Intelligent Cars:

Disrupting Everyday Life in the Automobile Industry

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Abstract

The car of the future will have a number of technological features that, although built on currently existing technologies, will result in something that is qualitatively different from the car of today. This paper begins by describing these features, namely full autonomy, connectivity, sustainability, software control and modular architecture. As such, the rise of the "intelligent car" will transform the automobile industry and both the experience and meaning of cars and "driving". Understanding the design challenge posed by the rise of the intelligent car - that is to say, the necessity of re-imagining the user experience of the car and mobility in a digital age - represents a profound challenge for incumbent companies seeking to stay relevant in the automotive eco-system of the future. In particular, business enterprises will need to develop organisational structures, processes and practices that facilitate the kind of design thinking necessary to maximise the opportunities afforded by the intelligent car. The paper suggests that there are various strategies that existing players can utilise to protect against the risks created by these changes. These strategies are derived from other sectors of the economy that have been forced to adapt to disruptive technological innovation. To this end, we identify a number of "principles" that can provide orientation in this project. A willingness and capacity to make a sustained commitment to such principles is going to be crucial to the long-term survival of both new and traditional players. Significantly, these principles involve a break with much of the contemporary discourse on best practice in the regulation of companies.

I. "But is it a Car . . . ?"

Let's begin with a story about the near future experience of the automobile:

> *"This morning, as I got ready to leave for work, I used the app on my smartphone to order a car. Today, I needed to drop off my children at football practice on the way to the office, so I ordered the four seat model. Since I usually commute alone I had to make a change to the pre-scheduled one-seater that normally collects me. At the designated time, a driverless car pulled up outside the house and a push notification on my watch alerted me that it had arrived. The car door was opened by the retinal sensor. Once we were all seated, I used the voice recognition system to confirm the various destinations and the car automatically set off. We took the most efficient route as determined by the on-board navigation system in coordination with the city's intelligent transport matrix. Our arrival times were accurately predicted in advance and the experience was safe and pleasant. The new electric cars are quieter and cleaner than the cars of my childhood. Moreover, driverless cars have all but eradicated accidents and there are less cars on the roads as a result of the managed traffic flows. In the absence of problems, my only task is to sit back and enjoy the ride. This suits me, as I never actually learnt how to drive. My children used the journey time to watch a TV show on the main in-car monitor. I sent a couple of e-mails and prepared for my first meeting of the day. Since I needed to work late, I booked another car to collect my children after practice. At the same time, I arranged for a car to pick up my parents for a barbecue tomorrow afternoon. It will be nice to see them, although I wish my father wouldn't go on to the children about how "a driverless car isn't really a car" and how much more "fun" it used to be when he was able to drive for himself. Somehow, I find his attitude irritating . . . "*

The car of the future - for convenience, we will refer to it as the intelligent car - is no longer the stuff of science fiction, but represents the near future reality for both the automobile industry and consumers of automobiles. There seems to be surprisingly little disagreement about where the industry is heading. Disagreements tend to focus on the likely time-scale for the roll-out of the technology and the nature of the transition period whilst intelligent cars co-exist with current "driver-driven" models.

And even if most of the above story doesn't come to pass, this particular vision of the future is taken sufficiently seriously right now within the industry to orient the thinking, decisions and actions of key players. As such, understanding the nature and implications of these developments, as well as formulating an effective response to them, represents

an important challenge both for incumbents within the automative industry, as well as newcomers looking to move in on this lucrative global market.

More generally, the automobile industry represents an important case study on corporate governance in an age of disruptive technological innovation. What do companies need to do in terms of their internal governance mechanisms in order to maximise their opportunities for succeeding in the context of these technological changes? And what are the implications of these new business models for policy makers and regulators?

The intelligent car will be a wonder of technology; that much is obvious. But in what sense is the imaginary car of the future still a car? The Ford T and subsequent generations of mass consumption automobile utilised the internal combustion engine and modern production techniques to deliver a unique experience of self-directed power freedom, and control. It was this experience that established the hold of the car over the modern cultural imagination. And - as with the smartphone more recently - this consumer experience has sold well everywhere; the global appeal of car ownership is evidenced by the economic success of automobile manufacturers in markets as diverse as China, India and beyond. Perhaps more than any other twentieth century consumer product, the car stands as a symbol of the potent combination of freedom, technology and mass consumption that has defined economic modernity.

And yet, a striking feature of the intelligent car of the future - at least as portrayed in the story above - is that the technology, experience and meaning of "driving" such a vehicle seems far removed from the technology, experience and meaning of driving today. The combined sense of personal autonomy and controlled power seems to have all but disappeared from the machine-controlled, digital living space that characterises the intelligent car. Rather than liberating us, the car of the future seems to lock us more tightly into the routines and control structures of everyday life.

In what follows, we want to suggest that the task of re-imagining the user experience of “driving” and the social meaning of the automobile is going to present one of the most important challenges for all players in the emerging new automotive eco-system. Offering an attractive new vision will be a crucial element in any new business model. We will suggest that this challenge is best thought of as a design challenge. Of course, developing, managing and integrating powerful new technologies will be vital in bringing the intelligent car to market. But ultimately, it will be the capacity of manufacturers to offer a meaningful personal experience of the intelligent car and its place in everyday life that will be crucial in determining which companies succeed and which don't.

Our hunch is that those companies that embrace the design challenge of integrating new car technology into a coherent value proposition that adds meaning to the quality of life of consumers will be best placed to succeed. As such, the challenge facing any business enterprise looking to operate successfully in the automotive eco-system of tomorrow will be to develop a business model and organisational structures, processes and practices that facilitate the kind of design thinking necessary to maximise the opportunities afforded by the intelligent car.

