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THE RACE FOR AUTONOMOUS RIDE-HAILING:

Developing a Strategy for Success

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EXECUTIVE SUMMARY

The race to win in autonomous vehicles (AVs) is well underway, with scores of companies scrambling to make their mark in the new market. While AVs stand to advance industries from farming to long-haul trucking, it's their ability to completely transform passenger transportation that has caught the imagination of the public.

Because AVs are likely to be too expensive for personal ownership, there is broad consensus that deploying them within ride-hailing networks will be, at least initially, one of the most commercially viable paths for autonomous passenger transportation. But capturing a slice of the ride-hailing market will require strategic thinking; players must determine which business model is right for them given their unique positions in the market.

Much of the analysis from industry experts has focused on various players' technological advancements, yet the Theory of Disruptive Innovation reveals that *how* the AV technology is deployed will actually be the greatest determinant of its commercial success. To that end, it's essential that AV players understand whether AV tech can be positioned as a Disruptive Innovation or a sustaining innovation.

Disruptive Innovations initially take root in simple applications at the bottom of a market, and then relentlessly move upmarket until they displace established competitors. In contrast, sustaining innovations improve existing products, and improve the cost position of incumbent companies. Our analysis suggests that AVs will be a sustaining innovation to ride-hailing services because AVs could lower the cost structure of incumbents and will likely improve safety.

This matters because in battles of sustaining innovations, it's usually the incumbents—in this case Uber and Lyft—who win. These players are powerfully motivated to embrace an innovation that could lower their costs, and the fact that it fits into their business model enables them to respond to any competition that threatens their core business. In this scenario it's incredibly difficult for entrants to replicate all of the advantages incumbents naturally have—from brand equity to customers and assets. Given the competitive forces at play, we offer the following recommendations:

1. **Well-resourced players new to ride-hailing should become the metaphorical Microsoft.** Players like Waymo and GM Cruise should avoid the temptation of using their vast amount of capital to engage in head-on competition with entrenched incumbents. Instead, they'll be better served by focusing their efforts on monetizing what is likely to be the scarcest technology in AVs: the operating system.

2. **Less-resourced players targeting simpler applications should own their niche.** Some of these players may believe that by targeting less-demanding applications such as retirement communities, they will be able to hone their technology under less competitive circumstances and eventually move upmarket. But, given Uber and Lyft's distinct advantages in a battle of sustaining innovation, reaching the top of the ride-hailing market is very unlikely. Instead, they should focus on building a viable business model in their niche applications.

3. **Ride-hailing incumbents should pursue partnerships but retain flexibility.** Uber and Lyft's in-house AV efforts, though trailing with respect to leaders in this space, could potentially act as an insurance policy against scenarios where they could be disadvantaged by not controlling their own self-driving tech. But as soon as a proverbial insurance policy is no longer required, they may be wise to give up owning AV technology and save hundreds of millions of dollars as a result.

Autonomous vehicles represent an exciting new chapter in transportation. Coupled with ride-hailing, they stand to completely reimagine how people get from place to place. With the right strategic vision, AV companies can play a principal role in the advancement of the industry—and make a handsome profit in the process.

INTRODUCTION

Autonomous vehicles (AVs) have captured the world's imagination as companies move ever closer to bringing this technology to the cusp of reality. While much of the discussion of self-driving cars has focused on the technology itself and its societal benefits, there is an equally important discussion needed around the business strategy required to get the product into the hands of consumers. Indeed, while estimates vary, UBS projects that autonomous vehicle technology will produce global markets of up to $2.8 trillion by 2030.[1] With so much potential revenue on the line, it is of little wonder that investment in the technology is running in the billions of dollars per year as companies vie for pole position in the automotive future.

