also the same of the productive model of Toyota in Japan.

So, we must probably abandon the appellations too general: taylorian, toyotian, and so on... to name the productive models of carmakers in the countries where they were able to build a governance compromise. To be rigorous, we must name them by their governance compromise. Another new Investigative fields.

4.4. The governance compromises that based the productive models change also in time

An "enterprise government compromise" is not a stable, indefinitely sustainable and unsurpassable. The reasons are exogenous and endogenous.

The exogenous reasons are the dynamics or the change of the national growth model. The dynamics of national model can obligé car manufacturers to find new means to exploit their privileged profit sources. It was the case in USA during the 1965-1975 period. The success of the moderately hierarchized distribution of national income allowed the great majority of households to own a car. The automobile demand passed from equipment stage to renewal stage. So the possibility, especially for GM and Ford, that they developed a volume-diversity strategy, to make economies of scale only by the growing number of buyers disappeared. The American carmakers were obliged to find new means. They had two possibilities: export and communalize more. They failed in these two directions. Instead to increase, their communalization rate declined. They were definitively challenged by the Japanese carmakers on their own national market. Their governance compromise exploded.

We can continue with the case of USA to illustrate now another cause of change of company compromise: the change of national growth model. The choice of USA to develop a competitive income distribution after 1985, and, a more and more inequitarian income distribution after 1995 changed the structure of automobile demand. The demand of light trucks, that are vehicles more expensive and more polluting, became more important in car demand. The Big Three decided to privilege this market and to specialize some of their US plants in light trucks. They close many others. And for the very competitive car market, they create new plants, out of US, especially in Mexico. The confrontation with UAW was at its maximum.

After, they believed they had found an integrated solution in the "new economy", but "new economy” was another disastrous history.

The first endogenous cause is the dynamics of the strategy and of the compromise. A sustainable profitability gives the opportunity, especially to employees, to claim and to obtain better working conditions, wages and employment. Are there any limits? The limit is the implosion of the compromise itself. But it is important to stress here that the limit is not quantitative, but structural. The company governance compromise is into question, only if employee’s claims are inconsistent with the requirements of the pursued profit strategy. One can take the example of Honda. Honda was able to provide during the 80-90 years the best working conditions in the Japanese automotive industry, because the ergonomic techniques to improve working conditions, such as assembly aids, improved also productive flexibility (essential for innovation strategy).

In Europe, the company governance compromises were destabilized, not because the market, that was far from reaching saturation at the beginning of the seventy years, like in the United States, but due to the refusal of employees to undergo longer the counter-part of the increase of wages: that is to say, a work ever greater divided. Solutions exist-
ed, some of which have begun to be explored then. But, before that new compromises were elaborated, monetary and oil crises of the second half of the 70s came broken the growth of the automobile market, placing the European automotive industry in a scenario similar to that of the United States. Ultimately, only Volkswagen found the solution, both the crisis of work (by a compromise on working conditions, employment and wages) and the crisis in productivity (by the absorption of small builders and the communalization of car platforms).

The Toyotian compromise fell also in crisis through work. Toyota employees refused in 1990 to make more overtime than before. The speculative bubble of the late 80s has caused a boom of automobile demand. Toyota, not finding young people to hire, wanted to further increase overtime of employees. Their refusal provoked a general crisis of the compromise and led to transform it completely, as showed Koichi Shimizu.

A last example is the liberalization of capital flows that led to the rise of the shareholders power, especially institutional investors, who sought to change thoroughly the existing compromises. The car manufacturers, which, because of their profit strategy, had carefully preserved their financial independence, have not had to suffer too much damage. Those, whose capital was widely dispersed and uncontrolled, were pushed to the "new economy". By its own logic, not by its excesses, as they say, the model called Anglo-Saxon, support of the announced globalization, imploded, barely born.

5. The productive models theory proposed six tools to investigate the trajectories of firms and of countries

5.1. To four tables and three figures, previously presented, we can add a sixth tool.

The previous tools allow respond to several questions:
What are the profit strategies of carmakers?
Table 1. Profit strategies: characteristics, conditions of relevancy to market and to labour, requirements of implementing
Table 2. Ranking of carmakers by profit strategy and period

Where and when their profit strategies are relevant?
Table 3. National growth strategy and model: growth engine, income distribution mode, type of demand, type of labour, ranking of countries, favoured strategies

What productive models have implemented efficiently their profit strategy?
Table 4. Productive models: implemented profit strategy, company governance compromise, product policy, productive organisation, employment relationship, dynamics and contradictions

A synthetic representation of engendering of productive models
Figure 1, The engendering of productive models
Figure 3, The engendering of national growth strategy and models
Figure 4. The new extended representation of engendering of productive models.
In addition, according to the paradigm of "limited diversity and periodically renewed productive models", which is at the base of the analysis schema, we have questioned some trends that were presented as inevitably going to be generalized, to all car manufacturers and to all countries. We have shown thus:

- or the conditions for universalization of a trend did not exist, as the supposed trend of carmakers to produce all types of vehicles, the once supposed necessary disappearance of car integral architectures because of modularization, the generalization of the shareholder value compass to manage a company, the necessity to merge with competitors or to buy them, the products globalization, etc.

