
THE FUTURE OF MOBILITY

From battery-powered cars to flying taxis, life on the move is set to change.

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Malcolm Borthwick (MB): Hello and welcome to Disruption Week. I'm Malcolm Borthwick, editor of Intellectual Capital at Baillie Gifford. During Disruption Week we're looking at four sectors which are going through transformational change. Healthcare and payments, which we looked at earlier this week, agriculture, which we're looking at tomorrow and the theme of today's webinar, which is mobility in transportation.

The world's first Model T Ford was delivered to its new owner on 1st October 1908. And the impact of the earliest mass market car was transformational. It was faster, cheaper, and more convenient. But let's fast forward to our relationship with the car today because it's taken a few wrong turns. Firstly, cars are inefficient. We rarely use them to their full capacity or capability. For example, the average speed of a car in central London today is eight miles an hour. That's the same average speed as a horse drawn carriage in the 1890s.

Secondly, they pollute, and they pollute a lot. Road vehicles account for 17% of CO₂ omission. And finally, thirdly, there are lots of safety implications for cars. There are more Americans who have died in car crashes since 2000 than the entire amount of Americans who've died in armed conflict in the 20th century. So these are some of the factors that are leading to the disruption of mobility and will shape the future of transportation, according to Thaiha Nguyen, who joined us in our studio here in Edinburgh. It's a bit of warm autumnal day here in Edinburgh. Thaiha, great to have you with us.

Thaiha Nguyen (TN): Thanks, Malcolm, and hi everyone. Thank you for coming to the webinar today. I've spent lots of time thinking and researching the topic of future of mobility. I find it a fascinating area and I'm so glad to be able to share with you some of my thoughts today.

MB: Thanks very much, Thaiha. Just to talk a little bit about the structure of today's webinar. It'll be 45 minutes. Thaiha will set out the case for the disruption of mobility for the first few minutes and then we'll have a conversation where we'll explore issues such as shared mobility, electrification, and autonomous cars. And then we want to hear from you the audience, we want to hear your questions.

And hopefully our conversation will spark plenty of questions. So if you do have questions during the course of the webinar, we'd love to hear from you. Please use the Q&A button which is at the bottom of your screen. And we'd also like to hear your thoughts on a poll that we wanted to kick off with. And the



subject of today's poll is, when do you think autonomous vehicles will become mainstream. Do you think they'll become mainstream in 10 years' time, 25 years' time or for the sceptics, never, not at all?

So, if you could select one of those and we'll come back with the results of the polls to discuss it with Thaiha later in the webinar. But firstly, I just want to start the webinar today with Thaiha's thoughts on what we're seeing in terms of the acceleration and disruption here and also maybe looking at some of the winners and losers, Thaiha, So, over to you.

TN: Thanks, Malcolm. And first, I think, let's have a look at some of the pictures. The pictures you are seeing on the screen now are of New York City, 5th Avenue. The first picture is before the age of automobile in 1900 and what you can see on the pictures are just horse carriages. The second picture, what you can see is just cars on the road. And what is so striking about those two pictures, is that they were just a decade apart.

And if you fast forward to today, a hundred years later, what you can see in the third picture is just a lot more different forms of automobiles. So, for the most part of human history, we travelled at a rather slow speed. Even when we leverage the power of horses and sailing ships, the speed and freedom of travel is still very limited. However, things changed dramatically over the last hundred years or so, starting with the advent of the Ford Model T in 1908, like you mentioned earlier.

98% of the time that we have had the wheel, we have not had the automobiles. So, you can see the speed of change in transportation over the last century, has been so much greater than all the previous thousands of years combined. But I think that it's going to be very highly likely that the next few decades are going to witness even more rapid changes than the last century did.