Amid this scramble, AV players are targeting a variety of applications ranging from autonomous farm vehicles to long-haul trucking to last-mile delivery. Yet it is AVs' potential to transform passenger transportation that seems to have captured the imagination of the public. Despite fully autonomous passenger vehicles being years from market-ready, we know one thing for certain: most people won't be able to afford them. For this reason, there is broad consensus that deploying AVs within ride-hailing networks will be, at least initially, one of the most commercially viable paths for passenger transportation. AV fleet owners can amortize the high upfront cost across a large number of riders to earn an attractive rate of return, at a price riders can afford.[2]

But what's the optimal path for the AV players aiming to capture a slice of the ride-hailing market?[3] For example, should Google's Waymo or General Motors' Cruise launch their own ride-hailing services in competition with Uber and Lyft? Should Uber and Lyft abandon their in-house AV technology development efforts and solely rely on outside technology partners? How can smaller venture-capital-backed companies that are targeting niche applications like retirement communities and shuttle services maximize their odds of success in a space that includes giants with nearly unlimited cash balances?

Facing this uncertainty, we argue that investors, managers, and policymakers should rely on sound theory to guide their decision-making. A theory is simply a statement of causality that emerges from, and evolves through, careful research and investigation into anomalies. It explains what causes what and why, and should be predictive in nature. It is also *circumstance-based*. It tells managers what is likely to happen and why, and arms them with appropriate courses of action given the prevailing conditions in the world.

A theory that has proven its mettle in this regard is the Theory of Disruptive Innovation, conceived by Harvard Business School Professor Clayton Christensen over two decades ago. It is fundamentally a theory of competitive response, predicting the likelihood of success for a new venture given its approach to a market and the presence of entrenched incumbents. This is precisely what new AV ventures need most—a toolkit to succeed as a business, not just to develop the best technology.

In this paper, we will examine the strategic choices faced by various players in the budding autonomous vehicle industry through the lens of the Theory of Disruptive Innovation, and outline their best courses of action for achieving long-term profitability in the ride-hailing market.

This is precisely what new AV ventures need most—a toolkit to succeed as a business, not just to develop the best technology.

THE AV LANDSCAPE: A SNAPSHOT

Before we dive into the theory and its strategic recommendations, let's begin with a brief overview and segmentation of the autonomous vehicle industry targeting passenger transportation. Broadly, there are three types of players in this market: well-resourced players targeting established ride-hailing markets; less-resourced players initially targeting simpler, niche applications; and incumbent ride-hailing networks such as Uber and Lyft.

Figure 1. Examples of AV Players Targeting Passenger Transportation

Group 1: Well-Resourced Players Targeting Established Ride-Hailing Markets

Companies in this first category share two characteristics. First, they have corporate backers with incredibly deep pockets and a willingness to spend billions of dollars to develop their AV technology. Second, they are shooting for the large and rapidly growing ride-hailing markets, either by launching their own ride-hailing networks, or by partnering with others. Though their initial pilots or deployments are geofenced, their target markets are, for the most part, far more complex than those targeted by their smaller peers.

The largest players in this category are Waymo, owned by Google's parent company Alphabet, and Cruise Automation, owned by General Motors (GM). These corporate sponsors have reportedly been willing to invest up to $1 billion per year in their self-driving subsidiaries.[4] While this is a jaw-dropping amount of money to spend on a technology that has yet to produce any substantial revenue, it is still a reasonable investment for a company like Google, which has a cash balance of more than $100 billion, especially considering the enormous market size that self-driving technology could unlock.[5]

Widely seen as the technology leader, Waymo has been working on autonomous vehicle technology since 2009.[6] As of October 2018, Waymo's self-driving vehicles had clocked 10 million miles on public roads across 25 cities in the US, and the company was on track to rack up approximately 7 billion miles in simulation.[7] On December 5, 2018, Waymo launched a limited ride-hailing service called Waymo One in the Metro Phoenix area, and in May 2019 announced that 10 of its cars would be available through Lyft in Phoenix. Waymo has expressed interest both in expanding its own ride-hailing service and in partnering with ride-hailing incumbents, seeking to retain strategic flexibility as the industry unfolds.[8]