- or the considered universal trend covered in fact a wide variety of contents and objectives, as it is the case for outsourcing, productive internationalization, global sourcing, after-sales services, suppliers parks, automation, etc.

The analytical framework then allowed us to better understand and even to predict in some cases, the failure of most mega-mergers in 90s, the bankruptcy of GM and Chrysler in 2008, the return to profitability of specialist car manufacturers, the rise of VW and its derivatives, the crisis of PSA, the tensions in the Renault-Nissan alliance, the divergent trajectories of the BRICs and their consequences on the car manufacturers who were based there, the success of certain joint-ventures in China and the failure of others, the contrasting results of the industrial relocation in peripheral countries with low cost, etc. modularization, product architecture, « new economy », globalization, regionalization, outsourcing, country attractiveness, suppliers parks, automation, work conditions, foreign subsidiaries, work crisis at Toyota, transition to clean car, etc.

The third contribution was to draw attention to some facts that were unnoticed or had been underestimated (such as changing in the structure of demand in some countries, the chaotic growth of some emerging countries, the work crisis at Toyota, etc.), and to propose a reading key for some current evolutions, such as the various transition scenarios to a clean vehicle according to the profit strategies of car manufacturers, and according to countries growth models.

In 2001, we elaborated the following table, which was published, without major changes, in The Second Automobile Revolution (2009). It remains largely relevant today. The profit strategies of car manufacturers, and, in several cases, their lack of a clear strategy, explain, more convincingly than others explanations, why the successive "trends", presented as going to become widespread, could not do it, and why they led both to successes as failures for the carmakers, who had adopted them.

5.2. How to use these tools?

The tables indicate the characteristics to fulfil, by a carmaker, to know what is its profit strategy and its productive model, and, by a country, to know its growth strategy and model, and the type of car demand and of labour it offers. The gap between what it is required by a profit strategy to be adopted and implemented efficiently, and the choices of a carmaker, allows to evaluate the degree of relevancy of its profit strategy, and of coherence of its socio-productive configuration. Ditto for each country.

The more or less importance of gap should allow to better understand the financial results of carmakers and the growth rate of countries, and more generally their trajectories. These tools can allow also identify eventually new strategies and productive models, if durable positive results are associated with new combinations of profit sources, or
new company governance compromises. They can be also improved if certain compatibilities or incompatibilities were underestimated or overstated.

Table 5. Compatibilities or incompatibilities between new “trends” and profit strategies

<table>
<thead>
<tr>
<th>Profit strategies</th>
<th>Offering all types of vehicles</th>
<th>Shared platforms</th>
<th>Externalisation</th>
<th>Modularity</th>
<th>Clean engine</th>
<th>Internationalisation</th>
<th>Merger-acquisition alliance</th>
<th>Development of customer services</th>
<th>Reliance on financial markets</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quality</td>
<td>No, only in the upper segments of the traditional product range</td>
<td>No, there is an absolute need for 'distinction', including in the non-visible aspects</td>
<td>Maintain the know-how that gives the project its image of 'social quality'</td>
<td>No, commercial need for a highly integrated product</td>
<td>Yes, but not before finding a reliable and lasting solution</td>
<td>Indispensable, but only at a commercial level, production in the country of origin</td>
<td>Incompatibility with firms pursuing very different profit strategies</td>
<td>Yes, part of indispensable and highly customised service</td>
<td>Possible, if investors are seeking safety</td>
</tr>
<tr>
<td>Diversity and flexibility</td>
<td>Yes, possible, but not indispensable</td>
<td>No, the demand is too 'balkanised'</td>
<td>Yes, to have the necessary flexibility</td>
<td>Yes, possible for certain customer bases</td>
<td>Yes, the necessity to synthesize innovations and rapid price reductions</td>
<td>Not necessary, possible in countries with a competitive income distribution</td>
<td>Possible with a firm pursuing the same strategy but not indispensable</td>
<td>Yes, this is a condition for capturing certain customer bases</td>
<td>Yes, possibility of high albeit variable returns</td>
</tr>
<tr>
<td>Volume</td>
<td>No, only models in the main market segments</td>
<td>No, standard and ‘integrated’ model</td>
<td>No, need for continuous flows</td>
<td>No, insufficient diversity</td>
<td>Yes, when there is a possibility to synthesize innovations and rapid price reductions</td>
<td>Indispensable, if national market is saturated, move towards countries with co-ordinated and egalitarian distribution</td>
<td>Very profitable if there is a possibility of adopting the same models</td>
<td>Standard service, minimum indispensable</td>
<td>No, resistance to lower prices in case of strong demand</td>
</tr>
<tr>
<td>Volume and diversity</td>
<td>No, only models whose platforms can be shared</td>
<td>Indispensable, diversity on ‘surface’ level</td>
<td>Yes, but maintaining control over volumes and prices</td>
<td>Yes, in the form of sub-assemblies for the moment, and if externalisation conditions are fulfilled</td>
<td>No, but very rapid copying, if there is sufficient demand and economies of scale are possible</td>
<td>Indispensable, if the national market is saturated in countries with a more easily hierarchised distribution</td>
<td>Vital where a second stage renewal is involved; absolute need for shared platforms</td>
<td>Yes, if economies of scale can no longer be achieved with material products</td>
<td>Yes, if stable returns are expected over the long run</td>
</tr>
<tr>
<td>Permanent reduction in costs</td>
<td>No, only models for which demand can be forecast relatively easily</td>
<td>Yes, if the demand is moderately hierarchised</td>
<td>Yes, but maintaining technical control and if there is the same profit strategy and productive model</td>
<td>Yes, carefully, in the form of sub-assemblies, and if externalisation conditions are fulfilled</td>
<td>No, but quick copies becomes the new norm</td>
<td>Indispensable, if possible, move towards countries with predictable demand and stable exchange rate, but not indispensable</td>
<td>Very profitable if possible, but this depends on the same strategy and company and not on a condition of low prices</td>
<td>Not advisable, since it is hard to find a firm with the same strategy and company government compromise</td>
<td>Yes, to ensure customer loyalty</td>
</tr>
<tr>
<td>Innovation and flexibility</td>
<td>No, only conceptually innovative models</td>
<td>Difficult, when the aim is to respond to new expectations</td>
<td>Indispensable for rapid mass production in success</td>
<td>Yes, but only for research and innovative models</td>
<td>Yes, at each stage of innovation</td>
<td>Not necessary if located in a region marked by</td>
<td>Not necessary, possible with firm pursuing the same strategy</td>
<td>No, unless it constitutes an innovative concept</td>
<td>No, risk of losing financial independence, indispensable</td>
</tr>
</tbody>
</table>

