

RethinkX

Disruption.
Implications.
Choices.

A Business and Investor Primer *for the Coming Transportation Disruption*

Authors:
James Arbib
Tony Seba



The move to autonomous vehicles and the end of individual car ownership

We are on the cusp of the most radical transformation in transport since the internal combustion engine (ICE) replaced the horse-drawn carriage, and the implications for the global economy, the way we live and the planet we live on are just as profound.

Autonomous, electric vehicles (A-EVs) will soon replace not just cars powered by gasoline, but the very concept of individually-owned cars itself.

This revolution in road transport will trigger one of the biggest boosts to consumer spending in US history, as trillions of dollars are injected into the economy through savings and productivity gains. In the automotive and technology industries in particular, companies will rush to take advantage of the almost unimaginable number of opportunities created by this fundamental technological disruption.

Deaths and injuries caused by road-traffic accidents will plummet, air quality will improve dramatically, while CO₂ emissions will plunge as the new fleet of vastly more efficient, safer cars and trucks driven by computers not humans run increasingly on renewable electricity.

And because A-EVs will run on the same roads we use and electricity we generate today, this radical transition will require nothing like the kind of massive infrastructure investment that characterized comparable transformations of the past.

Some companies, however, will pay a heavy price.

Carmakers will come under huge pressure, as will parts suppliers and garages that maintain individually-owned cars. Dealerships will all but disappear and second-hand car sales will dry up. Five million jobs will be lost but others created. **The current value chain will be blown wide apart as net cost per mile and availability, not upfront cost, become the key drivers of competition.** The whole car insurance market will be shaken to its core, as the incidence of theft and accidents tumble.

The knock-on effects for other industries will be equally severe. Global demand for oil will slump, with many oil companies finding a large proportion of their inventories – particularly unconventional assets – worthless. Key infrastructure projects will be left stranded. Countries dependent on crude revenues will face traumatic adjustment, while the geopolitical influence of oil will wane rapidly.

This is not a futuristic vision of some brave new world. We estimate that within 10 years of widespread regulatory approval for AVs, they will constitute the vast majority of passenger miles travelled in the US. This could be as early as 2030.

Businesses and investors must start planning now for this transport disruption. Indeed the race to lead this transformation has already begun. The early adopters will be rewarded with untold riches; the laggards will simply cease to exist.

Key findings:

The move from individuals owning and driving ICE vehicles, as they do today, to giving up their cars and instead hailing a fleet-owned A-EV as and when they need it – a model we call transport-as-a-service (TaaS) – will result in:

- Savings of \$5,600 a year for the average American family
- A \$1 trillion boost to US disposable incomes and a further \$1 trillion in productivity gains to the US economy
- TaaS providing 95% of all vehicle miles within 10 years of widespread regulatory approval
- TaaS being up to 10 times cheaper than owning and running a car. Even if cars were free, the operating costs alone would be twice the cost of TaaS, meaning the existing US fleet of almost 250 million vehicles might be left stranded
- Up to five million jobs being lost
- Demand for oil falling by 30%
- Oil slumping to a break-even cost of almost \$25 a barrel, with short-term price volatility possible
- More than half of US oil becoming uncommercial.

The biggest disruption will be felt by the automotive and oil industries.

Challenges facing the auto industry

Key findings:

- A-EVs will run for 500,000 miles (potentially rising to one million miles by 2030 as business incentives change), two-and-a-half times more than ICE-powered cars
- Vehicle utilization rates will increase tenfold – 40% vs 4% currently (100,000 miles a year vs 10,000 miles)
- Depreciation cost of a fleet-owned vehicle will plummet as cost per mile, rather than upfront cost, becomes the key industry metric
- TaaS will see a 90% decrease in finance and insurance costs, an 80% decrease in maintenance costs, and a 70% reduction in fuel costs
- The number of passenger vehicles in the US will drop from 247 million to 44 million
- There will be 70% fewer passenger vehicles and trucks manufactured each year
- As people move to TaaS and sell their vehicles, used ICE car values will plunge towards zero. Fixed ownership costs mean people will become forced sellers
- Oversupply of used vehicles and increasing costs of ICE vehicles mean manufacturing of ICE vehicles sold to individuals will stop completely
- TaaS will provide six trillion passenger miles in 2030, compared with four trillion delivered by ICE vehicles in 2021, at a quarter of the cost: \$393 billion vs \$1.48 trillion in 2015
- Huge potential revenue streams will arise from additional services offered by TaaS providers, potentially resulting in free transport.