Another frontrunner, GM Cruise, has its sights set on the launch of a robo-taxi service in the future, but it's also keeping its options open.[9] GM has sought to offset some of the cost of its self-driving research and development (R&D) by taking on more than $5 billion in investment

Examples of Corporate Sponsors and Their AV Ventures

commitments from companies like SoftBank and Honda,[10] subject to Cruise meeting certain performance targets.[11]

Other noteworthy companies in this category include Aurora, which has recently seen Amazon join its group of shareholders,[12] and Tesla, which claims it will launch its own autonomous ride-hailing service as early as 2020.[13] Argo AI, Zoox, Aptiv, Apple, and Toyota are other examples of well-resourced AV players.

Since the development of self-driving technology is so expensive, these players may have an important advantage.[14] Whereas less-resourced players will need to become profitable much sooner, these deep-pocketed players have the financial resources necessary to fund a long and expensive development cycle.

Group 2: Less-Resourced Players Targeting Simpler Applications

Given the huge appetite of venture capital firms for self-driving investment opportunities, there has been an increase in the number of smaller self-driving startups in recent years. Most of these startups have chosen to deploy AVs in more constrained and relatively simpler environments than the traditional ride-hailing markets being targeted by the larger players.

In general, these players restrict themselves to applications in which their cars can operate at lower speeds. Some also operate only along fixed point-to-point routes to further reduce complexity. For example, Voyage only operates inside of retirement communities where low speeds are required and service boundaries are well defined. Another example is May Mobility, a company that offers autonomous shuttle services along short, fixed routes.

Many of these companies aim to perfect their autonomous technology in these niche markets, and then build upon that success by graduating to larger, city-scale deployments, eventually taking on larger rivals like Waymo. Given their expressed desire to eventually move upmarket, it seems likely they are exploring mainstream ride-hailing as an eventual possibility. For instance, Oliver Cameron, Voyage's CEO, has noted, "Although retirement communities…are the first place we've introduced our technology, they are not where we stop. We will continuously expand community-by-community until everyone is able to summon a safe, affordable self-driving car to their doorstep."[15]

An advantage of this approach is that they can potentially eliminate the need for a safety driver earlier than their larger peers, and reduce ride-hailing costs. AVs are currently being piloted with the use of safety drivers who intervene if the car does something unsafe or can't understand its environment. So long as safety drivers are required to operate AVs, the cost savings from

removing human drivers in ride-hailing will not be achieved. But, if these smaller AV companies are able to eliminate them—and thus reduce their costs so they can achieve profitability sooner in their lifecycle—it could prove valuable to weaning themselves off additional capital raises and give them the ability to funnel profits toward R&D and larger deployments.[16]

Group 3: Incumbent Ride-Hailing Networks

Lastly, the existing ride-hailing networks are critical players in the race to an autonomous future. The two dominant ride-hailing providers in the US—Uber and Lyft—have yet to be consistently profitable,[17] and are pursuing AV technology with vigor. Both have active self-driving technology initiatives and are exploring partnerships with a wide variety of AV technology developers and automakers.

For its part, Uber has tasked its Advanced Technologies Group (ATG) with developing its own self-driving technology while also forging partnerships with Daimler, Volvo, and Toyota,[18] and holding talks with Waymo about a potential partnership.[19] Lyft has its own in-house self-driving technology division called Level 5 and has been more aggressive than Uber in forging partnerships with players like GM, Aptiv, Jaguar Land Rover, Waymo, Magna International, and Ford.[20]

Lyft aims to create a platform so that AV companies can plug their autonomous vehicles into Lyft's ride-hailing network.[21] Uber, too, is increasingly taking a similar approach. At a conference in 2018, Uber CEO Dara Khosrowshahi noted, "I think there are gonna be many autonomous players, and that's why I think as a principle, we will license out our own technology, and then we'll look to build around other autonomous technology as well. We're neutral. We're a network company."[22]