Table 5. Compatibilities or incompatibilities between new “trends” and profit strategies

5.3. Types of reasoning and theory

The highlighting of trends was one of those innovations, that allowed researchers to show, or to reveal social processes, that factual history concealed beneath an accumulation of facts. The benefits of this approach are now completely exhausted. Its shortcomings have become major obstacles to a better understanding of reality. This approach does not allow to understand why a trend is not generalizing, why it can turn into its opposite, why the forecasts made by prolonging it are almost always denied, why many situations, far from to be survivals of the past, persist and evolve according to their own logic, etc.

The analysis framework of productive models at contrary is a schema based on a reasoning that emphasizes not the trends but the differences. This type of reasoning allows to overcome the above contradictions. A theory is useful first by the dead end, from which it lets out.

A theory is a survey and analysis tool, designed to answer a research question. Its use, the improvements and developments, which can be provided, are justified only as long as it helps to understand, better than other analysis frameworks, the reality under observation. The function of an analysis framework is not to produce an image of reality as accurate as possible (that of firms trajectories, for example), but to help to better respond to the question that we ask ourselves about this reality: in our case, the question was: what is the origin of competitiveness and of sustainable profitability of a company?

One theory is not a fortress to be defended at all cost, this is not a forging press that should be applied in all circumstances, on behalf of the anthropological presuppositions, philosophical or political, on which all research is necessarily based in fine. A theory is only a tool that, like any tool, has to be improved, and that, when went after possible improvements, must necessarily be replaced by a more suitable and effective tool, even if, and especially if its replacement implies to revise principles on which it was based.

That is, indeed, by pushing to its limits of acceptability the explanatory power of a schema of analysis, that one can imagine usefully new concepts and that one can devise a new framework.

By construction, an analysis schema may not explain everything, since it is only there to try to answer a question. If it explained everything, it would not be a theory but the Truth, of which we know that no one can claim it, as it is inaccessible. Each fact exists only under given conditions, that are linked in an almost infinite chain.

To decide to experience an analytical framework by using it with the aim to better overcome it one day, unfortunately, is not sufficient to be truly and wisely. Like any tool, a theory may not be used without its instructions, and especially without learning and without the necessary know how. That's why we focused in this article to show how we built the schema of analysis of productive models, what was the process that gradually led us to develop the conceptual corpus presented.

Now, we want to show how this corpus was used to better understand some changes occurred since 2000. Over twenty analysed changes (see the list at the end of article), six major will be presented.
6. Events and evolutions of the last 15 years, that Productive Models analysis schema has allowed to better understand, and sometimes better anticipate

Relevance of an analysis tool can be evaluated by its ability to question the changes occurred after its elaboration, or to treat topics that were out of the initial investigation field. We have tried, throughout the last 15 years, to analyse these changes with the developed conceptual tools. This led us, as we have seen, to modify some of these tools.

6.1. Merger, acquisition, alliance: ones companies involved, ... not others

Late 90s, there has been an impressive wave of mergers, acquisitions and alliances said then, that it condemned those companies that did not participate. Daimler took control of Chrysler and Mitsubishi. Renault concluded an alliance with Nissan, took over Dacia and Samsung, and became the largest shareholder of Volvo Trucks and Nissan Diesel. General Motors seized Daewoo, which had shortly before acquired Ssangyong and the Polish firm FSO. General Motors allied also with Fiat, purchase Saab and took control of Isuzu and Subaru. Ford took the direction of Mazda, bought Volvo and Land Rover, after Jaguar and Aston Martin, acquired shortly before. Hyundai, a time in negotiations with Daimler, narrowly managed to remain independent and to buy Kia.

Mega-mergers were explained by several reasons: the supposed need to reach the new critical size, then estimated at 4 million vehicles / year, the opportunity to exploit all possible synergies and to offer any type of vehicle and body, (from small cars to luxury sedans and urban all-road, from personal cars to industrial vehicles), and above all the interest to be present on all major markets. The Asian crisis of 1997, having strongly destabilized Korean manufacturers and some Japanese ones, gave the opportunity to carry out some of these merger operations at lower cost.