This transition will involve far more than trading an ICE vehicle for an electric vehicle, in a like-for-like swap. **It is not a simple technology substitution, but a more fundamental business-model disruption.** People will no longer own their own cars, instead using TaaS providers to transport them wherever, whenever.

The substantial cost savings realized by using A-EVs will ensure the rapid take-up of TaaS. No longer will people have to buy a car, but they won't need to maintain, insure, register, park, drive or refuel it. This will save the average American family \$5,600 a year, equivalent to an almost 10% pay raise for the average earner.

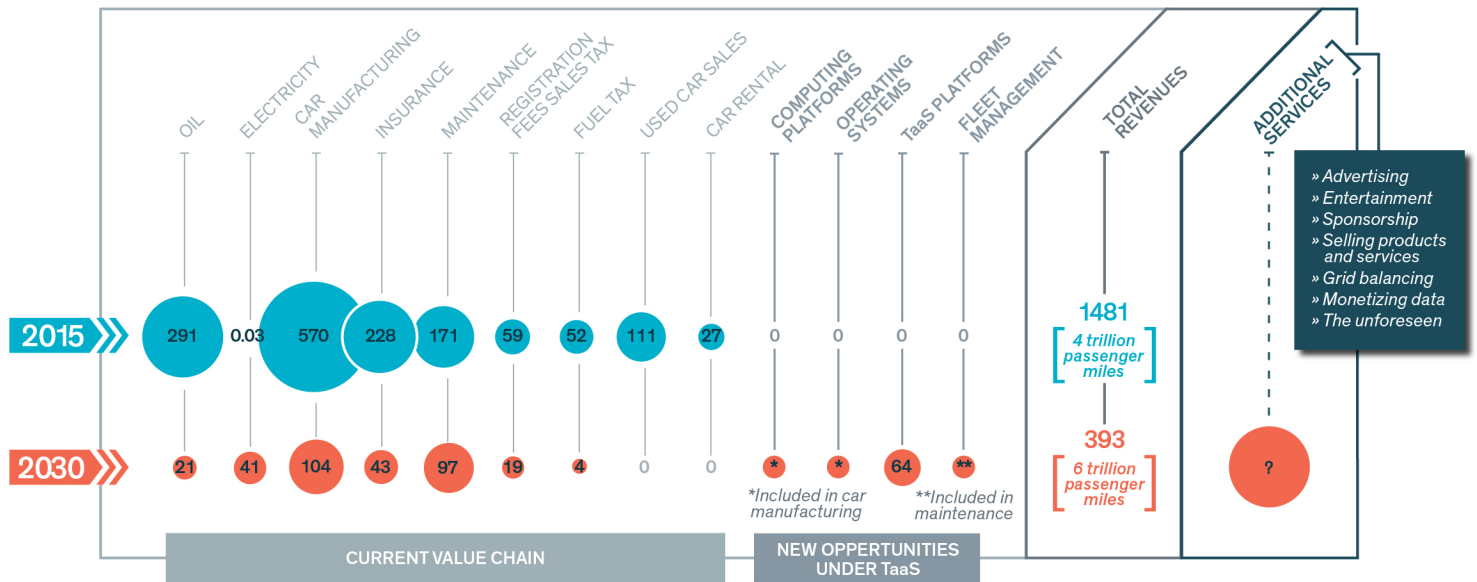
As more people use the service, costs and waiting times will come down, making TaaS even more attractive, convincing yet more people to join up. **This virtuous cycle will help TaaS to become far more attractive than individually owning and driving a car.**

The TaaS experience will also drive growth, as people come to enjoy being chauffeured around, giving them more time for hobbies or making money, free from the stresses of driving in endless traffic.

On the flipside, demand for individually-owned cars will plummet as more and more people, initially in towns and cities, take to TaaS. As demand falls, prices of used cars will slump. Buying a new car will make no sense at all. Soon dealerships, garages and parts suppliers will start to fold, while traditional carmakers, already operating on low margins, will be squeezed ever tighter. Car leasing companies will suffer as depreciation quickly accelerates and they are left with assets worth far less than projected. Right across the industry, those that fail to adapt will not survive.