Like GM Cruise, both Uber and Lyft have garnered investment commitments to offset some of the costs of their in-house AV development efforts. Toyota, Denso and SoftBank Vision Fund plan to invest about $1.5 billion in Uber's Advanced Technologies Group.[23] Similarly, Lyft has investment commitments from Magna.[24]

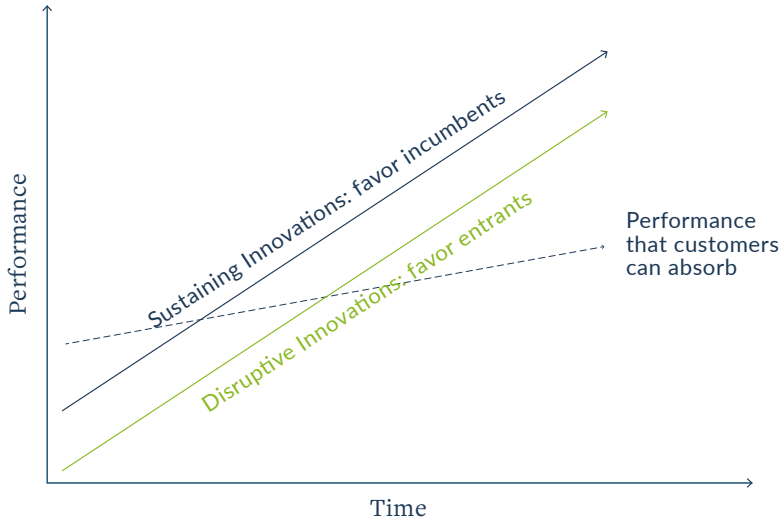
It's clear that incumbent ride-hailing networks are well-positioned in the market. But what is their best path forward—relying on their in-house AV tech, relying on AV tech from outside partners, or something else entirely? And how should the other players position themselves to succeed within this context? Determining whether AV technology can be shaped as a Disruptive Innovation will illuminate the ideal steps forward for all players in their respective circumstances.

AV TECHNOLOGY: DISRUPTIVE OR SUSTAINING?

Contrary to popular misconception, technologies themselves are not inherently disruptive. What determines whether a technology is disruptive—or sustaining—is the way it is *deployed into the market.*

At its core, Disruptive Innovation is the phenomenon in which a product or service initially takes root in simple applications at the bottom of a market—typically by being less expensive and more accessible—and then relentlessly moves upmarket, eventually displacing established competitors. In contrast, sustaining innovations improve existing products, and enhance the profitability of existing companies (see Figure 2). In the automotive industry, innovations that make cars faster, safer, or more luxurious are typically considered sustaining.

Figure 2. Disruptive Innovation vs. Sustaining Innovation



That isn't to say that sustaining innovations aren't as important as Disruptive Innovations; both play a key role in creating a robust economy. Whereas Disruptive Innovations help companies create new-growth businesses and often enable a much larger population to benefit from products and services, sustaining innovations enable the progression of an industry. In this case, autonomous vehicles represent a sustaining innovation to ride-hailing services for the following reasons:

1. AVs Could Make Ride-Hailing Safer

As is characteristic of sustaining innovations, autonomous vehicles hold the potential to provide an improved experience for customers. One of the most attractive outcomes for society at large could be their impact on safety; approximately 37,000 people were killed in automotive accidents in the US in 2017,[25] and many believe autonomous vehicles could substantially reduce this number. Autonomous vehicles could also remove safety concerns around getting into an unknown car with an unknown person.

