Chapter 25
How to Make A.I. Transformation More Likely to Succeed

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Abstract This chapter focuses on artificial intelligence (AI), drawing from examples of how companies invest in AI, why is has been challenging for established companies to truly unleash the full potential of AI as their core strategy and why the management team must think beyond the process of innovation as well as consider an alternative budgeting approach and capital structure to fuel the critical work surrounding AI.

25.1 Introduction

To get the most out of artificial intelligence (A.I.), companies need to think beyond having data, infrastructure, and off-the-shelf analytics, and redesign their investment processes.

"What are we learning about artificial intelligence in financial services?" asked Ms. Lael Brainard, one of the seven members of the Board of Governors of the US Federal Reserve. "My focus today is the branch of artificial intelligence known as machine learning, which is the basis of many recent advances and commercial applications," the governor told her audience in Philadelphia, Pennsylvania. "Due to an early commitment to open-source principles, A.I. algorithms from some of the largest companies are available to even nascent startups… So it is no surprise that many financial services firms are devoting so much money, attention, and time to developing and using A.I. approaches."

JPMorgan Chase is reportedly devoting some USD 10.8 billion to its tech budget in 2018. Europe's largest bank, HSBC, is spending USD 15 billion on new technology. And the biggest spender of all, Bank of America, has set an annual global budget of nearly USD 16 billion for technology and operations. That figure is at least USD 3 billion more than Intel, Microsoft or Apple spent on research and development in 2018. As Andrew S. Grove, the long-time chief executive and chairman of Intel

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Corporation, told a Stanford researcher in 1991, "Don't ask managers, 'What is your strategy?' Look at what they do! Because people will pretend." Whether they are pretending or not, the resource allocation patterns suggest that banks are now effectively IT companies.

What Grove saw as the actual strategy of a firm is the cumulative effect of day-to-day prioritizations or decisions made by middle managers, engineers, salespeople, and financial staff—decisions that are made despite, or in the absence of, intentions. And that's where the problem lies. Money for new investments accounted for only 27% of bank spending on information technology in 2017. According to Celent, a research and consulting company based in Boston, the rest—close to 73% of spending—was allocated to system maintenance. Of the nearly USD 10 billion JPMorgan Chase dished out for IT in 2016, only USD 600 million was in fact devoted to fintech solutions and projects for mobile or online banking, although CEO Jamie Dimon warned shareholders in his letter that "Silicon Valley is coming."

This knowing-doing gap is no simple pretension by senior leadership. Financial institutes I've spoken with have (1) all organized employee seminars inviting motivational speakers to talk about innovation; (2) established corporate venture funds to invest in innovative startups; (3) practiced open innovation, posted challenges online, and run tournaments with external inventors; (4) organized "design thinking" workshops for employees to re-think customer solutions outside the mainstream; and (5) installed *Lean* startup methodologies that allow employees to fail fast in order to succeed early. So widespread is the innovation process, and yet, managers continue to face unyielding organizations whose core business is being encroached on by Google and Amazon, if not Tencent or Alibaba or some other digital upstarts. "Tell me one thing that I should do but haven't done," hissed an executive the moment I mentioned Google Venture. It seems that no matter how hard these in-house innovation experts try, their companies simply won't budge. The ships are not just big; they cannot turn. Why?

Too many innovation experts are focusing solely on the nuts and bolts of everyday implementation: gathering data, tweaking formulas, iterating algorithms in experiments and different combinations, prototyping products, and experimenting with business models. They often forget that the underlying technologies—A.I. in this case—never stay constant. Seizing a window of opportunity is not necessarily about being the first, but about getting it right first. In this instance, that means getting it right for banking clients. Doing so takes courage and determination, as well as vast resources and deep talent.

But the banking industry isn't where Silicon Valley comes first—the auto industry is.