The last part of the paper will offer some suggestions as to how this might be achieved. We identify a number of principles that can orient such a project. A willingness and capacity to make a sustained commitment to such principles is going to be crucial to the long-term survival of both new and traditional players. Significantly, these principles involve a break from much of the contemporary discussion on best practice in the regulation of companies. Much of the extant discussion has become overly cautious and negative as a result of the focus on agency costs, investor protection and regulatory compliance. In this respect, what we advocate is a re-thinking of the contemporary debate on internal governance structures within companies in which greater emphasis is put on identifying organizational forms and practices that facilitate creative design thinking and an on-going process of disruptive innovation that will allow a business to remain relevant in the face of a radical technological transformation.

II. The New Technology of the Intelligent Car

The intelligent car will have a number of technical features that, although built on currently existing technologies, will result in something that is qualitatively different from the cars of today. Since these technologies are central to the disruption of the automobile industry, it is worth briefly reviewing them. These features can be introduced under five headings:

A. Fully Autonomous

The intelligent car will act autonomously; that is to say, it will make decisions independently of the driver, according to pre-programmed algorithms and machine learning systems installed by the manufacturer. For the moment, these decision making systems are limited to providing assistance in specific risk situations; for example, adaptive cruise control (the car alters its speed on the highway based on how fast the car in front is traveling); collision avoidance (the car uses radar sensors to tell if it is getting too close to the vehicle in front and issues a warning if it is); and blind spot notification (the car uses radar to inform the driver if another vehicle has entered into the blind spot and if an

attempt is made to change lanes while another vehicle is there, the system will emit a warning to stay in the current lane). All of these technologies share a common feature; they give temporary control to the car and not the driver. As such, the development of vehicle autonomy has already moved through several various phases; from information, warning, and assistance through to situational control. In this way, the trajectory towards full autonomy has already began to take shape.

In the near future, however, driverless cars that continuously control all facets of driving will become the norm. The role of the human "driver" will gradually diminish until finally the only task left to be performed will be the monitoring of on-board systems and problem management. Google's well-publicised project to develop a driverless car is perhaps the most high profile example and, as of mid-2015, Google-powered driverless vehicles had collectively logged over one million miles of fully autonomous driving. The Google Car combines GPS and Google Maps with various types of hardware sensors that perceive the local environment. The artificial intelligence systems collate this information and decide how fast to accelerate, when to slow down or stop, and when to steer the wheel. Self learning programs ensure that situation appropriate decisions are taken and permit the setting of different driver "personalities".

Most major automobile manufacturers are now working on autonomous vehicles of this kind. More recently, there have been rumours that Apple plans to develop a driverless car. Although differences in the implementing technology remain, the trend towards fully autonomous vehicles seems irreversible. Google and other automakers hope to bring fully self-driving cars to market by 2020.

B. Connected (V2V, V2I & the Internet of Things)

The intelligent car will be "connected" and able to monitor, in real time, its own operations and the road conditions, as well as communicate with other electronic devices and vehicles, as well as an intelligent transport infrastructure.[7] As such, the intelligent car will occupy an important place in the "Internet of Things", the expanding network of devices that connect everyday life into a global digital infrastructure.

Cars will seamlessly connect to other electronic devices. Google Android Auto already allows mobile devices running the Android operating system to be operated in vehicles through the head unit of the dashboard. This service performs several functions offering the driver control over GPS mapping and navigation, music, SMS, telephony, and web search. Hands-free operation and voice commands are included for safe driving. Apple's CarPlay offers similar functionality. The extension of the Android and Apple ecosystems

into the car will facilitate the merging of navigation, information, communication and entertainment functions.

Vehicle-to-Vehicle (V2V) connections will enable vehicles to send data directly between cars. For example, if a car senses ice on an area of road, it will alert other cars in the vicinity. Vehicle-to-Infrastructure (V2I) connections will allow cars to send and receive data from traffic lights, road signs and even from the road itself.

Perhaps most significantly, embedded connectivity of this kind will facilitate the operation of intelligent transport systems that are able to analyse traffic flows in real-time, adjusting traffic signals and junction priorities, and communicating with "drivers". Automated traffic control will permit driverless cars to go along certain routes at designated speeds creating an automotive social network that maximises efficiencies in traffic flows. This automotive network will, in turn, be integrated into an intelligent transport system, comprising intelligently controlled trains, buses, trams and bicycles, as a key component of the "smart" cities of the future.

C. Sustainable (Greener, Safer, Cheaper)

The intelligent car will be "greener", safer and cheaper than currently existing models.

New materials and energy sources will ensure that cars are more environmentally friendly. A combination of regulatory pressures regarding emission standards, technology advances, and consumer preferences mean that the end of the internal-combustion engine is simply a matter of time and producers will adopt some form of electrified vehicle. Various factors will determine whether range-extended electric vehicles, battery electric vehicles, or fuel-cell electric vehicles become the dominant technology of the future. The emergence of new sources of car power will create new opportunities for manufacturers. For example, some automakers are already investigating the possibilities of alternative fuels or investing in wind farms to generate power for electric vehicles.

Cars will be safer; the combination of computer controlled autonomy and connectivity will significantly reduce the 1.25 million deaths and countless (50 million+) injuries that take place on the world's roads each year. The driverless car of the future will be more reliable than humans, at least in the performance of routine driving tasks, since they will have more extensive perception, more reliable reactions, and they will not be affected by the various distractions that affect human drivers (e.g. noisy passengers, texting, sleepiness, or health emergencies). Since 90% of crashes are caused by human error, the scope for reductions is enormous. Factoring in the resources expended in dealing with car accidents -

ambulance services, police, medical care etc. - the potential savings from the these safety gains are estimated at more than US$500 million.