So then you may ask, why do we even care about this. I think we care about this because transportation is deeply embedded in our lives, and we make lots of important decisions in our lives. For example, where we work, where we buy houses and when we send kids to schools, based around how convenient it is for us to travel. And not only transportation, is the massive industry in itself, accounting for more than 10% of the total US GDP. But it also has an connection to other parts of the economy, whether it's energy, real estate or media, for example.

So, I think that there will be industries that it's relatively easy for us to imagine the impacts of disruptions in mobility. Like, oil and gas, like trucking, like auto EMs. But there are industries that will be affected by second order, third order, fourth order impacts of disruptions in mobility. And I'd like to give you two examples.

The first one is media. So recently, the CEO of Netflix, Reed Hasting, he said that there often two primary scarce resources that could put constraint on the growth of an entertainment business, which is consumers' time and money. It's interesting because imagine if technologies like autonomous driving or flying cars that can give us back some of the time that we spend on travelling to do something else, in the US people travel, on average, an hour a day.

That's only an hour, but if we add that up for hundreds of millions of people or billions of people on earth, then that could be enormous pools of profit for entertainment or advertising companies to tap into. Another example could be real estate. What if we don't have to live close to our office for convenient travelling to work. Imagine if we could live in the suburb areas and then travel in to work through autonomous cars or flying cars, again. Then surely we can reduce the pressures on urban cities, equalising housing prices and make housing more affordable for everyone.



And that's not entirely hypothetical. We are actually seeing some evidence of how travelling affects real estate during the pandemic. We have seen lots of employees started to move out of expensive areas into cheaper areas following the announcement of suburb working. And actually, one of our investment holdings in real estate, called Zillow, have said that 30% of their employees actually moved since the flexible working announcement and now they're living in 50 states across the US compared to just 25 years ago.

So, I think those are just two simple examples. But, hopefully, illustrate the potential widespread disruptions across the economy as a result of a mobility revolution. And I think that's going to be a very exciting time for long-term investor like us, because we can imagine the future and hopefully pick out the right winners of the future. So, I return to you, Malcom.

MB: Absolutely. So, we're going to look at three areas now, Thaiha. Shared mobility, electrification, and also autonomous vehicles. I think what's interesting, what you were talking about there, you were talking about how embedded in our psyche cars are. Most of the audience who are tuning in here will either own cars or will certainly have views on cars. In terms of shared mobility, how hard will it be to shift the mindset of people relinquishing the idea of owning a car to sharing ownership of a car?

TN: That's a great question. I completely agree with you that people are so attached to their cars, especially in the US. It's become like a car-loving culture. So how do we change that behaviour. I think there always going to be people who are deeply motivated by doing the good things and so they will be the early adopters of any new technologies or new services, like shared mobility. Unfortunately, most people are not like that.

So, first thing is how to create attractive economic incentive for them. So, right now, in big cities like LA, in Boston, in New York, the cost of owning a car has been climbing up. Some statistics I've read is like \$10,000, \$9,000, \$10,000 a year to own a car. Because you have to pay for very expensive parking and insurance in those big cities. So, in those cities you can see people adopt shared mobility much earlier than in other areas.

In rural areas or suburban areas, unfortunately it hasn't been the case yet. So, I think that over time the cost of shared mobility has to come down in order for people to switch. Whether that's going to come from autonomous driving, which removes the big cost of driver in the car, or it's going to be through pool services, like what Uber or Lyft already offer. Or it's just a scale. So, as the companies like Uber or Lyft gains more scale, they're able to pass down the cost to consumers.

And beyond the cost, I think another issue that we have to think about, is how to make the experience of shared mobility become more comfortable and more personalised. We're attached to our cars because we have things that are tailor made to us. We have comfortable driver seat, we have baby seat for our kids. We even have our preferred music list already installed. So how do we change all of that?

And for example, companies like Wavemo have been talking about experimenting with free Wi-Fi and free streaming service in the autonomous driving, in the shared network, to make it more comfortable, more enjoyable for people. So I think these could be the two components that I hope would change over time and encourage more people to use shared mobility.

