LES AMIS DE
l'École de Paris

http://www.ecole.org

Technological Resources and Innovation seminar

Organised thanks to the patronage of the following companies :
Algoé[2]
Alstom
ANRT
AREVA[2]
Cabinet Regimbeau[1]
CEA
Chaire "management de l'innovation" de l'École polytechnique
Chaire "management multiculturel et performances de l'entreprise" (Renault-X-HEC)
Chambre de Commerce et d'Industrie de Paris
CNES
Conseil Supérieur de l'Ordre des Experts Comptables
Crédit Agricole SA
Danone
Deloitte
École des mines de Paris
ESCP Europe
Fondation Charles Léopold Mayer pour le Progrès de l'Homme
Fondation Crédit Coopératif
Fondation Roger Godino
France Télécom
FVA Management
Groupe ESSEC
HRA Pharma
IBM
IDRH
IdVectoR[1]
La Poste
Lafarge
Ministère de l'Industrie, direction générale de la compétitivité, de l'industrie et des services
OCP SA
Paris-Ile de France Capitale Economique
PSA Peugeot Citroën
Reims Management School
Renault
Saint-Gobain
Schneider Electric Industries
Thales
Total
Wight Consulting[2]
Ylios

[1] For the "Technological resources and innovation" seminar
[2] For the "Business life" seminar

(liste at november 1, 2010)

WILL THE ELECTRIC CAR BRING SUSTAINABLE MOBILITY

by

Christophe Midler
Director, Centre de Recherche en Gestion (Management Research Centre), École Polytechnique
In charge of the Master's programme 'Project, Innovation and Design'

February 17th, 2010
Report by Élisabeth Bourguinat

Overview

The electric car is not a new technological innovation : it has been around for a century. Every ten years or so, attempts are made to alter the design which hitherto have not made any impact on the so-called 'dominant design' of 'traditional' vehicles, ie. those which use internal combustion engines. Recent attempts, however, are proving to be more successful. According to Christophe Midler, success will not be because of a technological breakthrough (despite significant progress in batteries), but because of a completely new way of managing innovation. The design of an electric car involves the entire vehicle rather than just electrifying a 'normal' vehicle. It is part of a global project to improve mobility by the use of electrical devices, where additional, proposed services play a dominant role. The project makes sure that the economic models of the different bodies concerned (manufacturers, national and local authorities, energy engineers, and transport service operators) are presented. Finally, the design incorporates the process of innovation adoption involving 'early adopters' who have important impact on customers' learning and 'latecomers'' buying decisions.

TALK : Christophe Midler

It is a common belief that the electric car is a new technological device, but there have been electric cars for as long as cars have existed. They have suffered from what Utterback and Abernathy call 'dominant design' : after a period of expansive and inventive exploration, some technologies become established, and eventually a system is developed which overcomes all rival technologies. The history of the car industry is a good example : about twenty companies manufactured electric cars between 1903 and 1920, but when the 'dominant design' of the internal combustion engine appeared, the manufacture of electric cars stopped.

A number of attempts have taken place since then, especially at a time of economic crisis associated with the price of oil, with some even giving cause for hope. Wisconsin University in 1973, Princeton University in 1979 and the World Resources Institute in 1994 predicted that the electric car would represent 20, 10 or 25 % respectively of the car market in the future. However, the company which has sold the largest number of electric cars over in recent decades has been PSA in the 1990s. However, it has manufactured no more than 10,000 cars in the last ten years.

In the meantime, considerable progress has been made on a technical level regarding the battery which is a crucial part of the electric car. As a result of new electrochemical couplings, results are now much better than with the old batteries made from lead. Mass production of portable lap-top computers has encouraged the boom in these technologies, and companies like Tesla are now demonstrating that they are capable of making an electric car using batteries in a short space of time. On this basis, is there reason to hope that the electric car will eventually replace the dominance of the internal combustion engine ?

A change of concept

Based on contemporary innovation management theories, my forecast is that the electric car will make an impact at last – not because of technological breakthroughs – but because of a new way of approaching the problem, and integrating the car into a comprehensive project based on electrical mobility. It is no longer possible just to compare technology A with technology B ; one must change the concept. The true definition of 'dominant design' is design which is not dependent on a particular technology, but on all the uses associated with this technology. A good example of this is the 'qwerty' keyboard which was specifically designed to overcome limitations in the mechanical typewriter, but is now universally preferred over more logical key board designs : lack of change is not for technical reasons, but because of users' willingness to save their traditional typing competency.