Regarding cost, the more energy efficient means of powering cars will contribute to a significant reduction in running costs. Freed from the need to prioritise safety considerations such as roll cages, bumpers and air bags, car producers can greatly simplify the production of cars, which in turn will become lighter and less expensive to purchase and run. Automobiles will last longer as collisions are minimised and new production techniques facilitate the creation of parts on demand. Moreover, the risk of auto-theft will be greatly reduced as security features, notably engine immobiliser systems, become more sophisticated.

In a myriad of ways, the intelligent car will contribute to the increased well being of drivers, as well as the sustainability of the natural and social environment.

D. Software Controlled

The value in car production will increasingly shift from the hardware to software. Cars are already complex products with most vehicle-controlled components being computer controlled. Even low-end cars now have more than 30-50 embedded electronic control units that communicate over multiple controller area networks. The number of lines of software code running these systems, at least when compared to other products, is already high. A modern high-end car, for example, features around 100 million lines of code, and this number is planned to grow to 200-300 millions in the near future as the drive to autonomy and connectivity continues. The average high-end car of today has at least seven times more code than a modern commercial jet, Windows Vista or an F-22. With enhanced autonomy and connectivity, the importance of computer software is only set to increase.

An important distinction in this context - at least in terms of the likely future structure of the automotive eco-system - is that between the car "operating system", which will control and monitor every function of the car from the autonomous functionality to the entertainment system, and the software "content" that will enhance the enjoyment, functionality and productivity of the passengers. In this respect, the new automotive eco-system looks set to evolve in a similar direction to personal computers, tablets and smart phones. A clear division of labour will exist between operating system providers (the Windows, Apple, Google equivalent) and the specialised software developers focusing on the many different aspects of the in-car experience (entertainment, productivity, information).

E. Modular Architecture

The intelligent car will be transformed from a "box-on-wheels" to a highly complex, integrated system of multiple hardware and software technologies. Intelligent cars will - even more than today - be the product of modular design and specialised production. The supply and assemblage of the hardware - i.e. the engine, body, lighting, sensors, seats, interfaces etc. - seems set to become even more specialised.

Car companies responsible for the ultimate production of the hardware will become assemblers tasked with the increasingly complex task of integrating the multiple and diverse hardware and software systems. In the automotive eco-system of tomorrow this task is closest to the task performed by car producers and hardware suppliers of today. To pursue the computer industry comparison of the last section, the hardware providers are analogous to the producers of computer hardware, such as Dell, Toshiba, HP etc.

All of the above predictions may not come to pass. But some - possibly most - will. As mentioned above, there seems to be a broad consensus on the direction of technological developments. Moreover, it seems obvious that these changes will transform the car and profoundly disrupt the automobile industry. The time-scale may be the source of some uncertainty, but there is agreement that these changes will gradually trickle down from luxury vehicles to mass-market cars, just as earlier technologies such as anti-lock brakes or power steering did before. The most difficult time is likely to be the transition period, while both autonomous and non-autonomous cars co-exist on the same roads.

Nevertheless, in spite of the uncertainties, we seem to be entering a period of transformation that threatens to undermine the pre-eminence of existing carmakers, just as smartphones displaced Nokia or digital cameras displaced Kodak from their once dominant position in the mobile phone and analogue camera markets. Already, high-tech newcomers with pre-existing expertise in integrated software design, such as Google and Tesla, have entered the car business, and - with other tech giants (e.g. Apple) contemplating a similar move - this trend looks set to continue.

III. Disruptive Innovation & the Design Challenge of the Intelligent Car

The intelligent car will dramatically reshape not only the landscape of the automobile industry, but also the way we interact with vehicles and, indeed, the future design of our cities. In order to appreciate the implications of the disruption caused by near future

developments in the car industry, it is important to have a clear understanding of *what* is being disrupted by the rise of the intelligent car. Answering this question invites us to think about the complex, multi-dimensional character of technological innovation and its effects.

A. What is Disrupted by Disruptive Innovation?

Clayton Christenson in his classical account defined disruptive innovation in the following way: "An innovation that transforms an existing market or creates a new market, typically by trading off raw performance in the name of simplicity, convenience, accessibility, or affordability." Christenson understood the force of disruption as progressively changing the industrial landscape and transforming business. Disruptors create growth by redefining performance that either brings a simple, cheap solution to the low end of an established market, or enables "non-consumers" to solve pressing problems.

In this way, innovative technologies disrupt at multiple levels. From the business perspective, new technology disrupts existing ways of doing business and the configuration of stakeholders and their respective interests that exists within a particular sector at a given time. We will return to the business model aspect of disruption later in the paper, as well as governance structures and practices within companies today.

From the perspective of government, innovative technologies disrupt existing regulatory schemes and create new policy issues. We don't want to talk about this aspect of the issue in this paper, but the intelligent car clearly raises multiple regulatory questions of this kind. Just to take a simple example, but important example: current rules in most jurisdictions do not allow self-driving cars on the roads. The 1968 Vienna Convention on Road Traffic, to which 72 countries are party, stipulates that a human being always has to be at the controls. There are many other issues. The intelligent car will generate an enormous amount of data for alternative usage, which is likely to present challenges pertaining to data security, privacy concerns, and data analytics and aggregation. In a tort context, questions will need to be resolved as to who is at fault in the event of an accident involving driverless cars. Moreover, autonomous cars will need to communicate both among themselves and infrastructure to be most efficient in their operation. To facilitate this, the government will need to safeguard telecommunication frequencies and protect against security threats, most obviously the possibility of car hacking. Finally, government will need to enhance the safety of intelligent vehicles by reorganising the transport infrastructure in a way that is more appropriate to them. Such changes might include updating road markings and signs, installing V2I communication infrastructure "in" roads, creating special lanes for autonomous vehicles to use when experiencing technical failures, and creating "no human driving" zones etc.