Successful adaption will involve embracing an entirely new business model, where cost per mile, rather than upfront cost, becomes the key metric. Carmakers will no longer design vehicles to degrade in order to ensure replacement sales and maintenance revenue. TaaS operators will buy only those vehicles that offer the greatest longevity, combined with the lowest maintenance and fuel costs. **Everything, therefore, will be directed towards driving down the cost per mile.**

» Revenue distribution along the car value chain in billions of US dollars



Copyright © 2017 RethinkX

Opportunities in TaaS disruption

The value chain that was forged almost 100 years ago, sparked by the production of the Ford Model T, will be completely dismantled. In its place, there will be opportunities for whole new businesses to develop:

Building the computer platforms

This is the hardware that will provide the computing power to drive A-EVs, which will need significantly more processing power than cars today. Intel was a big winner in creating the central processing units (CPUs) that drove the personal computer revolution. Now the race is on to become the Intel of autonomous vehicles. For example, NVIDIA has invested heavily in repurposing its graphics processing units to run the deep learning software needed by AVs, while Intel itself recently bought Mobileye, a self-driving technology company, for \$15 billion.

Building operating systems

Companies that develop A-EV operating systems – the artificial intelligence, self-learning capabilities that underpin these vehicles – could reap massive rewards, as was the case for Microsoft, Apple, Google and Cisco through their development of computing, internet and smartphone operating systems. **A network effect will operate in this market, driving a winners-take-all dynamic and**

ensuring that only a small number of systems thrive. This network effect is likely to operate at a global level.

However, the products and services offered by operating system companies might be largely commoditized, with low margins if, as we expect, an open-source operating system (like Android), free to users, is developed.

Building TaaS platforms

These companies will be the service operators, and will soon take over as the recognizable brands in the auto industry, just as Uber, Lyft and Didi are starting to usurp Volkswagen, Toyota and General Motors (GM). These are the companies that will have a direct relationship with the customer, just as Facebook, Google or Amazon interact with social media users rather than the computer or networking firms that support them.

Network effects will again ensure that a small number of companies win out here, as cost and widespread availability will be the two key drivers of success. But these effects are likely to be local – the winner in New York might not be the winner in Los Angeles. Again, margins on the core provision of transport might be low if open-source systems are developed.

The real money stands to be made by monetizing the user base by creating entirely new revenue streams from this low-cost transport system.

TaaS platform operators will be able to sell these additional services at much higher margins - not only do they have a captive audience for the entirety of each journey, but they are collecting vast amounts of data from every passenger. Control of the customer relationship and data will be critical to realizing the opportunities on offer here.

These additional services may include:

- **Advertising.** Screens in cars could be used to target passengers, especially as each vehicle will know who they are, where they are going and how they are going to get there
- **Entertainment.** Streaming services such as Netflix, Amazon and Hulu Plus could pay for access to passengers
- **Sponsorship.** Transport could be paid for by companies that provide a service to passengers. For example, Starbucks on wheels, where the coffee chain covers the transport costs, which would be much lower than renting retail space, but profits by selling food and drinks
- **Selling products and services.** The TaaS operator itself could sell any related or unrelated products and services to its user base
- **Grid balancing.** The A-EVs could be plugged into the grid when not in use, with the TaaS operator charging for the electricity stored in the vehicle's battery
- **Monetizing data.** The opportunities for collecting data are almost endless, from personal details and patterns of movement to likes, dislikes and health. All this data could be sold to the right company at the right price
- **The unforeseen.** There will be countless other revenue streams that cannot be imagined today.

With the creation of the internet – a low-cost communications system – the winners were not those who built the platform but those who built the businesses on top of it. So the winners in the creation of TaaS – a low-cost transport system – are likely to be those who find entirely new opportunities away from the core provision of transport.

In a competitive marketplace, the revenues generated from these additional services, which are potentially vast, are likely to be passed on to passengers in the form of lower prices, to the point where transport could ultimately be free, in the same way that Google and Facebook give away their services.