However, several previous merger episodes could recall that the general enthusiasm for mergers was not justified. BMW, which had preceded the movement, buying in 1994 Rover and Land Rover, had to sell them in 2000, just at the moment of the waltz of mergers. Land Rover was sold to Ford, and Rover was sold for a symbolic pound, to an English consortium, with the exception of the only nugget quickly exploitable: the Mini Cooper. Furthermore, the automotive story reminded us that merger failures were at least as numerous as the successful ones.

Finally, for our part, we could not fail to notice that the three car manufacturers sustainably profitable, during the studied period, were not involved in the run to acquire defaulting carmakers, while they could afford that having more money than others to do so. Toyota in the same period only ride in the capital of Daihatsu, and Volkswagen buy only Lamborghini and the logos of Bugatti and Bentley. As for Honda, which then produced yet only 2.4 million vehicles, it had not tried to develop by external growth.

To assess the likelihood of success or failure of mega-mergers of the late 90’ and 2000, we have thought that a consolidation has more chance to succeed when the concerned firms pursued previously the same profit strategy, or when one of them was able to impose its strategy.
This reading key have worked well for understand some successful mergers of the past. VW had been able to profitably impose at Audi, Skoda and Seat its volume-diversity strategy by imposing to them the same platforms. He was following in this what made the success of General Motors in the years 20-30. Conversely, when profit strategies remained different after the merger, losses were the consequence. PSA had not succeeded in imposing its platforms to Citroen and Chrysler Europe, in the decade 80 and a part of the 90's. Renault had failed both in the recovery of the fourth US company, American Motor Company late 80’s, and in a merger with Volvo in 1994. The merger of many British manufacturers in British Leyland Motor Company had to result a conglomerate, whose agony lasted nearly thirty years.

Therefore we took the risk to do comments and even predictions about the future of mega-mergers, that had just been made. The profit strategy of Daimler was the quality strategy. Those of Chrysler and Mitsubishi were mainly "innovation and flexibility" strategies. So the possible synergies were low. All Ford-Mazda-Volvo could only be visible if Ford imposed its "volume and diversity" strategy to the other two, which meant a profound change of customers for Mazda and Volvo. The General Motors and Fiat alliance made sense, since both companies had the same "volume-diversity". But it was still necessary that both companies agree on how to achieve the alliance. Soon some divergences arose. GM was trying at the same time to impose its platforms to its European subsidiaries, Opel and Vauxhall. It thought that Fiat would rally. But Fiat intended to design common platforms only with Vauxhall and Opel, tailored to the European market and Latin America. With divergent points of view chances of success of GM Fiat alliance were slim. As for the Renault-Nissan alliance, it was foreseen to create pragmatically synergies in several domains: purchasing, production plants, automobile credit, back office, production methods, etc., to share the markets, and to design progressively common platforms. We then formulated some fears. Renault and Nissan were characterized so far by hesitant and sometimes confusing profit strategies: between volume and diversity and innovation and flexibility for Renault, between volume and diversity, diversity and flexibility and quality for Nissan. Each manufacturer had the daunting task to clarify its strategy, and then to share it with the other. And in fact, we can observe now a destabilisation of alliance. As for the merger Hyundai-Kia, we did not say anything, by ignorance and by our underestimation of these manufacturers.

It remained to explain why in late 90’ and at the beginning of 2000’ Toyota, Honda and Volkswagen had not try to purchase some carmakers, or to merge with them. The strategy "permanent reduction of costs at constant volume" involves being extremely careful in all things, not to squander the on-going efforts to reduce costs. More than others, this strategy requires consistency of execution. A combination would have involved an immediate grip by Toyota from its new partner.

The strategy "innovation and flexibility" of Honda implies two things: anticipate new expectations of new categories of the population, by designing and producing innovative products, and be able to react immediately to extend as long as possible the innovation rent if success, and minimize losses in case of failure. This strategy requires a thorough knowledge of each country where the products are proposed, and to be free to innovate. Independence is the key word. When “innovation and flexibility” strategy is privileged, consolidation with another company can bring more disadvantages than advantages, as the case of Chrysler amply illustrate.

As for the strategy of "volume and diversity", it is particularly suitable for external growth, provided it can be applied immediately to all companies of the new group.
Volkswagen was able to do it, in the 70's and 80's, with small carmakers, that had no other options. But among the possible company preys of late 90s, none had that profile.

6.2. Globalisation or regionalisation? Firms competitiveness and regions attractiveness

What was the relevance of the analysis framework, when car manufacturers internationalized their production? The growth model of the other countries could be there less favourable to the profit strategy of a firm. The second international program of Gerpisa "Globalization or Regionalization? Showed that globalization, that we are supposed to live, is far from engendering a convergence of demand and of conditions of employment and work.

And indeed, we could verify that the subsidiaries, located in countries less favourable to the profit strategy of the firm, did not obtain a sustainable profit. This was the case with Ford subsidiaries in Europe and Japan during the interwar period, with subsidiaries of French manufacturers in Great Britain in the years 50-60, with subsidiaries of all car manufacturers in Latin America, as shown the works of Bruno Jetin.