Even a brief list of possible regulatory concerns highlights the range and complexity of disruption for governments. In this paper, however, we would like to focus on another aspect of disruption, namely the impact on consumers and what this might mean for producers. Innovative technology disrupts the routines and practices - the flow - of everyday life of end users of technology either by offering a previously unavailable experience or a novel variation on a pre-existing experience. When Apple created the iPhone, for example, it offered a new mobile phone/mobile internet/mobile content experience. What is being disrupted by innovative technology is a particular user experience and the attendant social meanings of that experience in the broader narrative arc of a person's everyday life.

The point that we would like to emphasise is that new technologies create opportunities for designing new or at least "updated" consumer experience. If we accept a definition of design as the delivery of a new and meaningful user experience, then design thinking can be thought of as anything that contributes to achieving this goal. In the context of new technology, therefore, this means designing, marketing and then selling products that aspire to deliver a meaningful user experience *through* technology.

With this framework for thinking about what is disrupted by disruptive technology, we can return to our discussion of the automobile history and the challenge posed by the intelligent car.

B. The Meaning of the Car in Everyday Life

In order to understand *what* exactly is being disrupted by the rise of intelligent car, it is instructive to consider the origins of the modern automobile industry. Karl Benz was granted a patent for his internal combustion engine in 1879, and started producing automobiles in around 1885. In the United States, Ransom E. Olds started operating an assembly line for the production of automobiles in 1901. But neither Benz's engine nor Olds' new production techniques were successful in disrupting the horse and carriage industry. The disruption came later, in 1908, when Henry Ford started mass production of the Model T.

The Model T was not primarily an achievement of new technology, but of design. Of course, it possessed the right combination of technological features necessary to offer a better experience than driving a horse driven carriage, it was simple enough to operate and it was affordable enough for the middle class to buy. But more than that it sold a new kind experience that was immediately understandable and appealing. In particular, what the Ford T offered was an experience of freedom and control for consumers. The allure of being able to go where we want, whenever we want is a powerful one. The experience of

driving - its physicality and associated feelings of independence - has always been crucial to the mass consumer appeal of the car and the sustained growth of the automobile industry.

The sense of freedom and new possibilities it afforded became central in establishing the special place of the car in the everyday life of ordinary citizens over the course of the twentieth century. Even a cursory look at contemporary car advertisements or the popularity of TV programmes such as the BBC's *Top Gear* reveal that much of the appeal of the car derives from this strong connection with a narrative of liberation, adventure and individual empowerment. The mythology of cars and the freedom of the open road has been central to the identity of modern societies. Modern cities have been shaped around the road network and vast suburbs far from urban centres have been built. All of this has been made possible by the automobile. The history of the car highlights the centrality of the user experience and of engaging customers in an experience that they value.

Of course, the everyday reality of driving for most people today is less and less about freedom and control. It is more an imagined than a real experience. Urbanisation and mass car ownership has created congested cities that mean driving has become, for the most part, a source of boredom, frustration and even anger. The average commuter now spends 250 hours a year behind the wheel of a vehicle and that time is increasingly seen as wasted time. And any feelings of freedom or escape can be seen as illusory. As such, mobility today is increasingly inefficient and expensive, and the imagined experience of driving is increasingly disconnected from the reality. Nevertheless, the mythology of the car as a site of self-directed freedom and control has been, and continues to be, enormously important for the continued growth of the car industry.

C. The Design Challenge of the Intelligent Car

A paradoxical effect of the intelligent car is that although it will be a technological marvel that solves many of the frustrations of contemporary mobility, it will undermine the meaning that driving and the car have had ever since the Ford T captured the public imagination in the early part of the twentieth century. The intelligent car offers a bland experience in which the very appeal of driving - the real or imagined sense of power, freedom and control - will be replaced by a joyless process of systems management. As such, driving will be reduced to an empty simulation of the experience of driving in which the car and intelligent transport system are "in control" and not the "driver". This, in turn, will transform the special meaning of the car in everyday as it becomes just another device in the Internet of Things.

In this way, the experience of the car and driving, as it has traditionally functioned, will be eroded by the rise of the intelligent car. The car will no longer be able to provide a sense of self-directed freedom and personal expression. Google's recent prototypes, for example, have no steering wheel, brake pedal, or accelerator. When a "driver" need only program or speak a destination, what becomes of the driving experience? In answering this question, a key challenge facing car-manufacturers - as well as any new entrants to the market - will be to re-think the role, function and place of the car and the experience of mobility in a networked age. Those manufacturers who are best able to offer a new and engaging experience of the intelligent car will be best placed to succeed.

This challenge of re-imagining the meaning of the car is a question of design more than it is one of technology. Design focuses on understanding an area of human experience and then developing a product or service that utilises technology to improve that area of experience and empower people in new and previously unimagined ways. This is what the Ford T did so successfully and this is what producers of the intelligent car will need to do. Technology will be central to the delivery of a new user experience, but it is the experience - again both real and imagined - that will be the key.