Fleet management

Vast fleets of A-EVs will be operated by TaaS platform providers, and these will need maintaining. This will be a vital service given the importance of keeping cost per mile as low as possible. Vehicle manufacturers could look to control the market, but other companies are likely to enter, driving down margins.

How can car companies adapt?

There is no guarantee that existing car manufacturers will have a place in the new autonomous order. In the ‘hardware’ market, they will no longer be competing just against each other, but potentially against electric bus companies, battery makers, technology companies and car parts suppliers.

We believe there are four main strategies open to carmakers:

- **Focus on hardware manufacturing and assembling.** As well as existing automotive suppliers such as Continental, Delphi and Magna, there will be many new entrants to this market. These could include electronics assemblers such as Foxconn, electric vehicle companies such as BYD Auto and NIO, and electric bus companies such as Proterra. More companies will be competing for a market in which far fewer vehicles will be needed. Margins will be tight, as manufacturing begins to resemble the electronics assembly industry.
- **Build and operate fleets for TaaS providers.** The emphasis here would be on manufacturing vehicles with the longest possible lifespan and operating them at the lowest possible cost per mile, a completely different business model than the one they currently operate under.
- **Become a TaaS platform provider.** This is where the real potential for both profit and building brand value lies. Companies such as GM, Ford and BMW realize this and are investing in these opportunities. This will not be easy. Building a TaaS platform requires the skill set, culture and development speed of a Silicon Valley high-tech software company, not of a Detroit carmaker. At the same time, the pressure to preserve cash flow and retrieve sunk costs by selling unfashionable ICE cars will be great.

- **Participate in all parts of the new value chain.** This would encompass manufacturing, operating systems, and TaaS platform and fleet operations. Some carmakers are already moving in this direction – Ford and GM have bought Silicon Valley self-driving companies, while Nissan is developing its own autonomous capability in-house.

Tactics that winning carmakers are likely to employ:

- Being at the forefront of AV trials
- Once AVs are approved, flooding urban markets with TaaS vehicles to seize market share. The local network effect will require targeting key markets, making concentration preferable to spread.
- Ramping up EV/AV production before 2020 to ensure enough supply is available for the early market-grab of the TaaS rollout
- Buying, or developing partnerships with, companies developing AV software
- Focusing on reducing vehicles' cost per mile and increasing vehicle lifespans
- Buying or creating TaaS platforms, or entering partnerships with those that are
- Developing alternative revenue streams, such as advertising and entertainment, in preparation for the move to a TaaS platform operator
- Winding down R&D and capital expenditure on ICE and individually-owned vehicles. Running existing ICE business to maximize cashflow.

FURTHER INVESTMENT CONSIDERATIONS

The move to TaaS does not have to be terminal for existing companies in the auto industry. Adaptability will be the key to survival. But there are some issues that should be considered to help identify the winners and losers:

- **Exposure to car loans.** The plummeting residual values of ICE vehicles as people move to TaaS mean that, at the end of their leases, cars will be worth substantially less than projected. Exposure to this loss is a major risk.
- **Debt load/contingent liabilities.** High leverage, or contingent liabilities (eg pension shortfalls), might mean that options for auto companies to adapt are limited. Downsizing or investing through a period of reduced earnings during the transition will not be viable options if there are prior calls on cash flows.
- **Culture/mindset/incentives.** Many incumbent businesses fail to adapt and get disrupted, largely because they are geared towards incremental change.

Impact of TaaS on insurance companies

Current safety data suggest at least a 90% reduction in the number of accidents involving A-EVs compared with ICE vehicles. This is because 94% of collisions result from human error. A-EVs would eliminate this error, while the vehicles themselves would become even safer over time through self-learning.

A-EVs will also be much more difficult to steal. While hackers could in theory take remote control of a vehicle, the cars will have cameras, GPS and vibration sensors, so tracking and recovering them would be relatively simple. In fact, stolen vehicle recovery rates of 94% are already being achieved using today's technology.

The combination of fewer accidents and thefts will have a devastating effect on insurance companies. The insurance market will be forced to move to a cost-per-mile model rather than an annual premium, resulting in a 90% reduction in revenues.