Another important characteristic of dominant designs is the stability of the value structures. The performance of a car is always tested over a distance of 500 kilometres, whereas, on average, relatively few journeys are made over such a distance. However, the performance of the electric car is relatively unknown since few people have test-driven this sort of car.

Finally, the essential requirements are 'fitted in' to the physical, social and economic environments which promote the co-ordination of those involved in the dominant designs. Specific infrastructures, especially petrol stations, exist for traditional vehicles, but not yet for electric vehicles. From an economic standpoint, the system of petrol pricing and taxes makes it possible for those involved in traditional vehicles to organise themselves easily, whereas it does not exist for electric cars.

In order to change opinions about the traditional vehicle model, it is not enough to consider it from a purely technological point of view. One must also find new ways of using a car, including the business models and the product environment. This represents a totally new

method of project management. It is precisely this sort of breakthrough which manufacturers are working on today, especially at Renault.

Two 'dead-ends'

It was not always like this. The traditional innovation matrix in the car sector was devised at the end of the 1980s. To put it simply, it is based on separating the initial phase (where all potential innovations are considered) from the development phase (which is focussed on quality, costs and timing). When applied to the design of the electric car, this matrix may be interpreted using two different approaches.

The first approach is the 'concept car', in other words, the production of a technical, innovative object which never appears in the market. This approach is useful for assessing the feasibility of a technology and wisdom of the proposed change, but does not enable one to test cost effectiveness or use in real-life situations. The second approach is the 'derived vehicle' : this means taking a mass-production car and replacing its internal combustion engine with an electric engine. The result is a mediocre technical performance at a high cost.

These two ways of traditional design had virtually no chance of destabilising the dominant design. In the first case, one is a long way from the user and the industrialisation process ; and in the second case, one is closer to the industrial process, but in a disastrous situation where all the constraints of the traditional vehicle are kept rather than optimising the new product.

If one really wants to challenge the dominant design, four requirements have to be fulfilled.

Genuine electric vehicles

The first requirement consists of designing a *genuine* electric product, in other words, an optimal product which is first and foremost based on an electric engine, and makes the most of this advantage while taking its limitations into account. This is a transition from an electric car to a vehicle which makes the most of the fact that it is electric.

Looking for lost watts

Two years ago, one of my students was working on the consumption of electricity in auxiliary engines (air conditioning, radio, electric windows, and so on) in Renault's DREAM department (Direction de la recherche, des études avancées et des matériaux – department for engineering, advanced studies and materials). Few were interested in this subject in the research department because a few more or few less kilocalories make no difference to a traditional car. However, kilocalories are important in electric cars as they can determine mileage performance, and are therefore much more strategic.

Designing an electric car is not simply a case of replacing an internal combustion engine with an electric engine. It involves modifying all the R&D department's skills and work standards. For example, in the course of his work in this field, the student had to meet paint specialists in order to identify the products which either absorb or reflect solar energy. One of the results of his work was the appointment in the Renault technocentre of a 'wattman', in other words, a person who is in charge of tracking down 'lost' watts.

Toyota, the pioneer

The Toyota Prius is a good example of this approach in a genuine integer hybrid vehicle. As well as the technology associated with the hybrid engine, Toyota managed to impose a totally new concept with a specific style, design and method of marketing. The success of this is based on a very original design process, consisting of restructuring the company according to a pilot project, and then adopting a repetitive strategy of spreading new skills throughout the various departments so that new models can be put in place.

I think that Renault's electric car project is particularly ambitious, firstly because it explores the breakthrough in four types of different products, and secondly because it replaces the 'in line', sequential process used in the Toyota Prius with a concurrent process where different factors advance together at the same time. Skills (those applied to the technical or electric components), batteries and new services are developed at the same time. Newly marketed products are no longer 'containers' of knowledge or early-stage innovations but are the 'stimuli' for future development, as a result of learning new applications.

An appropriate service offer

The second requirement in order to oust the dominant design is not to restrict innovation to the minutiae of the product. In order to be competitive, one must add to the product by services which increase its value.

For example, to reassure the client who is worried that the battery will run down, one must offer an extremely efficient back-up service. In order to compensate for the limited life of car batteries, two types of service are conceivable : either Renault's 'quick drop' which consists of changing the batteries in a few minutes ; or making traditional cars available for clients travelling to destinations which are more than 150 kilometres away, for example at week-ends or for trips. Some constraints might be impossible to overcome if one relied purely on the product, but if one offers a better service, there is no longer a problem. Financing systems also exist which may reassure clients from an economic point of view. Finally, changes in mobility patterns and the increase in new schemes or uses, such as car pooling, electric taxis or other means of getting around may prove to be valuable assets in the development of the electric car.