25.1.1 How Likely Is It that Your Industry Will Be Disrupted by the Valley?

No automaker today would speak to investors without mentioning "future mobility." BMW is "a supplier of individual premium mobility with innovative mobility services." General Motors aims to "deliver on its vision of an all-electric, emissions-free future." Toyota possesses the "passion to lead the way to the future of mobility and an enhanced, integrated lifestyle." And Daimler, maker of Mercedes, sees the future as "connected, autonomous, and smart." In contrast to the personally owned, gasoline-powered, human-driven vehicles that dominated the last century, automakers know they're transitioning to mobility services based on driverless electric vehicles paid for by the trip, by the mile, by monthly subscription, or a combination of all three. In the past, mobility was created by individual cars automakers sold; in the future, mobility will be produced by service companies operating various kinds of self-driving vehicles in fleets over time. At the BMW Museum, anyone can witness the gravity of this vision, articulated by its chairman of the board firsthand.

Walking up the spiral ramp of a rotunda inside the BMW Museum, one sees flashes of pictures about BMW history that display in variable sequences, slipping in and out of view like mirages. At the very top of the museum is a "themed area" of about 30 stations demonstrating an emissions-free, autonomously driven future. These are not only a vision, but a real project, begun in earnest in the autumn of 2007 by then-CEO Norbert Reithofer and his chief strategist Friedrich Eichiner. The two men tasked engineer Ulrich Kranz, who had revived the Mini brand in 2001, to "rethink mobility." The task force soon grew to 30 members and moved into a garage-like factory hall inside BMW's main complex.

"I had the freedom to assemble a team the way I wanted. The project was not tied to one of the company's brands, so it could tackle any problem," Kranz said in an interview with *Automotive News Europe* in 2013. "The job was to position BMW for the future—and that was in all fields: from materials to production, from technologies to new vehicle architectures."

And so Kranz and his team decided to explore uncharted territory that included "the development of sustainable mobility concepts, new sales channels, and marketing concepts, along with acquiring new customers." The starting point for "Project i" was, in other words, a blank sheet of paper.

"We traveled to a total of 20 mega-cities, including Los Angeles, Mexico City, London, Tokyo, and Shanghai. We met people who live in metropolises and who indicated that they had a sustainable lifestyle. We lived with them, traveled with them to work, and asked questions," Kranz recalled. "We wanted to know the products that they would like from a car manufacturer, how their commute to work could be improved, and how they imagined their mobility in the future. As a second step, we asked the mayors and city planners in each metropolis about their infrastructure problems, the regulations for internal combustion engines, and the advantages of electric vehicles."

Once the findings came back, Kranz expanded his team by seeking out "the right employees both internally and externally." The result was BMW's gas-electric i8 sports coupe and all-electric i3 people mover, which shimmered under white lights at BMW World, where the company's top automotive offerings are showcased. The i3 had almost no hood, and the front grille was framed by plastic slits that looked like a pair of Ray-Bans. It came in a fun-looking burnt orange. The front seats were so vertically poised, with the dashboard stretching out, that they exuded a "loft on wheels" vibe. Like the interior, made of recycled carbon fiber and faux-wood paneling, the electric motor of the i3 was geared to urban dwellers in mega-cities who yearned for a calm, relaxing drive.

What made BMW all the more remarkable was its timing. Almost two years before Tesla's Model S was introduced, BMW had presented the battery-powered car as a revolutionary product, and committed to build it and deliver it to showrooms by 2013. When the BMW i3 went on sale, Tesla's Model S had spent just over a year on the US market. The 2014 i3 went on to win a World Green Car award, as did the 2015 model, the i8. In short, BMW was fast and early.

Then something terrible happened—or really nothing happened.

The i3 is now five years old, and the i8 is four. The BMW i brand includes the services DriveNow and ReachNow (car sharing), ParkNow (to find available parking), and ChargeNow (to find charging stations). But, besides being featured in occasional press releases, Project i has given way to other BMW sports cars in prime-time TV advertising spots. There's no news from Project i, except that project members are reportedly leaving. Ulrich Kranz, the former manager, joined former BMW CFO Stefan Krause at Faraday Future, and after a short stay, they started Evelozcity in California, where they recruited another i-model designer, Karl-Thomas Neuman. And Kranz is not alone. Carsten Breitfeld, former i8 development manager, is now CEO of Byton, where he also enlisted a marketing expert and a designer from the BMW team.