Challenges facing the oil industry

Key findings:

- Oil demand will peak at 100 million bpd in 2020, dropping to 70 million bpd by 2030
- Oil consumption by US passenger vehicles will decline from more than eight million bpd to less than one million bpd
- Oil will fall to a break-even cost of \$25.40 a barrel
- In the US, 65% of shale oil and tight oil, and 58% of all oil reserves, will no longer be commercially viable
- Oil majors such as BP, ExxonMobil and Shell could see 40%-50% of their assets stranded
- Key infrastructure projects such as the Keystone XL and Dakota Access Pipeline will be unviable.

The transition to A-EVs will see global demand for oil fall by 30%, causing systemic disruption to the entire oil industry, from exploration and oil fields to pipelines and refineries.

As the move to A-EVs gathers momentum, we may see investment in exploration, production, shipping, refining and infrastructure start to dry up, leading to short-term supply constraints and price volatility prior to the disruption beginning.

By 2030, with significantly lower demand, the oil price will fall dramatically, laying waste to the value of oil-company assets. Revenues and share prices will tumble, as has happened to coal companies as the world transitions rapidly away from coal.

Some companies will be hit harder than others. For example, Aramco would see the proportion of uncommercial assets rise to just 4%, while Rosneft's would rise to 10%. Some majors, however, would see almost half their reserves stranded. The determining factor will be cost of production, so

expensive unconventional assets, such as shale oil, will be hit hardest. Oil services companies will suffer greatly, as their expertise is often needed most in the extraction of these unconventional oils.

Countries with high costs of production will also suffer the most. The US, Canada, Brazil, Mexico, Angola and the UK will see more than half of their assets stranded. Other countries hit would be Nigeria, Norway and Venezuela's heavy crude reserves. In stark contrast, Persian Gulf countries would be largely unaffected, as 95% of their oil would remain commercially viable.

All these countries, however, will suffer from lower oil prices, which will impact government revenues. This will severely curtail government spending, hitting economic growth. This will impact Kuwait, Iraq, Saudi Arabia and Libya the most, as these are the countries where oil rents constitute the largest percentage of GDP.

How can oil companies prepare for the TaaS disruption?

History suggests that a change in business focus will, in most cases, prove unrealistic. The best way to realize value would be through asset sales or the sale of the whole business. This will, of course, be increasingly difficult as the scope and depth of the TaaS disruption becomes clear.

Options available:

- **Selling high-cost assets**, which might include oilfields, refineries, petrochemical units and pipelines. Shell has pledged to sell \$30 billion of oil and gas assets by 2018. It has already disposed of half its North Sea oil and gas assets, offshore gas fields in Thailand and Canadian oil sands projects.
- **Selling the company** before markets appreciate the full scale of the disruption caused by the rollout of A-EVs.
- **Splitting the business, separating oil-based assets from all other assets**, thus protecting the 'good' business from the 'bad'. This is precisely what has happened in the electricity utility industry, where Eon and RWE have hived off their fossil-fuel business from their clean-energy business.
- **Focusing on maximizing cash flow by winding down the business**, writing off or writing down high-cost assets, cutting capital expenditure and offloading liabilities. Exxon has already conceded that it may have to write down as many as 4.6 billion barrels of its North American inventory in what would be the "biggest accounting reserve revision" in its history.

Investors hoping to understand the risk this poses will need to understand fully the potential liabilities of the companies, such as debt holders, lease payment obligations, clean-up costs, and workers' pension and healthcare liabilities and redundancy costs. It should be noted that the recent experience of coal companies demonstrates that complete destruction of value can occur quickly and with only a marginal change in demand. The impact on the commodity price can be amplified, while the impact on share prices can be extreme.

Summary

The rapid rollout of A-EVs, far faster than mainstream analysis suggests, will totally transform the auto industry, completely destroying the value chain that carmakers, parts suppliers, car dealerships, garages and insurance companies have relied upon for decades.

Those that prosper in the new autonomous landscape will be those that recognize the scale and speed of the disruption that is already underway, and respond and adapt accordingly. This will not involve simply refocusing and restructuring, but fundamentally reimagining how the business is managed and operated. **Those that do not adapt will not survive.**

The TaaS rollout will also send shockwaves through the whole oil industry. The assumption that the entire global economy is underpinned by oil will no longer hold true. Road transport will be the first to wean itself off; other sectors will soon follow suit.