As a result of the development of additional services in the car design process, companies have created departments to study 'programmes of mobility services' and have started taking into account the views of key people in the services value chain, such as service operators (like Better Place with whom Renault works, especially in Israel) ; local authorities who play a very important role in urban transport services, and, of course, transport operators who manage trains, taxis, the underground, and so on.

Sharing economic models

The third requirement is to take very seriously the characteristics of new economic models and the respective roles of the three types of interlinked parties (the manufacturers, authorities and energy engineers).

The idea of 'ecomobility', for example, which is based on the control of local pollution, and the fact that towns will become less noisy, is not a feature of the traditional model. There is no reason why these two factors should be financed solely by the consumer. The important question is how to fit the public bodies (local and national) who support ecomobility into the economic model.

It is also important to discuss the economic models of Renault, PSA and Total which depend on the price of oil and taxes. With the move towards electric mobility, this entire system needs to be redefined. Today, for example, there is no specific tax on energy mobility : it is the same tax as for all the other uses. If one establishes a specific tax one must think about whether one will be able to separate electricity used for mobility from electricity for other uses, just as fuel oil for use in cars is separated from that which one is used in tractors or heating systems.

A final example is managing the life of batteries the capacity of which diminishes inexorably with time. Batteries can still be used at the end of their lives for other uses which are more sedentary. One must identify the batteries which are best suited to their customers' needs.

The various economic models of the manufacturer, the energy engineer and the authorities should be redefined and pooled. With regard to the manufacturer, this link between the economic models should be explained (in the design system) by the creation of in-house business development departments which will take into account all these dimensions and will devise ways of conducting negotiations between the different parties. It is clear from this that innovation is not treated only from a technical point of view.

The process of learning about electric mobility

The fourth and last requirement is how to move from a situation where the electric vehicle is almost nonexistent, to a situation where there is a mass market for it. Unlike the telecommunications and general public electronic sectors, the car industry has not been faced with this sort of challenge for a century.

Geoffrey Moore's studies have shown that this transition is not smooth. There is a series of stages which involve five very different kinds of people (the 'innovators', the 'early adopters', the 'early majority', the 'late majority', and the 'latecomers') who demand new methods of marketing especially in the transition from the niche market (with very refined marketing) to the mass market (where the volume models are to be found).

At each stage, the manufacturer should review the relationship with his client, especially at the delicate moment when some clients are interested in the innovation for itself while others are interested in what the innovation is able to achieve in practice. During this process, each market should be assessed not only with respect to profitability, but also as a model for future markets.

Conclusion

Discussions about electric vehicles are very different today compared to a few years ago. The financial methods used by certain manufacturers and their objectives are equal to the magnitude of the change in the status quo which they want to make.

I would now like to open the floor to questions from manufacturers present in the audience.

DISCUSSION

Good timing

Question : *I share your point of view but I have a couple of reservations. You pointed out that electric cars first appeared a long time ago and that each new attempt to make them 'fit the times' was met with failure. For this reason, I find it hard to share your optimism. The success of current projects will greatly depend on variations in the price of oil : at $30 a barrel, an electric car in untenable, whereas at $200, it is a possibility.*

My second reservation concerns the organisational breakthrough that you described. Since the 1930s, manufacturers have realised that they would have to add services to their product offer. André Citroën created the first French car financing company, the SOVAC. Today, all car manufacturers throughout the world have become bankers. Some have also started up rental companies with varying degrees of success.

In conclusion, I would like to refer to an anecdote which emphasises the importance of 'good timing' for this type of project. The former head of PSA, who signed the cheque for 100 million Euros for PSA's entire electric development programme between 1985 and1995 including the Tulip programme (Transport urbain libre individuel et public), gave an initial explanation of the failure of this programme, and then some months later, a very different one. Firstly he said that it was 'too early' and then six months later, he declared 'I was a visionary but unfortunately my successor did not continue what I started.'