2. AVs Could Lower Uber and Lyft's Costs

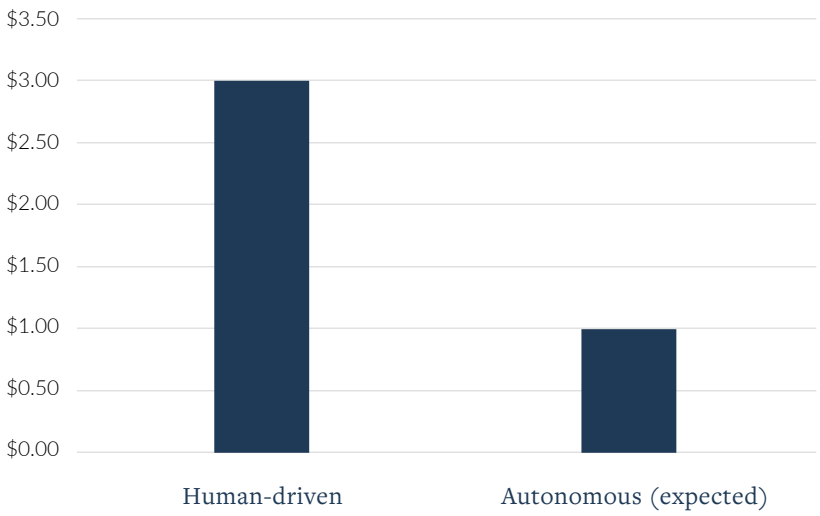
One key aspect of sustaining innovations is the ability for incumbents to capitalize on the innovation. In this case, ride-hailing networks are chomping at the bit to improve profitability by lowering the compensation that must be paid to drivers and/or vehicle owners (though profitability may still be elusive given the commodity nature of ride-hailing where price will follow cost wherever it goes).

Even in a fully autonomous world, many experts believe that ride-hailing networks will not directly own the vehicles. Rather, ride-hailing firms will open their platforms for owners of autonomous fleets to deploy vehicles to "drive" for their networks, similar to how human drivers link into ride-hailing networks today. In fact, Uber's Jeff Miller noted in an interview, "I think there's going to be very large, multibillion-dollar businesses to

be built on fleet operations, [but that market] is not where Uber has a long-term interest in participating."[26]

Among other costs, compensating drivers currently requires ride-hailing networks to charge between $2.50 and $3 per mile to riders, depending on factors such as trip duration and total mileage.[27] Under widely held assumptions about the operation of autonomous vehicles, the cost of a ride may fall below $1 per mile (see Figure 3). Reducing the single largest expense ride-hailing networks incur—human drivers—is an incredibly enticing target for an industry that has yet to be consistently profitable.[28]

Figure 3. Cost per Mile to Riders for Ride-Hailing



3. Ride-Hailing Networks' Business Models Can Deploy the New Technology

More often than not, well-established incumbents get disrupted because they are handcuffed by their existing business models, not because the new technology is inherently challenging to master. But in this case, Uber and Lyft's business models will actually work in their favor, rather than against them.

Business models are made of four critical components: resources, processes, value proposition, and profit formula. Resources, which consist of things like factories, distribution centers, people, and cash, are the most fungible. Though not easy, there is relatively little friction in swapping out resources so long as it doesn't require a simultaneous change in the way a company fundamentally makes money.

Assuming that Uber and Lyft choose not to directly own vehicles, the transition to autonomy represents one of the easier business model adjustments to implement since they will effectively be swapping out one type of resource—human drivers—for another—autonomous technology. Given that both companies already have in-house self-driving car development initiatives, it's clear that they are motivated to absorb AVs into their business model as soon as the technology becomes road-ready.

In the event that Uber and Lyft do end up owning a large number of vehicles on their balance sheets,[29] it will represent a more substantial overhaul to their current business model. But even in this scenario they will still be motivated to embrace AVs because of their safety and profit-enhancing potential, and will harness all of their resources to make the transition successfully.[30]

So why does it matter that AVs are sustaining to ride-hailing services? Because in battles of sustaining innovations, it's usually the incumbents who win.