The fall in demand for oil will be as severe as it is rapid, far quicker than mainstream projections allow for. The resultant slump in the oil price will drive many oil producers to ruin. Again, those that adapt fastest, by selling stranded assets, diversifying revenue streams and seeking out new business opportunities, will win out. There is no room for complacency. Companies must embrace change to survive.

Appendix – background for businesses, investors and other decision-makers

Decision-making in the dark

Decision-makers usually face an impossible task – making long-term judgements about business and investment while being fed information that is not only inadequate, but fails to recognize the potential speed and extent of disruptions.

Mainstream forecasters fail to understand how technology disruptions unfold. Their models are suited to incremental change, but in an era of ever-increasing technological progress and constant disruption, traditional models are ill-suited to their basic task of providing data, scenarios and information on which decisions about the future can be based.

These models consistently miss “Minsky moments”, when asset values collapse, like the global financial crisis of 2007-8, or the downfall of once-mighty companies like Kodak, Nokia or Blockbuster. Even when change is more gradual, they fail to comprehend its speed and scope, such as the fall in the cost of renewable energy, particularly solar power.

Mistakes that forecasters make

Linear progressions mistake

Analysts tend to make forecasts by looking back to past performance, then extrapolating trends into the future. But this makes a number of false assumptions, particularly that change is linear and occurs in a simple system, where one variable changes but all else remains equal. This can work in periods of incremental change, but during technology disruptions, these assumptions are entirely false. Technology disruptions are exponential, move in S-curves and occur in a complex system. They are driven by feedback loops, network effects and tipping points, which act as powerful accelerators to adoption, driving non-linear rollout. And yet these forces are often ignored by mainstream analysts.

Furthermore, technology convergence leads to disruption points – where suddenly new business models or products become possible. Once this point has been reached, change happens very quickly. Just as the smartphone was enabled by a number of technologies reaching a particular point in price and performance, so too will autonomous vehicles arrive as artificial intelligence, sensors, communications and computer processing all come together. This disruption point will soon be upon us.

Misunderstanding the systemic and interrelated nature of change

While acknowledging that technology improves in cost and utility at an exponential rate, forecasters mistakenly assume that “all else remains equal.” In fact, everything is dynamic and interdependent, with changes to any variable rippling through the system, impacting all others. This leads forecasters to see factors as constants and not variables, or to ignore the systemic implications of this dynamism.

For example, they view the public’s skepticism of autonomous vehicles, based on surveys conducted today, as a constant brake on adoption. This fails to recognize that, over time, perceptions change. Through increased exposure to AVs and to information about them, public opinion might come to view human drivers as reckless and unsafe in comparison.

Similarly, mainstream forecasters fail to recognize how business incentives and metrics change when moving to a new ownership model, such as TaaS. This can create new business opportunities built on a low-cost transport infrastructure – just as the internet created untold business opportunities based on low-cost communications infrastructure, like Amazon, Google and Facebook.

Assuming an energy transition, not a technology disruption

Many analysts claim this is an energy transition, and that past analysis of energy transitions “proves” they take 30 years to get to 1% of the energy mix, and decades more to have a material impact. There are many problems with this analysis, but most importantly it completely misdiagnoses the issue.

Energy transitions are slow because they require the associated infrastructure to be built. To replace horses with cars, for example, you needed roads, gas stations, oil wells, refineries and pipelines as well as the production capacity and supply chains for cars. For the rollout of electricity, you needed power stations, distribution networks and cables to every home. But for the coming TaaS transition, the roads, electricity networks – in developed economies at least – and vehicle production supply chains are already in place. We estimate that electricity demand will rise by 18% in the US by 2030, which will not require an increase in the capacity of existing infrastructure that is built to supply peak, not average, load.

So, rather than resembling a traditional, gradual energy transition, the TaaS rollout will represent a technology disruption and will therefore move along an S-curve. In other words, much faster than forecasters think.

Mistakes specific to AVs

Modelling the wrong disruption

Most forecasts model only the disruption of the gasoline vehicle by the electric vehicle (EV) in a like-for-like, one-for-one substitution. These forecasters assume the cost savings and utility improvement of EVs over ICE vehicles are minor, so adoption is slow, as ICE cars are only replaced gradually in new car sales over the course of decades.