The Tulip experience

François Chéry (PSA) : I worked for PSA for 37 years, 27 of which were spent in the electrical equipment department. In 1992, I was asked to work on the electric car project which had already been started in the 1980s. At that time, many manufacturers were interested in the electric car, but their approach was essentially to electrify existing vehicles. Peugeot's approach was very different : they did not just want to build a specific car, but to work in partnership both with a transport company (VIA GTI) for the global design of the system, and with Cegelec for IT management and electronic information exchange. I should emphasise that when Jacques Calvet presented the Tulip project on television, he did not just show the new cars, but he also showed the battery recharging sites on the pavements and all the means of communication available to users.

A full-scale experiment had been carried out two years earlier in La Rochelle with normal cars (electric 106s and Saxos), and a government agreement had been signed between the Ministry for Industry, the Ministry for the Environment and the manufacturers to develop an electric car and decide on its battery recharging sites.

The result is well-known : all in all, we sold 10,000 vehicles mainly as fleets of company cars. Not a single city in France nor Europe wanted to try out the experiment. Even the Ministry for Industry did not buy a car, preferring to accept our offer of free electric cars.

Why did this fail ? One of the reasons is undoubtedly linked to a design which emerged at that time, producing carbon dioxide from 'well-to-wheel'. At a time when the general public was eager to see the emergence of an electric car, we suddenly discovered that, depending on the origin of the electricity, this type of car could produce just as much pollution as a petrol-driven car. Furthermore, ecologists, especially German ecologists, accused the electric car of helping to promote French nuclear energy.

The second important reason was the time necessary to convince the mayor of a large city to adopt this sort of system. Installing a fleet of 200, 500 or 2,000 cars in a city requires discussion lasting several years, whereas a manufacturer like Renault makes 10,000 cars every day. We realised that as long as the electric car was reserved for mobility services and was not bought by private individuals, the market would never take off. The question is whether today it will be easier to put in place the necessary infrastructure so that private individuals can buy electric cars.

Hybrid vehicles

Éric Breton (PSA) : The Tulip was really the forerunner of the current 'Autolib' project (the electric car rental scheme for urban dwellers) and all the new economic models which are taking shape. It even included a system for recharging the car battery by induction, without having to use an electric power point.

The main new factor is the pressure being put on carbon dioxide emissions which have increased considerably in comparison to emissions registered in the 1990s. This pressure gives us hope that electrification will, this time, be able to have a significant and durable impact on the car industry. The CAFE (Corporate Average Fuel Economy) index which measures the average consumption of car models produced every month by the manufacturers, will encourage industrialists to develop electrification – even on their largest or fastest vehicles – which can no longer be purely traditional, but will have rechargeable hybrid versions.

It is likely that these 'Autolib' systems or carpooling systems will become quite popular because there appears to be a real demand for them in cities.

Companies which need to publicise their reductions in carbon dioxide emissions, will undoubtedly adopt fleets of electric cars, used either for delivery services or even to serve as in-house service vehicles. This is a way of improving the section of their annual report which is dedicated to the environment.

The real question is whether the electric car can really 'reach' the general public, especially because of the constraints related to recharging the batteries.

Because of this uncertainty, we decided not to put all our eggs in one basket. We make electric cars (Berlingos and Partners which, notably, are beginning to be sold to the French Post Office, and the Peugeot model, Ion and Citroën's C-Zero, derived from Mitsubishi's i-Miev) and we have also launched a new service, "Mu by Peugeot", which offers all sorts of mobility services, from bicycles to vans, and will soon offer the Peugeot Ion.

However, we remain convinced that there will be an important market for 'polyvalent' vehicles ; these are cars capable of running on electricity for an entire week (for distances of between 20 to 30 kilometres), but which also have a small internal combustion engine and perhaps in the long term a fuel cell to enable cars to travel longer distances (for example, at week-ends or on holidays) without having to recharge the battery or to exchange the battery. This is why we also work on hybrid, rechargeable vehicles derived from Peugeot's diesel-electric hybrid, the HYbrid4, which we will market in a year's time.

The perspectives for progress in traditional cars

Q. : *What is the future for progress with traditional vehicles ? When the car manufacturers had a monopoly on the manufacture of car engines, they were not really encouraged to reduce carbon dioxide emissions in a spectacular fashion, but the full-scale arrival of electric vehicles is likely to change all that.*

É. B. : The rate of carbon dioxide emissions in the most popular traditional vehicles has diminished very quickly in the last two years, due partly to pressure from the CAFÉ index and partly from the need to satisfy the demand of clients because the car insurance premium system penalises excessive carbon dioxide emissions.