MB: And with shared mobility you talk about Uber and Lyft, which I think's interesting. I also think the whole idea of car occupancy's interesting. If you look at the US, the average car occupancy is 1,1. So we're not really utilising cars very much. And looking around the streets of Edinburgh here, in London, looking at a lot of the taxis, they don't seem to be utilised much either. So, are the likes of Uber and Lyft the green solution to this?



TN: It's a great question. I think there have been sceptics saying exactly the same thing, which is Uber and Lyft actually makes the cities more unsustainable. Because it's just easier and it's just so convenient. So sometimes people will just substitute public transport and even walking than take a car ride. And there's been some study saying that for each mileage that Uber and Lyft removed from car ownership, they are like 2,8 mileage in their shared mobility network.

So, it's interesting issues and there's companies that have been tackling that. I've recently met a very interesting private company called Via Transportation and what they do is combine the convenience of shared mobility, like Uber and Lyft, with a public transit. So you can imagine, as a consumer, you can just order a ride in the same way as Uber and Lyft, open the app and request a ride when you want it.

But instead of a four-seat car coming to the door, it's going to be a minibus. So they're going to pool you along with ten to 15 other people going on the same route, so that really tackles that car occupancies that you mentioned. And also, don't forget the other forms of shared mobility, whether it's bikes or scooters, because those are the green solutions. And apart from being environment friendly, they're also a great solution for the first and last challenges in the less developed communities. So, I think, yes, there will be different solutions to address those issues over time.

MB: Speaking of different solutions, let's go right to the future. So, on your screen at the moment you can see a flying taxi which is one of Lilium's flying taxi, with, if you look at it closely there's Manhattan and the Empire State Building. So, Baillie Gifford has invested in a couple of flying taxi companies on behalf of their client, Lilium and Joby Aviation. Some of this looks like science fiction. Where are we with flying taxis?

TN: I admit that I used to think that it was science fiction. I first heard of the flying car concept back in 2018, a company called Kitty Hawk and when I looked at that I thought, no way, it's too crazy. And then in 2019 I had an opportunity to attend the Uber Elevate Summit organised by Uber in Washington DC. And then for two days, we've seen thousands of people, like businesspeople, investors, engineers, politicians, and regulators coming together and talking about this topic.

And at that moment, I thought, oh my God, this could be real, this is happening. So, I'd say that we have seen a convergence of multiple technology domains from electric propulsion, like battery technology, aviation engineering, lightweight materials, autonomous driving system, that makes the flying car concept plausible.

I wouldn't say that we are here yet in terms of the technology, but we have all the foundation technologies laid out to build the aircraft. And actually, right now, all the companies in this space, whether it's Joby, Lilium, and others, are in the phase of building the aircraft and get certified by the regulators, like the FAA in the US. And then the next step for them could be building the infrastructure related to it. For example, the vertiports for the take off and landing, onboarding customers, and also build the business model around it to make it become a feasible product.

MB: So, you mentioned there were quite a lot of flying taxis in this space, why Joby Aviation and Lilium?

TN: Yes, I think it's quite common in a nascent field that you're going to see lots of exciting and ambitious companies trying to tackle the problem. So why Joby and Lilium? I say that first is the talent. In a field like this where talent pool is very limited, I think talent could be a big competitive edge. And Joby and Lilium are the most well capitalised companies in this space, and they have been able to attract many talents to come and work for them. Joby, for example, have recently acquired Uber Elevate, which is one of the pioneers in the field of open-air mobility.



And then, they also working very closely with the regulators, and I think having close a relationship with regulators at this stage, is very important to get the aircraft being certified. And if anything, regulators are also learning from these companies because it's an entirely new area and there's no precedent. So, working hand-in-hand with regulators is going to help those companies set a standard in the industry, which other companies later on have to follow.