These players are powerfully motivated to embrace the sustaining innovation of AV technology, and they will respond to any budding competition that threatens their core business. Both Uber and Lyft clearly see the opportunity and threat posed by AVs. In fact, Uber's former CEO Travis Kalanick called autonomous vehicles "existential" to Uber,[31] while Lyft's vice president of engineering Luc Vincent noted, "We aren't thinking of our self-driving division as a side project. It's core to our business."[32]

Whereas Disruptive Innovations allow entrants to play by new rules and avoid head-on competition with incumbents, sustaining innovations give entrants no choice but to conform to the industry's predominant business model as they attempt to compete with industry leaders. In this scenario it's incredibly difficult for entrants to replicate all of the advantages incumbents

naturally have—from brand equity to customers and assets. For example, Uber offers a class of service called UberPool in which rides are truly shared. A driver picks up various passengers and drops them off in different locations. Developing the technology to optimally sequence passenger pick-up and drop-off was a tremendous engineering challenge.[33] And it is one that a new AV entrant would have to develop to replicate the UberPool offering.

Additionally, Uber and Lyft have one advantage other AV players will find especially challenging to replicate: a hybrid network that includes both AV tech and human driver options. The transition to autonomous vehicles will be a process—not an event—and as that process unfolds, ride-hailing firms' networks of human drivers will actually be a competitive advantage against purely autonomous entrants.[34]

Uber and Lyft have one advantage other AV players will find especially challenging to replicate: a hybrid network that includes both AV tech and human driver options.

In their initial incarnations, autonomous vehicles will likely only be able to operate in predefined, geofenced areas. This means that if customers fly into Boston's Logan airport and hail an autonomous vehicle, it may only be able to take them to locations within the Boston city limits. So, to be able to go from the airport to a Boston suburb like Quincy or Waltham, a human driver will be required.

In this way, the AV players best positioned to succeed will be the ones that can provide service wherever their customers want to go. An incumbent ride-hailing firm will be able to offer a more complete solution to customers and therefore remain the app that customers open first.

In fact, Lyft already considers this hybrid network, consisting of human drivers and robots, as a key ingredient in its strategy. Vincent explained, "Lyft will always operate a hybrid network, with rides from both human-driven and self-driving cars....In either event, we'll make sure everyone can get where they need to go."[35]

Uber CEO Dara Khosrowshahi echoed this sentiment, noting, "I think that our network is going to be a hybrid network for a long time." He continued: "Our network is going to be a machine network and a human network together, and I think that's a unique magic that Uber can bring."[36]

Given Uber and Lyft's distinct advantages in the AV space, any challengers looking to maximize long-term profitability within this context must play their cards right. With this understanding, let's examine the strategic implications for each of the key players.

DIAGNOSIS AND RECOMMENDATIONS

To Well-Resourced Players: Become the Metaphorical Microsoft

The Theory of Disruptive Innovation cautions entrants against engaging in head-on competition with incumbents.[37] Thus its recommendations for AV tech companies like Waymo, Cruise, and Aurora—who are all new to the ride-hailing space—are relatively straightforward: don't set your sights on unseating ride-hailing incumbents like Uber and Lyft unless you are willing to bleed red ink for years.

The theory does not predict that such efforts will *always* fail. In fact, there are situations where new entrants have been able to establish themselves as viable competitors through head-on competition.[38] But these examples have something else in common: an enormous financial toll that required companies to fund huge losses for years.

A similar dynamic could play out here, too. As discussed earlier, both Waymo and Cruise have parent companies who have reportedly spent billions of dollars even prior to earning meaningful revenue. And they appear willing to continue such spending until they establish themselves as leaders in the space. But if Waymo, Cruise, or others want to go into direct competition with Uber and Lyft, they will have to not only develop the AV technology, but also develop the customer-facing demand and the adjunct network of human drivers needed to fully service their customers until the industry reaches complete autonomy. In other words, to level the playing field, these entrants to the ride-hailing market will need to replicate at least part of the driver and rider acquisition costs that Uber and Lyft have already incurred. They will also have to fight the inevitable price wars that usually accompany head-on competition between ride-hailing firms.