How much Project i has cost BMW, we'll never know. But if, according to BMW figures, the carbon-fiber production and the autobody works for the i3 set the company back some half a billion euros, the entire project could easily have cost two to three billion—a sum that would have been enough for the development of two to three series of a conventional VW Golf or Mercedes S-Class. Two to three billion euros is also more than fifteen times the USD 150 million Apple spent to develop the first iPhone, which launched in 2007. With so much bleeding, the new CEO Harald Krüger talked of Project i 2.0, a plan to integrate the BMW i sub-brand back into the parent company, and refocus distribution efforts on "classic" products.

In 2018, BMW USA reported just 7% of its sales were cars with a plug, which included all its hybrid offerings. Meanwhile, Tesla reported booming sales of its Model 3, which has become one of the USA's top 20 most-sold vehicles in the third quarter of 2018. Tesla was ranked fourth in luxury car sales during the same quarter. At the time of writing, Tesla has surpassed BMW and Daimler to become the world's second most valuable automaker in terms of market capitalization, trailing only Toyota.

Did Tesla and other start-up companies steal BMW's idea and run with it? No, it's what's called the *Zeitgeist*, a German word meaning "spirit of the time." When the time is ripe, the ideas are "in the air." Competition invariably emerges, and companies have to improve their ideas to stay ahead. They need to come up with demonstrations that excite potential customers, potential investors and, more importantly, potential distributors.

BMW's shift in its distribution of the i sub-brand echoes what Kodak did. Kodak built the first digital camera back in 1975 and was the first to put out a competent product, but then ended up folding its consumer digital and professional divisions back into the legacy consumer film divisions in 2003. Meanwhile, Nikon, Sony, and Canon kept innovating in the subsequent decades, with features like face detection, smile detection, and in-camera red-eye fixes. We all know what eventually happened to Kodak.

25.1.2 How to Become Future-Ready

BMW is by no means a laggard in innovation. At IMD business school in Switzerland, we track how likely a firm is to successfully leap toward a new form of knowledge. For automakers, it's the shift from mechanical engineering, with combustion-engine experts, to electric and programming experts of the same kind as those who build computers, mobile games, and handheld devices. For consumer banking, it's the shift from operating a traditional retail branch with knowledgeable staff who provide investment advice to running data analytics and interacting with consumers the same way an e-commerce retailer would. The pace of change may differ between industries, but the directional shift is undeniable.

The IMD ranking measures companies in each industry sector using hard market data that is publicly available and has objective rules, rather than relying on soft data such as polls or subjective judgments by raters. Polls suffer from the tyranny of hype. Names that get early recognition get greater visibility in the press, which accentuates their popularity, leading to a positive cascade in their favor. Rankings based on polls also overlook fundamental drivers that fuel innovation, such as the health of a company's current business, the diversity of its workforce, the governance structure of the firm, the amount it invests in outdoing competitors, the speed of product launches, and so on. According to an objective composite index like this one, BMW is among the best. Table 25.1 below shows the ranking of the top 55 automakers and component suppliers. The methodology of the ranking is described in the appendix.

But the index also points to the general conservatism of large companies. Most radical ideas fail, and large companies can't tolerate failure. It doesn't matter whether you call BMW's strategy "throw everything at the wall and see what sticks" or a groundbreaking, iterative approach to mobility; if the only way to innovate is "to put a few bright people in a dark room, pour in some money, and hope that something wonderful will happen," Gary Hamel once wrote, "the value added by top management is low indeed."

Table 25.1 .