Yes, and probably one more thing I would mention is that, I think, it is really the long-term thinking and the willingness to embrace asymmetries of returns at Baillie Gifford that allows to invest in such early-stage companies later, be it Lilium. Because although it's early, but the potential payoff if things go right, could be huge.

MB: So, you mentioned long-term thinking there and we're long-term investors. How do you measure that within the companies before you invest in them? What kind of things are you looking for?

TN: Yes, like I said, I think first and foremost is the people. We look at the management team. We look at the founder of the business. Whether there is that committed, they have the vision of how to take this. They're not just motivated by monetary value. But also being able to do the good things for society. And the guys at Joby and Lilium, they are really motivated to really solve the challenges of urbanisation happening so fast and we're going to soon run out of all the spaces on earth. Where do we go next? Obviously go up to the sky.

And then, I think looking at the technologies, we are generalists. So it is really hard for us to know whether technologies are feasible or not. But just because something is hard, doesn't mean that we don't try not to do it. We do it by talking to different companies in the field, engaging with experts, engaging with scientists, to really help us validate some of the claims that the company make.

So, for example, before investing in Lilium, we actually asked the White Lab in Cambridge to do some of the validation for the battery technologies that Lilium claimed they were able to do. So, we do quite a careful due diligence with these companies. But first and foremost, I think, is the belief in the people in the management team.

MB: That's interesting. It's all about the people and the culture. I want to move onto electrification now. And maybe a lot of our audience are probably thinking of Tesla when we start talking about electric vehicles but there lots of other interesting companies out there, aren't there?

TN: Definitely. I think Baillie Gifford is one of the very early investors in Tesla and a big believer in EVs. And I think the shift to EV is inevitable. However, it's not going to be a smooth rosy curve. There's going to be challenges along the way. And when I say challenges, I don't mean to be pessimistic. I look at it through an optimistic angle that, if there are challenges, then there would be exciting companies, interesting companies that are trying to solve the problems.

One of the challenges that we have with EV right now, and potentially in the future, is around battery production. Because scaling battery production is costly, and it takes a long time. Right now, we probably have capacity for like 3 million units of EVs per year. But in the future, we're going to need tens of millions, hundreds of millions of EVs per year. So imagine the volume of batteries that are needed in that future. So, for that reason, we think that battery production's going to be a very important area for electrification.

And so, we made investments in companies like Northvolt, which is a Swedish company that's trying to build production facilities here in Europe. We also invest in CATL, which is the established leading player



in battery producers in Asia. We also recently made an investment in a private company called Redwood Materials that are trying to build facilities for recycling lithium-ion batteries, which is going to be increasingly important in the future. So, it's just a few examples to answer your questions.

MB: You mentioned batteries. The other interesting thing is the charging infrastructure. I was in a London cab a few weeks ago and he'd just converted his cab to a hybrid model, part electric, part petrol. And one of the things he was chatting about is that in London a few of the lamp posts, you can plug in your car to them to charge it, and he was saying that a few of them weren't working. It's quite hard when you're trying to charge your car, for example, and you can't find the charging parking space. How are we developing that infrastructure which is so important for charging electric vehicles?

TN: You're definitely right that charging infrastructure is the important piece of the whole puzzle and we have seen lots of progress over the years. I think the first is, thanks to Tesla, who are building up the Tesla supercharge network with a fast-charging infrastructure to really get people interested in the first place. And now, Tesla is talking about opening up their charging infrastructure to other OEMs to help all others moving along towards the future of sustainable energy.

We also invest in a company called ChargePoint, which is building the largest charging network in the US and want to do the same in Europe. And ChargePoint's view is that most people are going to charge their cars at home during the night or charge in their office place during the day. So, they're actually working with employers to install the charging port in the office place for employees.

They also partner with shopping malls or hotels, and restaurants, and bars, etc., to build the charging port, so that people can always enjoy their meal and charge their car at the same time. And then we also have companies in China doing completely different things. Like, Nio, which was one of our investments, that's building battery swapping stations.