Therefore, the best way forward for these players is clear: so long as ride-hailing networks are willing to partner with them, players in AV technology should remain just that—technology providers. Waymo, Cruise, Aurora, and their kind have the opportunity to emerge as the Microsoft or Intel of the autonomous vehicle. As with PCs, enormous value may flow to the owners of the operating systems of autonomous vehicles. This is the component within the vehicle that is most difficult to develop and that could have the most limited number of suppliers.

As newcomers to the space, these well-resourced players will need to employ an emergent strategy, iterating over time as they seek to monetize their operating systems. They may discover that their best bet is to own fleets of cars that will be "drivers" on the networks of existing ride-hailing firms. Or they may elect to charge fees to third-party fleet owners who buy vehicles powered by their operating systems. Either way, the road to success for these firms lies in cooperation with ride-hailing firms, not in competition against them.

As with PCs, enormous value may flow to the owners of the operating systems of autonomous vehicles.

To Less-Resourced Players: Own Your Niche

Some startups such as Voyage and May Mobility believe that by targeting less-demanding applications, they will be able to hone their autonomous technology under less competitive circumstances and eventually move upmarket. But given Uber and Lyft's distinct advantages in a sustaining battle, reaching the top of the market is very unlikely.

So what should these players do? In situations where incumbents have the upper hand, entrants like these should set their sights on building a sustainable business model in niche applications rather than planning to unseat the incumbents. There is a case to be made that self-driving technology developed in the context of specific applications will have certain advantages, enabling these less-resourced players to emerge as leaders within these specific applications. For instance, a startup like Nuro may be the first to perfect autonomous delivery while May Mobility may do the same in shuttle services.

Their ability to serve and maintain these niche markets is due to the unique challenges they will have had the opportunity to overcome given their specific focus. In contrast, players like Waymo that are focusing on complex ride-hailing markets may not have optimized the technology needed to address these specific conditions. For instance, to appeal to the more demanding consumers, players focusing on autonomous delivery need to solve problems associated with the "last 10 feet" of a delivery. This would include figuring out ways to deliver an item from the vehicle to the doorstep, regardless of whether it is a house or a third-floor apartment. Focusing on these unique challenges may help these players build compelling value propositions around fast, low-cost deliveries.

If niche players are determined to participate in the mainstream ride-hailing industry, a more promising strategy will be to license their technology to others who can monetize it in partnership with ride-hailing networks. Another route may be to sell their whole companies to an AV stakeholder like a ride-hailing network, an automaker, or others whose own self-driving development efforts are found wanting.

However, because deep-pocketed players like Waymo and GM Cruise are already trying to perfect their AV technology in these mainstream markets, a strategy of eventually selling technology to the likes of Uber is a more risky bet than building a sustainable business in niche applications.

Until AV technology can be reliably sourced from third parties at a reasonable cost, the competitive realities necessitate a balanced approach.

To Incumbent Ride-Hailing Networks: Pursue Partnerships but Retain Flexibility

As incumbents competing around a sustaining innovation, ride-hailing firms hold the strategic high ground. However, they must still play their hands correctly to capitalize on the opportunity that AV technology holds to help them become, and stay, profitable.

What are the strategic choices available to them? One option is to abandon their in-house AV tech development efforts and solely rely on players like Waymo and Cruise to provide them with the software to power the autonomous fleets. From a financial standpoint, this is an ideal solution as it could help the incumbents save hundreds of millions of dollars annually at a time when they are struggling to achieve profitability.[39]

However, if AV operating systems become dominated by a limited number of players, ride-hailing firms may have to cede more attractive economics to those firms. Additionally, though unlikely, Uber and Lyft could be left without a dance partner altogether in an autonomous world. If AVs do manage to get better than human drivers in both cost and performance, a ride-hailing network without self-driving vehicles would be at a tremendous competitive disadvantage.