Company names	Score	Rank
Tesla Inc	100	1
General Motors Company	98.357	2
Volkswagen AG	93.221	3
Ford Motor Co.	82.265	4
Toyota Motor Corporation	82.235	5
Nissan Motor Co., Ltd.	81.442	6
Bayerische Motoren Werke AG	71.473	7
Daimler AG	69.570	8
Peugeot S.A.	63.488	9
Visteon Corporation	59.146	10
Honda Motor	56.223	11
AB Volvo	53.885	12
Renault	47.907	13
Ferrari NV	47.710	14
Robert Bosch GMBH	47.094	15
Fiat Chrysler Automobiles N.V.	43.215	16
Brilliance China Automotive Holdings Limited	42.935	17
Audi AG	42.428	18
Continental AG	41.911	19
Valeo SA	41.208	20
Denso Corporation	38.351	21
Cooper-Standard Holdings INC.	36.989	22
Baic Motor Corporation Limited	35.015	23
Skoda Auto, A.S.	34.876	24
Guangzhou Automobile Group	33.444	25
Yamaha Motor Co., Ltd.	32.383	26
Fuyao Glass Group Industries Co., Ltd.	31.058	27
Hyundai Motor Co., Ltd.	29.133	28
Jaguar Land Rover Limited	28.849	29
Aptiv PLC	28.638	30
Suzuki Motor Corporation	27.926	31
Byd Company Limited	27.702	32
Geely Automobile Holdings Limited	27.568	33
Magna International Inc	27.077	34
Mitsubishi Motors Corporation	24.689	35
Chaowei Power Holdings Limited	24.134	36

(continued)

Table 25.1 (continued)

Company names	Score	Rank
Mazda Motor Corporation	22.551	37
Subaru Corporation	22.213	38
Tata Motors Limited	21.093	39
Beiqi Foton Motor Co., Ltd.	20.672	40
Kia Motors Corporation	17.535	41
Isuzu Motors Limited	17.462	42
TS Tech Co., Ltd.	17.074	43
Haima Automobile Group Co., Ltd.	13.603	44
Paccar Inc	11.671	45
Aisin Seiki Co., Ltd.	11.655	46
Saic Motor Corporation Limited	10.135	47
Mahindra & Mahindra Limited	8.539	48
Harley-Davidson, Inc.	7.375	49
China Faw Group Co., Ltd.	6.358	50
Anhui Jianghuai Automobile Group Corp., Ltd.	5.043	51
Jiangling Motors Corporation, Ltd.	4.127	52
Dongfeng Motor Group Company Limited	2.925	53
Chongqing Changan Automobile Company Limited	0.181	54
Great Wall Motor Company Limited	0	55

But it's not just about cars. The dilemma experienced by German automakers is strikingly similar to the ones facing executives in banking and a host of other industries these days. Just as Detroit is confronted by Silicon Valley, Wall Street can see the future of banking everywhere it looks. Turning to China, it sees Alibaba, whose AliPay has become synonymous with mobile payment, and AntFinancial, Alibaba's finance subsidiary, which is now worth USD 150 billion—more than Goldman Sachs. Looking homeward, it sees that start-ups like Wealthfront, Personal Capital, and Betterment have all launched robo-advisors as industry disruptors. In retail checkout lanes, it sees Square or Clover or Paypal Here taking in credit card payments on behalf of millions of small-time merchants. It sees that the future of banking is not only about Big Data analytics, but also about calling on and bundling a group of financial services that happen in real time and with little human interaction. A smart infrastructure that automatically interacts with customers, continuing to improve its algorithm and adjust its response without human supervision as it handles data gushing in from all around the world at millions of bytes per minute, is tantamount to one giant leap forward for every banking incumbent.

Deep-learning-based programs can already decipher human speech, translate documents, recognize images, predict consumer behavior, identify fraud, and help robots "see." Most computer experts would agree that the most direct application of this sort

of machine intelligence is in areas like insurance and consumer lending, where relevant data about borrowers—credit score, income, credit card history—is abundant, and goals such as minimizing default rates can be narrowly defined. This explains why, today, no human eyes are needed to process any credit request below USD 50,000. For these businesses, the question of where and how to deploy A.I. is easy to answer: find out where a lot of route decisions are made, and substitute algorithms for humans.