Consider companies like Apple and Google. The recent success of Apple, for instance, has not been the result of their ability to develop new technologies, even if technology is central to what they do. When Apple created the iPhone, for example, it designed a new mobile phone/mobile internet/mobile content experience - using a combination of off-the-shelf and custom designed parts. According to their public statements, Apple did not think of itself as delivering a new technology to consumers. Rather, it aspired to design a new experience, and then identified the technologies best placed to deliver that experience in the most elegant manner possible. Steve Jobs, in particular, was always very insistent on this point on the relationship between technology and meaningful experience:

> You've got to start with the customer experience and work backwards to the technology. You can't start with the technology and try to figure out where you're going to try to sell it. And I've made this mistake probably more than anybody else in this room. And I've got the scar tissue to prove it. And I know that it's the case.

Apple has repeatedly disrupted whole industries - computers, music, PDAs, mobile phones, software distribution, tablet computers. What is the lesson of Apple's success in delivering great products? However exciting or "clever" a particular piece of technology may be, if it fails to contribute to or connect with a new user experience capable of generating billions of dollars worth of sales, it should be shelved until such time that it can be incorporated into such a meaningful experience. It is only by obsessively focusing on

the task of designing innovative experiences that matter and not getting caught up in the technology that technology companies - actually, any companies - are able to survive and flourish.

A design-oriented account of innovation allows us to re-frame the challenge facing existing players in the automobile industry today. If the intelligent car no longer represents a space of power, freedom, and control, what kind of user experience is going to be associated with the car of future? How can mobility be re-imagined and re-packaged in a networked and digital age?

Thinking about the design challenge created by the emergence of the intelligent car also allows us to recognise the seriousness of the threat posed by the arrival of tech savvy new players, such as Google, Tesla and Apple into the automotive space. How can traditional players in the automobile industry compete with newcomers that have a proven track record in the type of design thinking that now becomes so important to the future of the car? What can automobile manufacturers do to enhance their design capacities and skills in order to remain competitive in an age of the intelligent car? We believe that answering these questions will be crucial to the long-term future of established players in the automobile industry.

D. The Value Proposition of the Intelligent Car

Who will succeed in the new automotive ecosystem that emerges when the intelligent car becomes a reality? The disruption caused by this new technology will compel established and new players to formulate original business models, and what will be crucial will be developing and selling a new value proposition. To adopt the the technologies and embrace fully self-driving vehicles, consumers will need to see real value for each new feature they buy. The ability to deliver an attractive value proposition that motivates a consumer to be willing to pay will therefore be critical. There are several overlapping visions in the existing discussion. Here they are presented separately, but manufactures will be obliged to engage with all of them. Each offers opportunities. Brief consideration of these three models of the future shows us the kind of innovative design thinking that will be required.

1. "High-End Disruptor"

In the early stages, the intelligent car will be sold as an exclusive, high-end product. Currently, this seems to be the Elon Musk - Tesla model, at least in the short to medium term. With its first generation models, Tesla won't be selling to low-end, price-sensitive customers (i.e. those who will continue to buy current vehicles) nor do they pursue non-consumers (i.e. those who don't currently drive cars at all). Rather, the selling point of the

Tesla will be a unique mix of technology, power and image. The Model S will produce the fastest 0-60 mph time of any four-door production automobile, but with an electric engine and "only one moving piece". Hence the marketing slogan: "Zero Emissions, Zero Compromises". As such, the Tesla business model is still selling a rather conventional vision of power, freedom and control.

In this regard, first generation intelligent cars will be sold as high-end disruptive innovations (i.e. the electric engine) that outperform existing products on traditional performance indicators (i.e. speed and image). They will sell for a premium price and will target the most discriminating buyers, only later entering low-end markets. The danger for incumbents is that they will be too slow to react to this change and that by the time the innovator enters the mainstream, it will be too late and the incumbents will be seriously threatened.

2. "Mobile Living Space"

Dieter Zetsche, Chairman of the Board of Management of Daimler AG and Head of Mercedes-Benz offers a more long-term vision of the value proposition of the car of the future: "Anyone who focuses solely on the technology has not yet grasped how autonomous driving will change our society. The car is growing beyond its role as a mere means of transport and will ultimately become a mobile living space." This view reflects a perception of the intelligent car as a new kind of private space that offers new opportunities for creating value. In a social environment where space is often at a premium and everything happens at an increasingly rapid pace, people have a desire for privacy and a space of their own to retreat to. On this vision, the real value of the intelligent car comes from selling the experience and content to the occupants.

Car interiors can then be redesigned to support activities other than the current model of driving and accident survival. Possibilities include a living room, bedroom, mobile office or a re-configurable space that can be adapted to the occupants' different needs. Fully autonomous driving means that time spent in the car can now be used for other activities opening up new revenue streams. In this way, the desirable qualities of intelligent cars will no longer be engine size and performance, but will gradually shift to various "in-car" factors, such as noise eradication, the smoothness of the suspension, the sophistication of the in-car computing systems and the ability to connect with other devices.

3. "On-Demand Mobility Service"

The intelligent car will contribute to a significant redefinition of vehicle ownership and expand opportunities for vehicle sharing. If vehicles can drive themselves, they can be ordered when they are needed. Thus, travellers would no longer need to own their own

vehicles and could instead purchase mobility services on demand. Technology and connectivity will pose the question of whether it's necessary to own an automobile. Car sharing is a prominent example: the consumer pays to use vehicles only as needed and foregoes the responsibilities - and benefits - of individual ownership. Car-sharing services, which allow people to make a reservation at the tap of a personal mobile device, are expected to grow significantly in the next few years, with dramatic increases in the number of users and in revenues. These developments also defy the very notion of a car as a personal, autonomous machine. The 18–34 demographic appear to place less importance on car ownership than previous generations. They are more open to sharing cars and to the rapidly growing number of "mobility services," such as BaBaCar, Uber and Lyft.