It is obvious that competition between internal combustion engines and electrically run cars will continue and will increase. Will electricity win in the end ? Who can tell ? The trade in traditional vehicles may still increase, especially if their weight is significantly reduced. When I started working on PSA's hybrid vehicle projects, Renault estimated that the electric car would represent 20 % of the world market in 2020. Today, people say the figure is closer to 10 % of the European market. As far as I am concerned, I believe that there is a good future for traditional vehicles, and one would expect them to have a dominant market share for another ten or fifteen years.

F. C. : The development of hybrid vehicles will reinforce this trend. A hybrid vehicle can only travel on electricity alone for a maximum of two kilometres, but its electric engine can

function in all situations where the internal combustion engine has a very poor performance. Given these facts and the improvement in the output of the internal combustion engine, it is hoped that we can halve the use of traditional vehicles.

Christophe Midler : If we continue to compare the electric car with the traditional vehicle, we have no chance whatsoever of changing the dominant design. Petrol consumption is by no means the only criterion on which to appreciate performance. People who have driven an electric car notice a very big difference in the handling of the car such as the way it moves, it acceleration, not to mention the silent engine.

É. B. : The contrast between driving a traditional car and an electric car is very striking, but the difference is not so obvious compared to the hybrid Prius. At low speed, there is virtually no sound when the electric engine is operating and when the internal combustion engine starts working.

Constraints

Q. : *After attending a seminar at the École de Paris about the electric car*[1]*, I decided that my next car would be electric. However, after reflection, I realised that I was going to have many problems. I knew it would be difficult to have permission from my co-owners (either where I live or in my workplace) to install a power point. I would undoubtedly have to wait for the government to make it obligatory, but this would take time, and once the decision was taken, the installers would be snowed under for a couple of years with demands. An alternative solution would be the 'quick drop', but this might cause some problems with stock management and queues, as in the case of rental bicycles in the Parisian Vélib' scheme where there are bike docking stations which are empty when one is looking to rent a bike and full when one wants to hand back one's bike. The idea of owning an electric car and renting a traditional car for the week-end is not very convincing either : everyone would want traditional cars at the same time and then the renters would have unsolvable headaches… If there were traffic jams on the motorway, is there not a risk that the hard shoulders would be littered with electric cars with run-down batteries ? This would be a disastrous image for electric cars. Finally, what would happen if a battery exploded ?*

I can just about imagine the system of electric mobility on a long-term basis, but I have a few doubts about the short-term, transitory period. Will the manufacturers have enough clout with the government, EDF and cities to force these bodies to install all the necessary infrastructure ?

C. M. : I do not know whether you consider yourself to be a 'latecomer' or 'late adopter' as defined by Geoffrey Moore, but you are certainly not one of the 'early adopters' for the electric car !

One of the unusual features of the current situation is that manufacturers do not think that the problems which you describe should be handled by their clients, the government, the municipalities or any other operators, but they think that initially it is their job. My research team studied another innovative method of transport which had a few problems regarding infrastructure ; the Airbus A380. Because this aeroplane could not land on runways which currently exist at airports, Airbus asked the people whose job it was (in other words, the airport managers) to study the question. The assessment was so expensive that it made the task unworkable. Airbus decided to appoint an internal person to take charge of the necessary infrastructures for the A380, and launched its own study which radically reduced the costs. The infrastructure problems you describe have not been abandoned : the manufacturers are meeting them head-on and will continue their efforts until a solution is found.

Christian Rousseau (Renault) **:** Solving all the difficulties which have been highlighted would require all concerned to work together, and the local authorities to be aware of their

[1] Patrick Pélata, Michel Matheu, Christophe Midler, Philippe Hirtzman, *"Le véhicule électrique va-t-il enfin démarrer ?"* 'Guest Speakers' seminar, École de Paris du management (IN020210).

role. Following the *Grenelle de l'environnement* (a round table which brings together various bodies to discuss how to tackle environmental issues), bills will be voted on to allow co-owners, and maybe even renters, to take over collective ownership in order to be granted the right to install power points for battery recharging in garages. From 2012, all new constructions must be equipped with a minimum number of power points.

The amount of infrastructure required on the road network is still under discussion. Normally, the characteristics of the vehicles mean that there is no need to recharge batteries for daily use (of distances between 30 and 60 kilometres). If we know that the local authorities will take care of this, one must then find the most cost-efficient solution.

Car rental agencies are well aware of the problems of stock management. The possibilities offered by new means of communication, which may be inside the cars, should allow one to anticipate needs and manage queues and stocks in a satisfactory manner.