This fact, however can not be observed in all cases today, not because of "globalization", but due to the formation of groups of countries of non converging economies: the integration of "low wages" countries into the North American Free Trade Agreement or into the European Union. The creation of auto plants in these countries were used, not or less to develop the automobile market, through a moderately hierarchized national income distribution, but to produce vehicles at less cost for the countries of the region in capacity to buy them.

The paradox is that often these relocations have failed so far to make as competitive car models as before, as we have shown in the case of European Union. The competitiveness of a firm in a country is not linked to low labour costs, but to consistency of "national growth model - profit strategy of firm - productive model". It is because Volkswagen has been able to build this consistency, that it was able to develop both its abroad production and its home workforce and production, including for the lower and mid-range models. The sustainable attractiveness of a territory depends on the profit strategies that it is possible to develop, and depends on conditions that it offers to implement them consistently.

If a car manufacturer has not the guarantee to find elsewhere the permissive conditions for its strategy, may it develop as much strategies than countries, or groups of countries, where it is commercially and industrially implanted? No carmaker has managed to do that so far. However, retaining their original strategy and developing it in compatible countries, some have managed to build other company governance compromises, so a viable model, different from that of the parent company.

This was the case for example of Honda and Toyota in the United States during the 70's to 90's, Opel in Europe until the 80's, but not Toyota, Nissan and Honda in Britain, as has shown Tommaso Pardi. Only specialist car manufacturers of high-end managed to date to have a global product policy, albeit however with local adaptations. But this is true from their origin. They have always exported to find abroad sufficiently rich customers. Wealthy people find indeed, in the codes of social distinction that premium vehicles embody in producing countries, means to further enhance their social status or signify their social success in their own country.
6.3. The trap of financial and wage deregulation, in which GM, Ford and Chrysler fell

American carmakers were not unfortunate victims of some financial crisis that got in the way of their recovery. Quite the contrary, they were direct contributors to their own problems, first and foremost through their adherence to “new economy” precepts and efforts to implement its recipes. The question is whether they ever had an alternative. Even if they had preferred another trajectory or had correctly anticipated what would eventually happen, they might well have been obliged – as many foreign car manufacturers were - to respond to the growing demand for light trucks. Everyone was exposed to the sudden turnaround in market conditions (and in the regulatory environment). This has explained why everyone has paying the strong price during the crisis.

At the same time, it is just as true that the Big Three could have used their profits to re-conquer the passenger car market and prepare the inevitable transition to clean driving. Ford, General Motors and DaimlerChrysler all tried to lower costs by sharing their American car platforms with their European or Asian subsidiaries. In all three cases, this failed. Indeed, such efforts ended up losing money for Opel-Vauxhall, Ford Europe and Chrysler.

A second question is whether the Big Three were in actual fact obliged to outsource, as much as they did, or to place so much faith in their financial activities. Ford family members, for instance, was able to retain power over their group because of the preferred shares they held, but nevertheless had to take shareholders’ interests into account. Jacques Nasser, the group’s ephemeral CEO, was a flamboyant expression of this new orientation, with his singular focus on “shareholder value”. General Motors, with its highly dispersed shareholdings, came under direct investor pressure. Non-American carmakers may not have all followed the Big Three down the road to externalization and financialization, but they too were guilty of offering credit and leasing facilities promoting sales to insufficiently solvent buyers.

General Motors and Ford tried to pursue a “profit strategy” that emphasized “economies of scale” for their vehicles’ invisible parts and “diversity” for their visible parts. Quite logically, they copied their more innovative counterpart, Chrysler, which had discovered the urban light truck market in the 1980s. However, broadening a product range within a “volume and diversity” strategic framework is only sustainable under two conditions: if “commonalisation” practices are expanded to the same extent; and if a lasting demand exists for new vehicle types. The first condition was not met, given the excessively dissimilar architecture of cars and light trucks, such as they had been designed in the United States. The second condition is in the process of no longer being met. A “competitive” distribution of national income, such as it generalised in the United States, cannot guarantee the relative stability that market segments require. The “innovation and flexibility” strategy that Chrysler revived in the 1980s was more adapted to the new demand structure and helped the firm to rise from the ashes. However, as it had done before, Chrysler tried - once its situation had improved - to copy its two American rivals. It merged with Daimler, an unfortunate move, instead of seeking (as its strategy required) new and conceptually innovative vehicles corresponding to the expectations of
the new population categories that are periodically engendered by a “competitive” distribution of national income.

However suitable their profit strategy had been, the carmakers would have found it difficult to survive in a national growth model, that was as self-destructive as the one that the “new economy” wanted to embody. This model has revealed a complete lack of economic, ecological, social and geo-political sustainability. The issues at hand largely supersede the automobile industry and speak to the re-foundation of the entire American model of growth. Automakers can contribute to this by helping to reign in social inequality, subordinating financial activities to the imperatives of long-term development, establishing supplier relationships on another basis than the race to the social and ecological bottom and proposing vehicles that respect people and the environment.

6.4. The different forms of externalisation and manufacturer–supplier relationships

Externalisation is a leitmotif that has convinced many people of its generality and uniformity. The basic principle is that manufacturer–supplier relationships are destined to undergo a number of radical changes as part of the shift from an era of prime contracting to one of ‘win–win’ partnerships.