Intelligent cars will inevitably be linked to many kinds of new services, many of which cannot be anticipated today. For example, supermarkets may use them to deliver goods purchased on-line to your home. Meals other services to the elderly may become much more common, enabling the elderly to stay independent longer. Emergence services will be transformed by automated cars that can switch into an emergency mode and deliver anybody to the nearest hospital at high speeds.

4. "Open Operating Systems & Big Data"

A key theme of the intelligent car concept is the continuous exchange of information between the passengers, the car and the outside world. An alternative business model focuses on this data and how to exploit this data in order to customise the consumer value proposition. The market for big data is growing rapidly and major players in the data market may not want to manufacture vehicles, but they could see opportunities in designing vehicle operating systems. With more than a billion cars generating enormous amounts of data consumer behavior, traffic patterns, and topography, an operating system developer could generate significant value from the data they would collect. OS providers would partner with any of the world's vehicle manufacturers – and not just the traditional automotive manufacturers – to develop a platform for in-vehicle information and communication systems to provide drivers information about their vehicles and to connect to information and content from networked devices. Connected vehicle technology requires a large network of vehicles equipped with similar, or at least interoperable, communication systems.

E. Staying Relevant?

Incumbent players are rarely successful when an industry is radically disrupted.. As such, it seems clear that the capabilities, willingness, and foresight of incumbents will be severely tested by the arrival of the intelligent car. The main advantages enjoyed by the traditional

players will be their familiarity with the automobile, their control over the industry, and their high standards for testing and guaranteeing reliability. But these capacities alone may not be enough. Corporate history is littered with examples of companies that have died out because they ceased to be relevant and failed to be imaginative enough in responding to the arrival of new disruptive technologies. Recall Blackberry, Kodak, Sony (the Walkman) or Mosaic (Netscape), all of whom struggled to survive in the face of technological disruption. The companies best situated to navigate this new reality will be those that acknowledge the need to maintain relevancy via an on-going internal process of strategic transformation. Although this challenge raises many issues, in what follows we want to focus on the issue of internal governance reform.

IV. Governance-for-Innovation in the Automotive Eco-System of Tomorrow

The design challenge of the intelligent car creates a need for governance reform within the existing organisational structures of the incumbents. In this context, we are not thinking of corporate governance in the traditional sense of managing agency-costs, but the more pressing task of creating governance structures that facilitate value creation through innovative design thinking. This task has to start with an acknowledgement of the limits of existing organizational forms to successfully and continuously deliver innovation. The governance structures of companies that have lost their "start-up feel" need a serious makeover in order to survive. In particular, such companies need to implement governance practices and structures that make them better innovators. This involves recognising the importance of "flat hierarchies", "open communication" and "inclusiveness". The pace of innovation tends to be fastest in those companies that actively embrace looser organizational forms that are controlled by the innovators, rather than in companies with more hierarchical structures.

Based on practical experience and research conducted elsewhere, we have identified a number of principles and their related practices that have been utilised by the most successful and innovative firms. These principles are also relevant in context of a discussion of retaining relevancy in the automotive eco-system of the future. To that end, we offer an interpretation of the governance principles and related practices that we believe are going to be most effective in allowing a firm to succeed.

A. The Principle of "Flat-Hierarchy"

As Lawrence Ellison has observed, tech moguls like Larry Page, Sergey Brin and Mark Zuckerberg run ostensibly public companies that are essentially "private fiefdoms". These charismatic leaders have structured corporate control in such a way that there is no way that investors or board members can unseat them. Charismatic leaders do this in order to ensure that regulatory requirements - e.g. the short-term quarterly results and the demand for dividends and share buybacks - don't take over and kill the relevancy of the company. Of course, from the regulatory perspective, such a structure can make such firms appear to be governance "renegades", something that in turn might have a chilling effect on prospective investors.

But this does not mean that these firms are absolute monarchies, like the fiefdoms of history. Quite the contrary; it is these firms that are associated with a "best- idea-wins" culture in which the seniority of the person making a proposal doesn't matter and in which open debate and collective decision making is fostered. Elon Musk, the CEO of TESLA Motors and the founder of SpaceX (a aerospace manufacturer and space transport services company), describes this sort of work environment as a "flat hierarchy". The most effective charismatic and visionary leaders recognise that the pace of innovation tends to be much faster in those companies with looser organizational forms and they use their innovation talent and control over the company to ensure that such a flat culture is allowed to flourish.

In this respect, the "flat hierarchy" and "best-idea-wins-culture" comes from the top-down. It represents a considered choice on the part of company leadership to break from the static hierarchies of traditional corporate governance.

In order to succeed, however, a flat hierarchy also depends on the active bottom-up participation of everyone inside the firm. Without the cooperation and input of talented employees this approach cannot succeed. An additional advantage of such an open working culture is that it provides greater opportunities for personal expression for those inside the company and ensures that the company remains relevant to them. The most talented employees in search of a meaningful career experience are not willing to passively accept the view of managers and will be increasingly inclined to move somewhere else if the firm does not afford opportunities to contribute or for personal growth. In this way, the flat hierarchy works to retain the relevancy of the firm for the best employees and other company insiders, as well as the consumers who benefit from the higher quality products or services that such a flat culture produces.