Finally, the role of private cars compared to communal transport systems will certainly change, and the number of car pooling schemes will increase. Electric cars will certainly be at the heart of these schemes : it is hard to imagine that local authorities would invest in car pooling, and then inform their citizens and electors that these systems would work with dirty, noisy cars emitting carbon dioxide.

The role of car dealerships

Q. : *You have not spoken much about marketing. Often the amount of energy spent on innovation is eventually wasted when, at the end of the chain, the cars are sold in a rather 'rough and ready' way by salesmen. What organisational system could be put in place to motivate the sales team ?*

Q. : *A speaker mentioned the fact that services offered with the cars have existed since the 1930s. This is true, but until now, these services were juxtaposed with the product offer. There was no link between the two. What matters with a project like the electric car is to have a very strong link between products and services. This could, perhaps, be achieved by a specific distribution system : I do not know if this is envisaged, and if it were then I could not talk to you about it. One thing is certain : the first customer will be company fleets, but in order to sell to the general public, one must develop appropriate methods of marketing.*

É. B. : We are relying a great deal on our 'Mu by Peugeot' service to make our electric vehicles popular, in particular for urban use in medium-sized towns. The dealers will be encouraged to get started. In order to rent these cars, they will have to learn how to maintain them, and in so doing they will, perhaps, become more motivated to sell them.

Car maintenance

Q. : *What about the maintenance of your electric cars ?*

É. B. : For our electric cars marketed between 1995 and 2004, it was difficult for us to organise the maintenance of the vehicles both because it required a specific electrical accreditation, and because the car mechanics did not think they would be getting enough work to keep up their knowledge as the electric vehicles were very reliable,. This created a vicious circle, as they were less and less inclined to carry out these repairs. From this point of view, the advent of hybrid vehicles is interesting : garages will be forced to service these vehicles in order to maintain the internal combustion engine part, and at the same time will be forced to obtain the electrical accreditation to service the electrical part. This will encourage them to accept the maintenance of electric vehicles. The total volume of hybrid and electric vehicles will greatly exceed electric vehicles which are only electric and this will ensure sufficient activity so that the know-how is not lost.

C. M. : The fact that each car should be individually monitored may mean that maintenance systems which are much more efficient than current ones can be devised. The experience

which leads Renault to test markets such as Israel, in partnership with the operator Better Place, will enable people to learn how to monitor cars in a fleet in real time. This sort of system already exists for lorries, with, for example, monitoring provided by Michelin of all heavy good vehicles equipped with their tyres.

Q. : *Does the network run the risk of being weakened by the loss in turnover ?*

É. B. : It will be compensated by new activities such as mobility services.

Why this interest ?

Q. : *How do you explain this extraordinary interest and determination surrounding the electric car today ?*

Michel Berry : I have a fact which demonstrates this interest : 700 people signed up for this evening's debate at the École de Paris. This has only happened once before, for a session about the New Economy, just before the economic bubble burst.

C. M. : Personally, I have always been interested in the car industry : I am fascinated by its capacity to bounce back, and to redefine itself after each crisis, for example inventing Fordism (the diversification associated with standardisation with Sloane), then Toyotism, and now confronting the enormous challenge of greenhouse effect gas emissions and the energy crisis.

China's economic rise

Q. : *Imagine that the electric car took off. Then there would be a great deal of competition in the market because, according to Patrick Pélata, the manufacture of an electric car is much simpler than of a traditional car. Furthermore, there is a lot of talk about car sharing, rental and other schemes where the aims are to 'socialise' the use of the car which thereby tends to reduce the numbers sold. Who is going to earn money in this sort of situation ?*

Q. : *New competitors can occupy some niches, but as far as mass production is concerned, the manufacturers already in this market have a head start.*

Q. : *The car world has been turned upside down by the recent bankruptcy of General Motors on the one hand, and the rise of Chinese manufacturers on the other. This should stimulate us to begin this type of project as quickly as possible.*

Presentation of the speaker :

Christophe Midler : director of the Centre de recherche en gestion (CRG : Management Research Centre) and professor at the École Polytechnique. He studies changes made by large industrial companies with respect to innovation, project organisation and the design of new products. He has published numerous articles and several books on this subject including 'L'auto qui n'existait pas : management des projets et transformation de l'entreprise', 'Faire de la recherche en management de projet' (with Gilles Garel and Vincent Giard) and, in 2010, 'Working on Innovation' (with Guy Minguet and Monique Vervaeke).

Translation by Rachel Marlin (rjmarlin@gmail.com)