But data can be expensive to acquire, and investment conventionally involves a trade-off between the benefit of more data and the cost of acquiring it. For many traditional banking incumbents, the path to A.I. is anything but straightforward. Managers are often tasked with considering how many different types of data are needed. How many different sensors are required to collect data for training? How frequently does the data need to be collected? More types, more sensors, and more frequent collection mean higher costs along with the potentially higher benefit. In thinking through this decision, managers are asked to carefully determine what they want to predict, guided by the belief that this particular prediction exercise will tell them what they need to know. This thinking process is similar to the "re-engineering" movement of the 1990s, in which managers were told to step back from their processes and outline the objective they wanted to achieve before re-engineering began. It's a logical process, but it's the wrong one.

Consider the process of shopping at Amazon. Amazon's A.I. is already predicting your next purchase under "Inspired by your browsing history." Experts estimate the A.I.'s success rate at about 5%, which is no small feat considering the millions of items on offer. Now imagine if the accuracy of Amazon's A.I. were to improve in the coming years. At some point, the prediction would be enough to justify Amazon pre-shipping stuff to your home, and you'd simply return the things you didn't want. That is, Amazon would move from a shopping-then-shipping model to shipping then shopping, sending items to customers in anticipation of their wants.

The complication lies in *when* Amazon should introduce this A.I.-driven fulfillment service. With the underlying technology improving, Amazon might choose to launch such a service just a year ahead of the competition, when the A.I. prediction is not yet perfect, and suffer a hit on returns and a dip in profitability. Why? Because launching the service slightly sooner will give Amazon's A.I. more data sooner than the competition, which will mean its performance will improve slightly faster than that of others. Those slightly better predictions will in turn attract more shoppers, and more shoppers will generate more data to train the A.I. faster still, leading to a sort of virtuous cycle, a prohibitive lead against competition.

In fact, this data intelligence is the only first-mover advantage that matters. It grows from a positive feedback loop. The more data that is used, the more valuable the business becomes, since getting relevant data in quantity is always difficult and expensive. This is why Google Maps becomes more accurate as more people use it: the underlying algorithms have more data to work with, so the apps become even more accurate. Google has made two decades' worth of investments to digitize all aspects of its workflow, but not because it has a clear notion of what it wants to predict. It had done so before a clear notion of A.I. fully emerged. This is the groundwork that must

be laid before a well-defined strategy for effective A.I. can be established. Any data scientists would agree that data sets become geometrically more valuable when you combine them. Combined data sets often reveal insights and business opportunities that could not have been imagined previously. Facebook's photo tagging expanded the social graph. News Feed enriched it further. The Like button deliver data on emotional triggers. Connect tracked users as they went around the web. The value is not in the photos and links posted by users. The real value resides in metadata—data about data—which describes where the user was when he or she posted, what they were doing, with whom they were doing it, alternatives they considered and more.

Put it differently, when Google introduce Gmail, it built a data set of identity. Combining the two data sets created a geometric increase in value, as future AdWords ads would have more value to the advertiser and, by extension, to Google. The same thing happened again with Google Maps, which enable Google to tie identity and purchase intent to location. Each time Google introduce a new service, but Google would find new use cases for user data made possible by combining data sets. One of the most value use cases that resulted from combining data sets was anticipation of future purchase intent based on detailed history of past behavior. When users get ads for things they were just talking about, the key enabler is behavior prediction based on combined data sets. Hence the importance of metadata. Its application potential only means the conventional budget allocation won't work for banking incumbents seeking to scale their footprints in the age of A.I. They have no choice but to follow a disruptive playbook, but with a twist.

25.1.3 How Understanding Disruption Helps Strategists

In the early 1990s, Professor Clayton Christensen of the Harvard Business School noticed an interesting pattern among companies facing the emergence of a new technology. When technological progress was incremental, even if the increments appeared in rapid succession, powerful incumbents always triumphed. Companies that were endowed with vast resources, extensive networks of suppliers, and a loyal customer base were able to command great advantages over their rivals, as would be expected. This is what made IBM a formidable player in the computing industry and General Motors a bellwether organization in the automotive industry.