Reid Hoffman, Ben Casnocha and Chris Yeh, discuss this issue in their book, *The Alliance*. They acknowledge that lifetime employment is no longer feasible or even desirable in a modern economy and that there is a need for a new model of employment relations. Such a model would not only aim to rebuild trust and loyalty between firms and employees, but would also create incentives for employees to become more entrepreneurial in the sense that we discussed above. Their answer is an "alliance-based relationship", which offers mutual benefits to the company and its employees. This alliance between the company's managers and its employees has various elements. The core elements include mechanisms that enable a company to hire employees for well-defined, but successive "tours of duty". The second element focuses on the creation of the employees' networks outside the organisation. The final pillar includes the creation of an "alumni network" which enables companies to maintain long-term relationships with their former employees. The employer-employee alliance can already be observed in a number startup communities, where the establishment of networks and connections is crucial to the success of both the company and the employees.

A less well-documented, but similar trend can be observed in the relationship between managers, directors and shareholders of a company. A new consensus amongst investors seems to be emerging, with the investors realising that when they frame the relationship between managers and shareholders in hierarchical terms, they trigger a short-term focus on quarterly results and share price within the company that usually leads to increased demands for dividends and stock buybacks. Accepting such demands can then make it extremely difficult for companies to recapture the focus on innovation and growth. Recognising this risk, however, investors are becoming more interested in the question of what it is that causes companies to thrive and stay ahead of their competitors. As they ask themselves how to imaginatively design their "portfolio" companies, they focus on the need to frame their relationship with managers as collaborative, rather than hierarchical.

B. The Principle of Open Communication

The second principle concerns communication strategies, particularly in the context of engagement with investors. A contrast between two types of firm may be helpful here. On the one hand, there are those companies that satisfy themselves with minimum compliance with the respective rules and regulations regarding interaction with investors. Such firms organise shareholder meetings, respect the shareholders' legal rights and provide investors with the mandatory quarterly and annual reports. Compliance-based communication with investors is characterised by a "check-the-box" attitude that usually results in bland, "boilerplate" statements about corporate governance and the company's past performance and opportunities for growth.

On the other hand, are more innovative and disruptive companies that go beyond the mere dissemination of information obliged by the rules, but take a more integrated and innovative approach to the communication of the companies' prospects. In general, these companies publish their ownership and control structures in a clear, visually attractive and compelling way to provide investors with the confidence that they have been given sufficient information to make the best possible investment decision. These communications are often highly personalised with corporate leader clearly explaining in detail how they are going to propel "their" company towards value creation in the short, medium *and* long term. As a genuine partner, such an approach is also characterised by a willingness to admit to operational mistakes and challenges.

The French food services and facilities management firm, Sodexo, provides a good example of how this type of personalised, visual and clear, "integrated" report has been used. The firm is a "Governance Renegade" in the sense that the founder, Pierre Bellon, has used dual class shares to guarantee long-term control. Nevertheless, the company has presented its reports in an open and visually attractive way that goes way beyond the regulatory requirements. For instance, Bellon was very open in focusing on the succession issue, in particular the question of which one of his children would succeed him. The suggestion is that by openly confronting such a sensitive issue he was able to create trust and this trust ensured investors remained confident in the firm's prospects, in spite of the governance concerns that might (from the conventional perspective) otherwise deter them from making an investment.

Marc Suster and others have addressed the question of the limits of this kind of openness for private companies. His starting point is that providing management updates periodically for all investors is important, but in doing so you must assume that any information that is released to investors will be seen by others and that it is therefore important to hold back on your most sensitive information. Suster's concern is not that malevolent investors will misuse this information; such misuse would be revealed at some point damaging the investor's reputation. Rather, careless information dissemination by any company communicates poor judgment and risks reputational costs. Suster's proposed solution to this danger is a "state of the company" e-mail a couple of times a year, written on the assumption that it will get shown to others, but which nevertheless contains non-sensitive information on a wide range of issues that indicate the potential for positive future performance.

Moreover, open communication is not just about sharing information (the one-way dissemination of information *from* the company to other stakeholders, notably investors). It is also about building an on-going and constructive dialogue between executive

management and investors that will have a significant impact on the future performance of the company. There are multiple additional potential benefits for a company in adopting this kind of active and engaged communication strategy.

Firstly, the most important aspect of open engagement may be the connections created with other leading investors to explain and discuss growth strategies and invite input. These discussions assist company leaders in making better decisions and avoid tunnel vision by providing them with relevant information on the current state of the business environment in which they operate. Second, open engagement may facilitate the identification of new business opportunities or provide a better sense of their peers and competitors. Assuming that such peers and competitors are likely to be attracting a similar type of investor, then this knowledge can be extremely valuable. Finally, pro-active engagement helps founders-entrepreneurs in identifying "expertise gaps" on their board of directors and executive teams. It is in this collaborative context where investors may have the most impact on the spending plans of the CEOs of their "portfolio companies".

This last point is crucial. Open communication is concerned with information dissemination and exchange, and the potential benefits that accrue from the free flow of information. But this open flow of information can facilitate the identification of "gaps" in current corporate decision-making, and points to our third principle, namely the need for greater inclusiveness.

C. The Principle of Inclusiveness

The principle of inclusiveness, in this sense, covers a range of practices from those aimed at fostering a sense of belonging to maximising opportunities for substantive involvement in key decision making processes. There is obviously a significant degree of overlap with open communication in this regard. But whereas open communication is concerned with the flow of information within the corporate eco-system, inclusiveness is linked to various other aspects of participation, up to inclusion in key decision-making. The most innovative companies have acknowledged that they stand to benefit from a more inclusive attitude towards all stakeholders. In particular, inclusion creates a sense of participation and belonging that makes the whole corporate project more meaningful, both from the perspective of the employee and the firm.

Here we will focus on how inclusiveness might affect our thinking about the board. Currently, the dominant view is to see the board as the supervisor/monitors of the senior managers. In consequence, the board of directors tends to focus on the control of managerial misbehaviour and the monitoring of company past-performance and sustainability, rather than actively contributing to future performance.