So, their views are that consumers don't have to own batteries. If the battery's getting old, they can just come to the swapping stations and swap for a new battery under a few minutes. So, I think there's lots of different ways that people in the industry are trying to solve these infrastructure challenges and I'm optimistic that in the future, it's no longer the bottle neck for EVs.

MB: Great. Thanks, Thaiha, I want to go back to our poll now before we move onto autonomous vehicles, because it's a good transition.

TN: I'm curious.

MB: So, the results of the poll, it's very split. So, 50% say ten years' time. So, just to remind you of the question which is when will autonomous vehicles become mainstream. 50% say in ten years' time, 49% say 25 years' time, and 2% say never. So that's quite an optimistic audience. What's your view, Thaiha?

TN: Difficult question. I don't think I have a simple answer for this. I think to understand why autonomous driving has been so difficult and why it takes us so long to have autonomous driving on the road, we have to understand the autonomous system. So there are three components of an autonomous driving system. The perception, which is how the car sees the road. Then the prediction, which is how the cars can what all other agents on the road are going to do in the next few seconds. And then the third is the planning, which is based on the predictions, what are the cars going to do next.

All three of them are incredibly difficult. But through my conversations with companies in the field, it seems like prediction is the hardest bit. So, if prediction is the hardest bit, then it's quite intuitive to think



that there are going to be applications like delivery robot or tracking that are going to happen earlier than passenger vehicles. Because the environment that delivery robots or trackings have to do with, whether it's the highway or close to the pavement with very slow speed, it's going to be a lot less complex than the urban environment that the passengers' vehicles have to deal with.

So, yes, we're going to see applications in those before passenger vehicles. And then even when it comes to passenger vehicles there's no simple answer. Because it depends on the scale of the operations that we are talking about. So, if we talk about certain areas with very favourable weather, very clear road guidelines, then autonomous driving is already happening. So, today in Phoenix, Arizona, you can actually order an autonomous ride directly from Waymo app or from Lyft. But if we are talking about autonomous driving become ubiquitous, it happens in all weather conditions, at all times, in all cities, then I think we're still quite far ahead.

MB: So, I just want to ask one quick question before we move onto questions from the audience. Where are we with progress with autonomous cars and society acceptance of them?

TN: It's hard to answer that because right now, like I said, we haven't seen the scale deployment of autonomous driving yet. So, the supply side isn't ready yet for us to know what the demands are going to look like exactly. But from the small-scale operations at the moment, I see it quite encouraging acceptance from the public. So, like I said, in Phoenix, Arizona, people are quite excited to take the autonomous ride with the firm Waymo.

And if you think about Tesla Autopilot, although it's not fully self-driving system, it's not fully level for autonomous system yet, but people they are generally, they excited to try it out. And there's even concern that whether people are too excited that they forget that this is not a fully self-driving system yet and they still have to pay attention to the rules and to the road.

So, I think from this little evidence that we have so far, I say that, yes, people are quite willing to try and I'm optimistic that the acceptance will be high. Because at the end of the day, there so many car accidents per year and more than 90% of that comes from human error. And if we can leverage the machine and reduce that rate. Even though it doesn't have to be a hundred percent safety, it only needs to be better than human driving, That's good enough.

MB: That's a good transition to the questions that we've got coming in from the audience. Just a reminder, just use the Q&A button which is at the bottom of your screen if you want to ask question. So, here's the first one, what do you think about the case of LiDAR or Camera Technology for autonomous vehicles?

TN: Very good question. I think it's a debate right now in the industry itself. Because there are two approaches of autonomous driving to have. I often say it's like Tesla versus the rest of the world. So, Tesla is the one who goes only with computer vision and no LiDAR, just with camera. And then you have the rest of the industry, like Waymo and others, that are using LiDAR. And I guess that this is really difficult for us as a generalist to know which is the better one, because even the experts in the field are debating and have their own opinions on this.