Alternatively, they could continue to execute their current strategy: develop AV technology in-house while inviting capital from partners, and simultaneously position themselves as a platform for all other AV technology developers to deploy their fleets. Even with lagging R&D in comparison to industry leaders,[40] in-house efforts could eventually produce a viable solution that would act as an insurance policy against scenarios where they could be disadvantaged by not controlling their own autonomous vehicle technology. For example, if Waymo were determined enough to launch a ride-hailing network in key cities, however expensive that might be, it might be able to undercut Uber and Lyft on pricing and take away market share if the ride-hailing leaders were unable to offer autonomous rides. In fact, Khosrowshahi has commented on the risk AVs pose to ride-hailing, stating, "It's existential if we don't have access to the [AV] technology."[41]

Until AV technology can be reliably sourced from third parties at a reasonable cost, the competitive realities of the early stages of the AV industry necessitate a more balanced approach.[42] But as soon as a proverbial insurance policy is no longer required, and it's clear that Uber and Lyft are unlikely to catch up with the industry leaders, the ride-hailing incumbents may be wise to give up on the idea of owning self-driving technology themselves and save hundreds of millions of dollars as a result.

CONCLUSION

Autonomous vehicles are undoubtedly one of the most exciting innovations to arise in passenger transportation in decades. Coupled with ride-hailing, they stand to reimagine how people move from place to place, free consumers from the burden of personal ownership, improve safety, and lead to significant changes in how cities are built. But reaching this exciting future requires more than meticulous development of the technology; the right deployment strategy will be equally important.

As incumbent ride-hailing networks look for ways to remain competitive, their best path forward may be to keep their options open—developing AV technology in-house while simultaneously positioning themselves as a platform for all other AV technology developers to deploy their fleets. Conversely, ride-hailing entrants—regardless of their financial backing—will be best served by avoiding head-on competition with Uber and Lyft, and may find that their best option is to focus on monetizing their technology by partnering with them instead. If done right, there's no reason that each of these players can't secure their financial future by collecting a piece of the pie, and play a principal role in the advancement of the industry.

NOTES

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3. For the purposes of this paper, we have restricted our analysis to ride-hailing networks in the US only.

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13. Tim Higgins, "Tesla's Elon Musk Promises Robot Taxis by Next Year," *The Wall Street Journal*, April 22, 2019, https://www.wsj.com/articles/teslas-elon-musk-promises-robot-taxis-by-next-year-11555974437.

14. Based on our interviews with AV executives and our analysis of the market, the two key factors that make self-driving development so expensive are the large number of edge cases (exceptions that cannot be accounted for in advance) and the high salaries that exceptional AV engineers command.

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29. Based on our interviews with AV executives, we understand that autonomous fleet owners may eventually have substantial bargaining power with Uber and Lyft. This may impact their profits and could be one reason why Uber and Lyft may consider owning some or a large number of AVs on their balance sheets.

30. The Theory of Disruptive Innovation, at its heart, is a theory of competitive response. We can predict with certainty that Uber and Lyft will try everything possible to stay in the AV game. Whether they can successfully own assets (if at all) on their balance sheets depends on a lot of factors (like their ability to raise capital) that are beyond the scope of this paper.

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42. Both Uber and Lyft do not need to have a proprietary in-house technology that would not be shared with other players. They should strive to rope in more partners to develop a viable AV tech, thereby further offsetting some of the costs of development.

About the Institute

The Clayton Christensen Institute for Disruptive Innovation is a nonprofit, nonpartisan think tank dedicated to improving the world through Disruptive Innovation. Founded on the theories of Harvard professor Clayton M. Christensen, the Institute offers a unique framework for understanding many of society's most pressing problems. Its mission is ambitious but clear: work to shape and elevate the conversation surrounding these issues through rigorous research and public outreach.

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