Many companies now recognise that this role is no longer sufficient and that the model of board "independence" constitutes a missed opportunity. Instead, the more innovative firms include a diverse range of individuals who are then expected to work in collaboration with the firm's CEO and other senior managers to drive innovation. The directors help the firm stay relevant by the inclusion of diverse perspectives that are relevant to the company and a more collaborative model of the relationship with management ensures that these perspectives are incorporated into the decision making processes in a way that adds genuine value.

Consider Apple, for example. The company's late CEO, Steve Jobs, understood early on the important role of the board of directors for Apple's growth and innovation needs, but also in order to build relationships with its suppliers and customers. In order for the board of directors to retain a competitive advantage and help carry Apple forward (by focusing on relevance), its members needed to have a thorough understanding of the computer industry and the firm's products, and be actively involved in decision making.

Recall, that it was the board that removed Steve Jobs as Head of the Macintosh division in 1985. Following his return in 1997, Jobs, who was initially employed in an advisory role (along with being the CEO and Chairman of a computer animation company, Pixar), quickly regained control over the company's affairs. This became clear in the keynote address during the Macworld Expo in Boston on 6 August, 1997, where he explicitly avoided the announcement of new and innovative products, but revealed the appointment of four new, handpicked, board members. Jobs was convinced that changing the composition of the board of directors was a necessary first step to bring back focus, relevance, and interaction (with the outside world) to the company in its quest for disruptive innovation and creative products.

What is most relevant here is that Jobs knew that in order for the board of directors to become a competitive advantage and help carry Apple forward, its members needed to have experience in the computer industry and be passionate Apple users. Perhaps this is the reason why Mr. Woolard, Chairman and former CEO of Dupont, and Mr. Chang, a senior executive at Hughes Electronics, were "allowed" to stay for their leadership skills and knowledge of the Asian market respectively. Larry Ellison (software expertise and co-founder of Oracle), Jerry York (Former CFO with experience of reorganisations at both Chrysler and IBM), Bill Campbell (CEO of Intuit and former Vice-president of Sales and Marketing at Apple) were added to the Board of Directors. As expected, Jobs also joined the Board of Directors himself.

Again, Larry Ellison showed foresight about the new nature of the firm by explicitly stating (in 1997) that "Apple is the only lifestyle brand in the computer industry. It is the only company that people feel passionate about. My company Oracle - it is a huge company, IBM is a huge company, Microsoft is a huge company, but no one has incredible emotions associated with our companies. Only Apple is really a lifestyle brand". In the light of this piece, it is therefore not surprising that Apple has become the world's largest company by market capitalisation in 2012.

On the other hand, Arthur Levitt, the longest serving Chairman of the US SEC, who was a self-proclaimed fan of Apple and long time Mac user, was apparently denied a seat on the board after Jobs read a speech of Levitt's in which he emphasised the importance of a strong, *independent* board of directors. Jobs apparently phoned Levitt and told him that his ideas on the role of the board didn't fit with the culture of Apple, in that the board was not designed to act independently of the CEO, but in partnership with the CEO.

Critics of Apple's approach tend to make a point of emphasising that the board merely comprised the "friends of Steve", but this misses the point. A diverse board with a range of relevant expertise and an inclusive decision making process in which CEO and board work collaboratively offers a better prospect for fostering growth. In contrast, if the board is simply regarded as a device for the monitoring of senior management, there is a risk that the board will be filled with inappropriate people. In particular, there will be an over-representation of lawyers and accountants - i.e. those with a compliance-related expertise - and not individuals who can add genuine value to the core competencies of building a business.

One final point about inclusiveness: to accelerate innovation, established companies need to master collaborating and co-creating with external parties that have pre-existing capacities for design thinking. There is a pressing need for incumbents in the automotive to forge new connections with those sectors of the economy that are best situated to respond to the design challenge of the intelligent car, namely local start-up communities and the emerging global innovation eco-system. You will not get a new Toyota from a start-up, but Toyota will find that its core business is disrupted by start-ups. And new cars will emerge out of this process of disruption. It is in these sectors that visionary, entrepreneurial, and innovation-minded design solutions are most likely to emerge. They know what it takes in a networked age to find, develop and scale new products and solutions, and tapping into these capacities will be crucial to energise and inspire established players.

V. Conclusion

The car industry has been built on a business model that has not changed much since the time of Henry Ford. The industry is based on the production of vehicles that are powered by an internal combustion engine, driven by human beings and (for the most part) privately owned. All three of these features are likely to be disrupted over the course of the next few decades. There is a broad consensus that the new business model will involve electric cars that will drive themselves and there will be much more car-sharing. This vision of the future means that firms with expertise in electric power, networking, machine learning and autonomous technologies will be well situated to enter the automotive eco-system and challenge incumbents.

As such, the rise of the intelligent car seems likely to transform both the meaning of cars and "driving" in everyday life, and pose a profound challenge for the automobile industry. Certainly, that seems to be the consensus of those inside the industry. Understanding the design challenge created by the rise of the intelligent car - that is to say, re-imagining the user experience of the car and mobility in a digital age - represents a genuine challenge, particularly for established players. Nevertheless, there are strategies that existing players can utilise to protect themselves against these risks. In particular, a focus on disruptive internal governance reform and external collaboration with proven innovators. The paper identified some key strategies for achieving this, namely flat-hierarchies, open communication and inclusiveness. A willingness and capacity to make a sustained commitment to such strategies is going to be crucial to the long-term survival of the traditionally dominant players.