My view on this is that the two approaches that we see comes from historic reasons. So, like Tesla first, because they sell the car to consumers so they cannot afford to have a very expensive LiDAR that's worth, at the beginning, hundreds of thousands of dollars sitting on their cars. It's not going to go to the mass market, so they cannot go down that route.



Whereas Waymo, at the beginning, they were not constrained by that. So they can afford to follow this approach. I think both can work. And we have systems like Tesla, we have systems like Waymo, Aurora, both seems to have greatly progressed over the years. If anything, I think is the questions of whether LiDAR is going to come down in terms of cost as quickly enough, before computer vision's taking off.

MB: It's interesting you mentioned computer vision there because there's a question that's come in which I think's a fascinating topic, is whether or not AI and machine learning can mimic human behaviour when it comes to autonomous driving. Because that kind of thing blows my mind.

TN: I think as the human brain is so complex, we go through millions of years of evolution to be where we are today. So I say it's a really difficult thing for the machine to mimic. We have come quite far with the autonomous driving system, but there are still things that the machine is not quite there yet in terms of solving. Just to give you some examples that I find fascinating.

So, recently at the Tesla AI day, Tesla gave two examples of the issues that they are trying to teach their AI. One is called temporary occlusion. So, the cars have to be equipped with lots of high-definition cameras to see things. But what if these are blocked in a very crowded intersection?

So their vision is temporary blocked and then they cannot make the predictions so they cannot move forward. So that is something they are solving. The second issue they're talking about is called memory loss. So, imagine a car that's seeing a sign saying that a hundred metres ahead, there's going to be a lane merge.

The car drives forward a hundred metres and then it just forgets that sign that it saw a hundred metres earlier. So, how do you make the cars remember all of the things it saw and incorporate that into decision making? So, yes, those are just two examples that I find fascinating, just to illustrate that to mimic human behaviour is really difficult.

MB: I've got a question here. I know you mentioned Northvolt, the Swedish-based green battery company earlier. The question relates to, how many companies have you found outside the US which are innovating in this space of electric vehicles and autonomous cars?

TN: Yes, so Northvolt is one. It's a Swedish company here in Europe. And then I would say that we haven't seen that many innovations coming from Europe. We see it mostly from the US and another area, unsurprisingly, is China. We have seen lots of innovations coming from China. For a variety of reasons. I think it could be that because China has to solve the problems of pollution which is really huge for them. They also want to reduce the reliance on importing oil. But also, there could be a great ambition from the Chinese government to want to claim the leadership in the next era of mobility that they didn't have over the last hundred years.

So all of these create a very supportive regulatory environment in China for innovation to take place. And I mentioned a couple of names, like Nio, which is the Chinese OEM. There's CATL, which is the battery producer. But we also have companies like Li Auto or Xiaoping that are doing electrifications. And even in the flying car space, we have companies like EHang. Which is similar to Joby and Lilium in the West. So, I see definitely a lot of innovations coming from China as well, beside the US.

MB: Where's Lilium based?

TN: Lilium is based in Germany. So that's another European name.

MB: I just wanted to check. I wasn't quite sure.



TN: Thanks for checking that.

MB: I had a few questions about carbon footprint. This is an interesting one. So, I assume flying taxis will have higher carbon emission than ground-based taxis. Are they really a good idea from this perspective? Because we did talk about carbon emission to begin with.

TN: A very good question I think is whether is the ground electrifications or in the air electrifications. Electrification is only as good if the energy that we use to make the battery and to generate that electricity is the green one. So I don't think that the is problem unique to open-air mobility. I think it's the problem of the whole electrification field that we have to address over time. And right now, I would say that not all the electric sources are green.