But the more meaningful disruption will arrive before this first transition is anything like complete. It is a business and ownership model disruption – with TaaS replacing car ownership, both of ICE vehicles and EVs. With TaaS, the cost savings are dramatic, and undercut both new car sales and the cost of keeping the existing fleet on the road. This disruption can happen much faster – within a decade – with far greater benefits for the economy and society than is generally recognized.

Underestimating cost savings of TaaS

The scale of the cost savings that will drive the fast adoption of TaaS are not widely appreciated. These cost savings come from a reduction in vehicle degradation, which leads to lower maintenance costs and longer lifetimes. **Because an EV has only 20 moving parts compared to 2,000 for a car with an ICE, there is less to go wrong. There is also far less friction, so less heat and vibration to cause damage.** This means electric vehicles can last for 500,000 miles vs 200,000 miles for an ICE vehicle, and cost 80% less to maintain. Spreading the initial vehicle purchase cost over more miles driven leads to a dramatically lower cost per mile.

Mainstream forecasts are generally obsessed with the crossover point in EV vs ICE upfront costs, which they see happening in the 2020s. But this misses the point entirely. Cost per mile is the new key metric, and upfront cost is only one factor in its calculation. Of far more importance is vehicle lifetime. Further savings come from reduced insurance, finance and fuel costs.

Ignoring dynamic factors that drive S-curve adoption

Once adoption unfolds, systemic, dynamic factors drive it ever faster. An example is the feedback loops in the potential death spiral of the gasoline car. Once an early tipping point in TaaS is reached, where people in cities realize that a car is always available when needed, we can expect people to begin selling their used vehicles. As used-car supply increases, and demand drops, used car prices will fall. Dealerships will begin to struggle.

Meanwhile, the case for buying a new car becomes ever harder to justify, causing new car sales to drop. Economies of scale in car manufacturing will begin to unwind, increasing the cost of ICE vehicles and reducing sales further. R&D in ICEs will stop as manufacturers focus on TaaS vehicles, meaning ICE cars won't evolve and will become even less attractive. Eventually, the supply chain will break down, and ICE sales will stop completely.

Self-fulfilling forecasts and the risks of being wrong

Forecasts can become self-fulfilling, as decisions made without knowledge of a better alternative can lock in high-cost, uncompetitive business models that make changing course at a later date more difficult.

Consultants and businesses tend to hide behind commonly-held viewpoints and not challenge the received wisdom. In fact, their business incentives dictate that it is safer to follow the crowd. Some find the safest course, career wise, is to base decisions on the overwhelming consensus. As the saying goes, nobody ever got fired for choosing IBM.

The danger for business leaders and investors is that they take these forecasts as gospel and allow them to become self-fulfilling, thus missing out on the opportunity to lead, implement and realize key benefits of the transition. And this is particularly so with the rollout of TaaS, where only a small number of platforms are likely to win out. Courage and vision are needed in a marketplace where the danger of getting left behind is very real. As Warren Buffett says: "You pay a high price for a cozy consensus."

RethinkX is a not-for-profit think tank, and we have no intention of making money from our analysis. Our research is provided as a public good, and we hope decision-makers can use it to make better choices. We are very happy to clarify any issues raised here, or to engage with policymakers, free of charge (subject to time constraints!).

About RethinkX

RethinkX is an independent think tank that analyzes and forecasts the speed and scale of technology-driven disruption and its implications across society. We produce compelling, impartial, data-driven analyses that identify pivotal choices to be made by agencies, investors, businesses, policymakers and civic leaders.

Decisions made based on mainstream analysis risk locking in investments and strategies that are inadequate, and that make businesses, investors and societies poorer by shackling them to expensive, obsolete, uncompetitive assets, technologies and skill sets.

We focus on understanding the dynamics and the systemic nature of disruption across key market sectors, according to a highly evidence-based approach. This approach is designed to help make decisions that maximize the benefits and minimize the costs - economic, social, and environmental - of technology disruption.

Rethinking Transportation is the first in a series of reports that analyzes the impacts of technology-driven disruption, sector by sector, across the economy. A copy of the report is available for download, free of charge, on our website.

We invite you to learn more at www.rethinkx.com

Disclaimer: www.rethinkx.com/disclaimer