And yet, there is a class of technological changes in which the new entrant—despite far fewer resources and no track record—almost always topples existing industry giants. This special class of technological changes, Christensen noted, does not have to be sophisticated or even radical.

Take transistor television as an example. When RCA first discovered transistor technology, the company was already the market leader in color televisions produced with vacuum tubes. It naturally saw little use for transistors beyond novelty, and decided to license the technology to a little-known Japanese firm called Sony.

Sony, of course, could not build a TV out of transistors, but it did manage to produce the first transistor radio. The sound quality was awful, but the radio was affordable for teenagers who were delighted by the freedom to listen to rock music

away from the complaints of their parents. Transistor radios took off. Still, the profit margins were so low that RCA had no reason to invest further. It was busy making serious money and investing every R&D dollar on improving vacuum tube color TV.

Sony, meanwhile, was looking for the next big thing. It launched a portable, low-end, black-and-white TV at a rock-bottom price, targeting low-income individuals. Called the "Tummy Television," it was tiny enough to perch on one's stomach—the antithesis of RCA's centerpiece of middle-class living rooms. Why would RCA invest in transistors to make an inferior television for a less-attractive market? It didn't.

The real trouble began when Sony finally pushed the transistor's performance to produce color TVs based entirely on the new technology. Overnight, RCA found itself trying to catch up on a technology that it had ignored for the past three decades, which it had ironically pioneered and licensed out. Christensen called this type of technology—inferior at first but immensely useful later—disruptive, a term that has since been immortalized in the business lexicon of executives, consultants, and academics.

What we see today in the financial industry are new entrants leveraging digital interfaces and A.I. decision-making processes that involve minimal manual work to target an underserved market segment. Their technologies cannot satisfy high-end banking customers *yet*. But like the desktops that displaced minicomputers, or the angioplasty that displaced open-heart surgery, A.I. and digital automation will inevitably improve and, one day, these new solutions will be able to meet a substantial part of the need among big clients. The implication is that there will always be space for manual-intensive, human-centric operations, but that space will shrink substantially in the future.

One logical solution is for banking incumbents to create a separate unit and launch "speed boats" that adhere strictly to the playbook of digital disruptors. These will target an underserved market, and provide security services on a digital platform, with minimal human intervention. Initiatives like this are meant to develop a new set of capabilities—advanced analytics, dynamic product deployment, linking to third parties to fill a sudden surge in market demand—initially targeting a new segment that doesn't interfere with the mainstream business of the current banking operation. Over time, such new businesses will develop crucial capabilities that will mature enough to be transplanted back into the mainstream. This approach prevents the often-heard refrain of IT large-scale transformation: overtime, overbudget, and with underwhelming market results. In a way, it's RCA launching Sony's transistor radio, but keeping ownership of it to get future technologies ready.

And here is one last twist. Scaling up a disruptive business will always be costly. But without which, none of these matter. The late Andy Grove, Intel's legendary CEO pointed this out in his 2010 op-ed for Bloomberg:

> Startups are a wonderful thing, but they cannot by themselves increase tech employment. Equally important is what comes after that mythical moment of creation in the garage, as technology goes from prototype to mass production. This is the phase where companies scale up. They work out design details, figure out how to make things affordably, build factories, and hire people by the thousands. Scaling is hard work but necessary to make innovation matter.

And yet, scaling up disrupotion is where a company is likely to suffer financial loss for years, if not decades, and in the foreseeable future, carry with itself a business that is unlikely to achieve the same level of profitability of its core business. BMW has been profitable for a very long time; Tesla is still operating at a loss today, as is Uber.