Not all the battery productions are green. But hopefully companies are taking care of this. And in the future we're going to have technologies, like renewable energy, getting cheaper and become more affordable. My hope is that those energy sources will become greener in the future, and we no longer have the problems that you asked today. But I acknowledge that it is something that we have to think about.

MB: Yes, it's interesting isn't it, it's often about the supply chain?

TN: Yes.

MB: Here's another battery related question. Are solid-state batteries going to supersede lithium-ion batteries?

TN: Yes, it's a great question, I think. So, solid-state battery has some very interesting benefits over traditional lithium-ion battery. It is lighter. So, for those who are not familiar with solid-state battery, the electrolyte, instead of being liquid, is solid. So that's why it's called solid battery. It's safer. It's less inflammable. It also has high energy density. So it has all the very good characteristics. The problem with that is that it's still very expensive to produce at the moment. It's a matter of scale. The same thing that we have seen with lithium-ion battery before.

But also, the questions of how would you find the right materials, like the right metals, to go into those electrolytes to make it the most conductive. So, I would say that we definitely see progress in solid-state battery and I'm sure that they're going to be place for solid battery. But I'm not convinced that we need solid battery for EVs to take off, because right now I think lithium-ion battery has seen so much progress. And we have seen the cost come down over ten x over the last decade and now it's almost reaching \$100 per kilowatt hour. Which many experts consider like a holy grail.

Because at that price then the cost of EVs is nearly reaching the cost of internal combustion engines. And there's going to continue to be progress in lithium batteries that I think will be sufficient for EVs to take off. Solid battery is probably going to be in other applications that require more power. Maybe like EV, flying cars, or planes and trains, for example.

MB: We have touched on elements of this, I think with infrastructure and batteries. But maybe there are more specific things within the supply chain. The question is, is the supply chain coping with the pace of EV manufacture?

TN: I think, like I said earlier, battery production is really a big challenge here because this is not easy to scale it up. So, to some certain extent you can say that it hasn't been kept up with. But again, I say there've been efforts from many companies around the world trying to tackle that. There is also interest in



thinking about how recycling is going to play a role in the future. Because right now, we only produce a limited number of EVs, so that's why we don't need to care too much about recycling.

The cost of virgin lithium is five times cheaper than the cost of recycled lithium. But in the future, if we produce hundreds of millions of EVs, then that recycling part of the battery becomes so important. And right now we see efforts from companies like Redwood Materials, which is a private company in the US.

Or even Umicore, which is a public company in Belgium, yes, another European company, that's trying to think about the recycling of battery. So I definitely think that the supply chain is innovating as well at the same time to keep up with the pace of EVs.

MB: You've done a great job there about answering a couple of questions that have come in about battery recycling as well. So thanks so much. That's all we've got time for with the questions from the audience. Thanks so much for those. I wonder, Thaiha, if you'd like to leave the audience with one thought in no more than a minute, what would it be?

TN: Gosh, it's hard because I have so many thoughts. But maybe I would reinstate what I said earlier in the session, that I believe that the speed of disruption is accelerating and we're going to see disruptions in mobilities happening over the last few decades, the speed of change is going to be even more than what we've seen over the last hundred years or so. And that is a really exciting time for long-term growth investors because we can deep dive into imagining the future and pick out the winners.

MB: It's great to end on such an optimistic note, Thaiha. Thanks so much for joining us.

TN: Thank you.

MB: I really enjoyed our discussion. I hope you, the audience, have enjoyed it as much. And rest assured we will get back to you with answers to those questions that we didn't have time to get to in the Q&A at the end. And also, we'll make a recording available of this webinar which will be available on the Disruption Week sites next week.

If you would like to find out more about our insights, our investment thinking, into various topics, I'd recommend Thaiha's paper on The Future of Mobility, which you can find on the Insight section of our website at bailliegifford.com/insights. Tomorrow in Disruption Week we're talking about agriculture. But in the meantime, thanks for you investing your time in Disruption Week. Goodbye.

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