In reality, the integration rate of groups like Toyota, Volkswagen and PSA has barely changed since the mid-1980s. Thus, it is difficult to make the argument that ‘externalisation’ is a condition for profitability. Conversely, there are some firms that are just as profitable as these three yet whose integration rates remain very low, like Honda since the beginning, or Renault since the 1990s. All in all, the different paths towards and objectives of externalisation deserve further analysis.

The first instance of externalisation entailed troubled manufacturers in the 1980s trying to reduce debt levels by divesting ‘non-strategic’ subsidiaries, sometimes because this would also help them to disengage from social conflicts they had been unable to resolve. Then, in the 1990s, a number of companies tried to share with their suppliers the investments and risks they faced, when extending their product ranges to encompass new vehicle types, and/or when setting up operations in new countries. The latest example of these kind of externalisation occurred in the late 1990s, when this policy was often portrayed, as mentioned above, as an inherent trait of the ‘Anglo-Saxon’ model. In a more recent avatar, externalisation meant disengaging from insufficiently profitable manufacturing activities and replacing them with design activities and above all marketing and services. At around the same time, some carmakers viewed this policy as a way to restructure the automobile branch around ‘modular’ vehicle design. First-tier suppliers were increasingly asked to specialise in the design and delivery of ‘modules’ assembled from components supplied by a host of subcontractors. Note, however, that modularisation was not always accompanied by externalisation. Indeed, on several occasions, the exact opposite occurred. For example, at a time when other carmakers were cutting all links to former subsidiaries, PSA used a series of acquisitions to build a major supply subsidiary (Faurecia) that would become world leader in six ‘modules’.

Nevertheless, manufacturers cannot afford to totally ignore their suppliers’ plight. To really work, a profit strategy must be pursued in a coherent manner, not only by the manufacturer, but also by all of the actors in its supply chain. It is impossible to pursue
a ‘permanent reduction in costs’ strategy, if suppliers are not committed to the same approach. This is why Toyota was so concerned with maintaining control over its main supply subsidiary, Denso, which had wanted to become independent. The same notion of supply chain coherence applies to other strategies. It is impossible to achieve economies of scale, ensure a product’s ‘social quality’ or launch innovative models, without insurance that one’s upstream partners are doing everything they can to commodalise products in the first case, ensure the ‘excellence’ and singularity of equipment and components in the second case, or be responsive to both the successes and failures of innovative models in the third case. Nissan, which sold almost all of its equity interests in suppliers under the direction of Carlos Ghosn, had to reverse its position on several occasions. Geo-political and technical secrecy considerations must also be taken into account. French carmakers feel the need, for instance, to ensure that local supply firm Valeo is in a position to resist the Anglo-American funds that have been trying to take it over and sell it off piece-by-piece.

It remains that in many situations, the carmaker–supplier relationship is anything but partner-like. Competition remains a key variable, with certain car manufacturers often setting a double-digit price cut as a precondition for any contract renegotiation.

Some observers have hypothesised that the balance of power between large suppliers and manufacturers might switch if the former grew big enough. If carmakers were to delegate too much responsibility for their suppliers, they could lose technical control – although nothing like that has happened yet. Manufacturers continue to be the only parties possessing sufficient knowledge to integrate components into an architecture that they alone are in a position to define. Of course, this does not mean that nothing will ever change. Electronisation and replacing internal combustion engines with electrical driving systems might upset this status quo.

6.5. Modularisation, electronisation and new paths towards commonalisation and innovation

At present, ‘modularisation’ in the automobile industry involves more than just building large sub-assemblies. Unlike the modules used in electronic products, the ones that autos use are neither physically nor functionally unified. Thus, they do not feature the kinds of properties at a practical level (ease of assembly, interchangeability) or at an economic level (economies of scale versus variety of possible combinations) that would usually be part of this configuration. Automotive modules often fulfil several functions and have multiple and complex interfaces. So far in the automobile business, ‘modularisation’ can be interpreted as having been not an architectural choice for those who have adopted it, but instead as a new ‘government compromise’ for the branch as a whole. This choice consists of delegating to first-tier suppliers, via such so-called ‘modules’, the task of organising the branch, with all of the advantages that come with this (i.e. the ability to appropriate much of the value produced), in exchange for sharing the investments and the financial and social risks that they either cannot or do not wish to assume. Of course, other firms (like Toyota) that have not faced the same problem, prefer to control their supply chains and still perform most assembly operations in-house.

‘Modularisation’, which remains a mainly metaphorical concept, might assume greater meaning one day. The electronised management of certain functions makes it possible to obtain very different levels of performance from a given piece of equipment, like an engine, gearbox or suspension unit. This enables a modulation of the power,
consumption or responsiveness of the item in question, depending on the physical and commercial characteristics attributed to the model on which it is supposed to be fitted. This is a process still in its early stages, but one that offers great possibilities, first in terms of commonalisation, but further down the road in conceptual innovation terms. It could theoretically narrow the range of engine-propelled groups and equipment in general. Electronics can be used to compensate the degraded road performance of a given platform, by turning it into a springboard for an innovative model that was not part of the original plans.