That's why from Amazon to Square to Ant Financial, profitability is not the most important metric for managers; user base and market share are. That's also why banking incumbents need to consider an alternate investment structure, allowing third parties, venture capitalists, and even competitors to take an equity stake. Such a structure seems controversial, but is not unprecedented: Alibaba doesn't own all of Ant Financial; Uber now owns a minority share of its Chinese rival Didi after exiting China. This is the same strategy of GM's CEO Mary Barra, and it paid off handsomely in May 2018 when SoftBank announced a USD 2.25 billion investment in Cruise Automation—the self-driving unit of General Motors, headquartered in San Francisco. The investment pushed Cruise, originally purchased by GM for USD 581 million, to USD 11.5 billion. It does take more than vision, belief, passion and experimentation in A.I. to transform a company. It takes a pocket so deep that it requires other people's money to act on that aspiration. It's an unconventional approach taken during an unconventional time.

25.1.4 One Last Flashback…

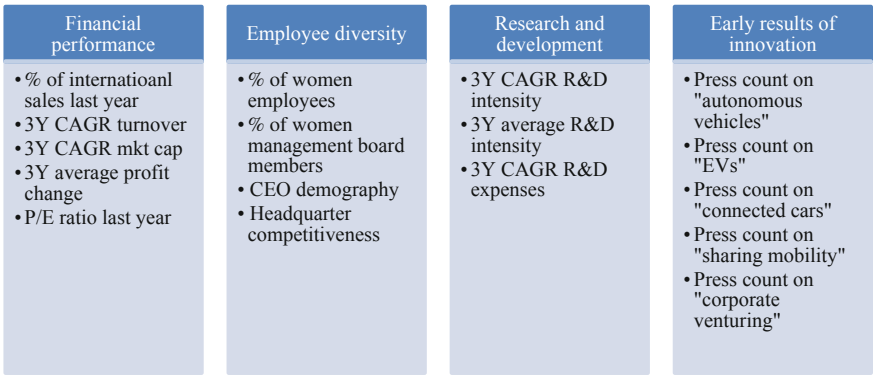
Adjacent to the Mercedes-Benz museum in Stuttg art, Germany is one of the largest Mercedes dealerships in the world, which I also visited during the autumn of 2018. Its cavernous main hall is preceded by a restaurant, a café, and a shop hawking Mercedes-Benz merchandise. I saw a vertical banner stretching from the ceiling to the floor along the glass panels on one wall. "Ready to change," the banner cheered. "Electric intelligence by Mercedes-Benz." It referred to *Concept EQ*, a brand of electric plug-in models first unveiled in Stockholm on 4 September 2018. I found three EQs on display next to an exhibition kiosk that didn't work, but instead displayed an error alert and tangled cables spilling from the back that had come unglued.

Then an escalator took me to the top floor, where I found visitors gawking at a Mercedes-AMG, known for its "pure performance and sublime sportiness." Here was a vision of a forward-looking sports car with all its driving pleasure fully realized. The risers and the wrap-around LCD walls only accentuated the carbon-fiber composite of the chassis, gleaming in matte black. But I also noticed that the CO_2 emissions rating of this Mercedes-AMG GT 63 S, with its 630 horsepower, was an F.

Appendix

This appendix presents a short description of the calculation behind the "Leap readiness index" for the automotive industry in 2018.

This index includes the top 55 automakers and component suppliers by revenue by the end of 2017. The ranking measures four factors: (1) financial performance, (2) employee diversity, (3) research and development, and (4) early results of innovation efforts. These four main factors are tracked by 17 separate indicators that carry the same weight in the overall consolidated result.



All of our 17 indicators are hard data, i.e. they are publicly available from company websites, annual reports, press releases, news stories, or corporate responsibility reports.

In order to calculate the "Leap readiness index," we first manually collected historical data for each individual company. We then performed calculations for each indicator (e.g. 3-year compound annual growth rate) before we normalized criteria data by scaling it between 0 and 1.

For "early results of innovation," we identified five key trending topics in the automobile industry. These were autonomous vehicles, electric vehicles (EVs), shared mobility, connected cars, and corporate venturing. We consulted Factiva—a global news database that covers all premium sources—and counted the number of press releases on each trending topic over the past three years (2016–18). We then conducted the same normalization for these five indicators.

Finally, we aggregated indicators to build the overall ranking. For the purpose of comparison, we have ranked each company from 1 (best) to 55 (worst) on a scale of 0 to 100.

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