The question is whether there will soon be, at least at some technical level, a degree of compatibility between commonalisation and conceptual innovation, something that General Motors was once able to achieve, by associating volume and diversity – factors previously considered irreconcilable – when it invented the idea of a platform being shared by several models. Will carmakers pursuing a ‘volume and diversity’ strategy, whose current customer base was people with moderately hierarchical and foreseeable incomes be able to use innovative models to attract customers with more variable incomes? For the moment, dynamic constraints more than offset what might be done electronically. It is possible that certain innovative cars, ones differing greatly from any of the others, will no longer be able to function using the existing platforms. This is not the most crucial consideration, however. In the same way as the ‘volume and diversity’ strategy did not lead to the disappearance of the ‘volume strategy’ nor the ‘diversity and flexibility’ strategy, since each of them is based on different enabling conditions, a potential new ‘commonalisation and innovation’ strategy will not lead to the disappearance of the two strategies of which it is an hybrid (in the sense that a prototype has been created) – ‘volume and diversity’ and ‘innovation and flexibility’ – since there will always remain countries where coordinated and moderately hierarchical incomes will not require of manufacturers to design conceptually innovative models to be profitable. Inversely, there will also be countries where income distribution is based on merit and the balance of power, with this system being generalised to such an extent that the only useful and possible profit strategies will be ‘innovation and flexibility’ and ‘diversity and flexibility’. Lastly, even if electronically managed modules could minimise the commercial risks that innovative cars creates, ability to cope with successes surpassing expectations, or to cope with total failure, will remain a precondition for profitability in such instances. Of course, this ability implies that productive organisations and employment relationships differ from the ones required by a ‘volume and diversity’ strategy.

On the other hand, electronisation will facilitate the adaptation of car models featuring some specific conditions of new countries where companies are moving into, conditions that have not been considered or planned by the project, when it was first designed. This could reduce the impact on the economies of scale of an increasing markets’ geographic heterogeneity. In the end, it can be said that electronisation reduces the rigidity of existing automobile architectures, without changing them.

There is another more decisive development, however, that will modify the automobile architecture itself, to wit, the replacement of internal combustion engines by electric driving systems, be it using electricity stored in batteries or produced in the vehicle itself (fuel cells or another source). This will enable a functional miniaturisation and specialisation of engines. Once multiplexing has been mastered, this will reduce connectivity problems and enable the standardisation of interfaces. In turn, this will allow for a deployment of modularisation.
It remains that a machine travelling at varying speeds on different road surfaces in changing traffic conditions in all kinds of weather and in different cultural and political contexts, when driven by people in very different ways, will never be as free of external constraints as a desktop computer might be. Even if modular combinations will always be limited electric driving systems constitute one of the ingredients of the pending second automobile revolution.

6.6. The second automobile revolution has begun. Several scenarios are confronting

Over the past 15 years, new engines appeared, timidly with the Toyota Prius in 1999, most significantly with plug-in hybrid powertrains, more radically with the Nissan Leaf, the Zoe Renault, Tesla's cars and others electric BMW. Is this a trend that will be limited to some market niches, or are we witnessing the beginning of a second automobile revolution, of which the consequences are still underestimated? Thus started, the debate cannot advance, each one watching every day what reinforces one point of view or another. Someone highlight the fall in oil prices; sales of electric vehicles and rechargeable hybrids, growing much more slowly than what was announced, and still dependent on public subsidies; the limited battery autonomy; the small reduction in emissions, electricity remaining massively produced by coal or oil, etc. The others emphasize the growth of electric cars sales in many countries despite the fall in oil prices, the limit of the oil reserves, including counting the possible reserves, the fall of batteries prices and the doubling of autonomy of second generation batteries, significant investments of a growing number of car manufacturers in the electric vehicles, continuous and strong pressure from some governments and local authorities, etc.

To get out of this exchange of arguments, which are far to be scientific analysis, we proposed to use the approach that allowed us to challenge the universality of many trends, that is to say, the highlighting of their conditions of possibility and viability.

To do this, we studied first the conditions that allowed in the past to move from horse-drawn vehicle to the motor vehicle, and to choose, among three different options, the petrol engine. Four conditions have been highlighted:
- the crisis of the previous transport system (strong and rapid growth of needs, limited food resources for horses, pollution, accidents, saturation, footprint, cost growth, social conflicts, etc.) demanding to find a solution that "reshuffling the cards"
- the convergence of technical innovations, often designed in other industries, to experiment different solutions: steam, electricity, petrol
- the formation of coalitions to defend one solution or another: and finally, the choice of what was at the time the worst technical solution, the internal combustion engine, both by Army Forces, mechanical industries and by many States, due to the possibility of having quick and easy a fuel distribution network throughout the country, unlike other solutions
- finally, the adoption of macroeconomic policies and regulatory to allow households and businesses to purchase automobiles and to force carmakers and oil companies to improve the internal combustion engine to reduce pollution and accidents. That is occurred mainly after 1945. The first automobile revolution had required a very long time!

We then examined whether those conditions are being met or not, in the case of new engines today. It is possible to say that the first two are already fulfilled. Indeed the petrol vehicle is in crisis. If the car sales resist or recovered in traditional markets, and continue growing in some emerging countries, specially in China, the dependency of these
countries to petrol will be unsustainable economically, geo-strategically and environmentally. The overall cost, both individually and collectively, is increasing, despite cyclical fluctuations in oil prices that are on an uptrend in real price. Decline in the use value of petrol vehicle, because of multiple constraints and restrictions on its use. Its nuisances of any kind are socially and politically less and less accepted.

We can observe a convergence of technical innovations from other industries that allow to develop different solutions: agro-fuels from agro-business, natural gas from the oil industry, electronic control systems of thermic and electric motors and lithium-ion batteries from electronics industry, connecting and automated devices from software industry, alternative energies from new industries such as photovoltaic and wind power, new materials and fuel cell from chemistry and metallurgy, charging systems from electrical and electronic industry, etc. These innovations have given rise to different solutions to the crisis of petrol engine: low-consumption petrol engine, agro-fuel engine, natural gas engine, hybrid, plug-in hybrid, electric motor, fuel cell engine.

The third condition is on going. Several coalitions support different transition scenarios to cleaner vehicle, connected and automated. They combine some countries, that have energy preferences, due to their own resources, and industrial players, political and social, that can be found everywhere.

The coalition for partially or fully electric vehicle is to day, in 2016, the most visible, even noisier. This does not mean that it will impose its transition scenario. This scenario is the most complicated of all and the riskiest. It involves several steps and many new players. It must take into account the time to increase autonomy and to lower the price of batteries, to target potential buyers at different stages. The first step is to target market niches (fleets, 2nd vehicle, islands, rural areas, car sharing, top-of-the-range, islands, etc.), in order to be after able to expand the clientele.

We showed that several scenarios are now developing in parallel: the scenario of diversity (different powertrains are offered depending on continents and carmakers), the scenario of progressivity (gradual transition from simple hybrid to full electric, or even to fuel cells) and the scenario of rupture (direct passage to all electric). We also showed that the choice of auto producers, among its various scenarios, depended on much their profit strategy and the countries where they are mainly located. Of course, their decisions and actions are not immediately legible, because they are the results of the unfinished internal debates on the risks and opportunities of different scenarios.

What one can say is that the scenario will prevail is the one that will be worn by the strongest coalition economically and politically. Can we risk a prognosis? Everything contributes to what China chooses durably the all-electric (no oil reserves, possibility of becoming technically independent, and even leader, existence of a powerful industry of the battery and of software, population already using electric bicycles and motorcycles, etc.). But the American, European, Japanese and Korean car manufacturers, which depend more and more on the Chinese market, cannot long ignore this choice.

Finally, the fourth condition can be more easily filled than during the first half of the twentieth century, at least in countries where the automobile market exists.

Presently, nobody can be predict which scenario will prevail and when, because new big crises can occur. But we can be sure that all scenarios prepare an economical great transformation, geopolitical and social of car industry, like a revolution!
Now, let's see how the schema can be a tool to analyse the rapidly evolving, changing and sometimes confusing of the automotive industry in China. To do that, some brief methodological remarks can be useful.

The presented approach to analyse firms trajectories and countries is a reconstitution ex-post in the intention to help to inquire new fields. The reality of our work was, of course, much more confuse, hesitating and extraordinary long. But we had used some compasses: start the questioning from the basic stake of actors: in our case, profitability; reason by difference of trajectory and not by general tendency; research always the condition of possibility and viability to any phenomenon to know if it can diffuse; refuse any disciplinary limitation or pre-supposition to investigate.

List of analysed changes with the help of Productive models framework and of its developments

1. The mega-mergers in 90s,

2. Globalization or regionalization

3. The success of certain joint-ventures in China and the failure of others,
4. The bankruptcy of the American Big Three in 2008,

5. The 2007 Great Crisis

6. Post-global Financial crisis, national growth modes and profit strategies

7. Transition to clean and connected car

8. Renault trajectory

9. PSA trajectory and crisis

10. Two crisis at Toyota
- Freyssenet M., Shimizu K., Ce que Toyota n’est plus. Ce que le toyotisme n’a jamais été, version initiale envoyée par les auteurs au journal Le Monde, Édition numérique: freyssenet.com, 2010, 60 Ko, ISSN 7116-0941.

11. The History of automobile industry, 1898-2000

12. The diversity of capitalism and growth modes

13. The origins of firm competitiveness and country attractiveness
- Freyssenet M., Is it true that offshoring, outsourcing and labor costs reduction were conditions for competitiveness?, Communication, *Beyond (de)industrialization: the future of industries*, EAEPE Annual Conference 2013 European Association for Evolutionary Political Economy, Paris Nord/13 University Campus Bobigny, November 7-9, http://freyssenet.com/?q=node/1899

14. Suppliers parks

15. Automation
16. Plants analysis

17. Labour at the core of productive models
- Freyssenet M., « Why the labour and the industrial relations are apparently not any more in the core of the reflection within the GERPISA ? », La Lettre du GERPISA, Janvier 2003 (n°165)

18. Work conditions

19. ... and other changes

20. About Gerpisa method
- Freyssenet M., « To pursue the macro-micro links analysis, discussing he both notions : "growth mode" and "productive model". La Lettre du GERPISA, Novembre 2004 (n°179), pp 2-6.
The main publications of Gerpisa
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Boyer R., Freyssenet M., Th


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