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Building Fractal Advantage in a Fragmenting World

15 NOVEMBER 2021 By Arindam Bhattacharya, Hans-Paul Bürkner, and Andrea Gallego

Powerful forces are reshaping the global business environment. To stay competitive, companies need to evolve beyond the traditional quest for scale.

From the dawn of the industrial age to the modern digital economy, one rule of business has held true: size wins. A company with annual revenues of $100 billion will usually beat one with revenues of $100 million; whether a company achieved its scale by building an expansive physical presence that stretches across geographies or a broad-reaching data-driven ecosystem that spans the globe, size has always been critical to success.

Now, suddenly, the link between "big" and "successful" appears to be weakening. Major companies that have built global scale-driven businesses over the past century, including behemoths such as Ford and HSBC, are actively "descaling" by retreating from markets where they have been present for decades in order to minimize the drain on their profitability: Ford from India, HSBC from the U.S. and Europe. Even a relatively new company such as Uber, which in its early exuberance had tried to scale up quickly by entering as many new markets as possible, has changed tack by pulling out of China, Russia, and several Southeast Asian countries where it faced stiff competition from local, "subscale" rivals.

At the same time, a growing number of startups, despite their smaller operations, have managed to compete with much larger rivals and win. So-called "unicorns"—startups valued at $1 billion or more—have been taking on the digital giants for years. But we are seeing a similar incumbent-shaking phenomenon in industries as disparate as electric vehicles, plant-based meats, and gene-based drugs.

Why is the hegemony of global scale in decline? We believe it is the result of an unexpected confluence of three powerfully disruptive forces: the fragmenting of the geopolitical consensus, the growing presence of digitization in the value creation process, and the rapid rise of new forms of innovation for product development. Together, these forces are creating a world with much greater fragmentation, where the traditional advantages of global scale are harder to achieve than they once were.

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The consequences are profound. No longer dominant in the way they were in an integrated, globalized economy, larger companies must seek a new source of competitive strength—one we call fractal advantage. In the natural world, the word "fractal" denotes a design-optimized object, such as a leaf, present as limitless self-similar pieces at the edge of a complex system, such as a tree. In the new global business environment, companies must build advantage in much the same way: by breaking apart their traditional scale-driven, centralized operations and creating "fractal" optimized teams with the capabilities and decision-making power to nimbly respond to opportunities emerging at the edge.

The fractal company is designed to fight and win multiple local battles instead of waging a single global war. Its operating model allows it to develop and launch multiple, rapidly evolving customized solutions at the edge of its business as opposed to milking a handful of big, slowly changing products. It draws insights from local, incomplete data sets—not just by collecting and crunching a few big data sets at the center. And it builds a new kind of global advantage through the aggregation of these fractal wins.

By deploying these fractal strategies, companies can expect to prosper not because of better economies of scale but because of better customer responsiveness and loyalty. The fractal approach generates more conversations, interactions, and connections—which, in turn, generates the kind of insights and innovation needed to create better solutions to customer needs. And these rapidly evolving, highly customized solutions are the foundation for exponential profitable growth in a fragmenting world.

It is not our contention that size no longer matters. Indeed, scale is likely to continue to be an important driver of growth for many years to come, especially in sectors less impacted by the disruptive forces we describe here. However, companies will have to rethink scale-based advantage in a world where many assets and capabilities, such as warehouses and logistics, can be bought as a service with the same cost efficiency as cloud services. Moreover, building scale in new capabilities like IoT and cybersecurity is becoming as important as traditional scale. To stay competitive, every company in every sector will need to find new ways to exploit scale *and* build fractal advantage.

The Eroding Hegemony of Global Scale

To begin with, let's take a closer look at the three disruptive forces that are changing the global business landscape: the fracturing of the geopolitical consensus, the impact of digitization, and the rise of "deep tech" innovation. Although each of these forces emerged at different times and are at different stages of maturity, together they are not just leveling the playing field—in many cases they are tilting it in favor of smaller, more local subscale companies.

THE FRACTURING OF THE GEOPOLITICAL CONSENSUS

Over the past 30 years an extraordinary geopolitical consensus emerged, leading to the systematic lowering of trade barriers that sparked a dramatic period of economic growth. A major engine of that growth has been the coupling of China, the world's manufacturing hub, and the United States, the world's consumption hub. Now, however, these two great economies appear to be decoupling. At the same time, the European Union, the third great trading bloc, is showing visible cracks following the departure of the United Kingdom.

Beyond economic issues, countries are taking contrasting approaches to several other supranational topics, including climate change reform, the management of public and private data, and the regulation of digital companies. For example, the EU is preparing to introduce the world's first carbon border tax, which would create an uneven global playing field for carbon-intensive products such as steel, aluminum, fertilizer, and cement. Similarly, differential rules around data privacy and localization are impacting the investment patterns of global companies and skewing the competitive balance in favor of local competitors.

This sudden fragmenting of geopolitical consensus is squeezing the lifeblood out of global scale-driven companies. Their business models, designed to capitalize on size and the capacity to spread costs across markets, are being undermined by tariffs and other barriers to trade. The price of chasing consumers around the world is becoming increasingly steep. Not surprisingly, some business leaders are beginning to wonder if the quest for global scale is really worth it.

THE IMPACT OF DIGITIZATION ON VALUE CREATION

Since the advent of the digital age, global companies have gathered and exploited vast data "lakes" and complex data-crunching algorithms to build dominant, highly advantaged businesses. In effect, these companies have merely extended the same hegemony of scale that began with the Industrial Revolution, when large factories first supplanted "cottage industry" manufacturers. Now, ironically, the all-pervasive growth of digitization is causing a revolution in the very processes of value creation, allowing small businesses—digital startups and industrial companies alike—to compete with their much bigger global rivals.

To see why this is happening, let's look at the core value creation processes of making, marketing, and selling products. When it comes to making products, subscale companies can now simply pay the fees charged by cloud-based online platforms to interact and codevelop new products with their customers; meanwhile, they can use "factory-as-a-service" providers to manufacture complex, customized, low-volume, fast-to-market products in microfactories located close to the customer. Similarly, when it comes to marketing and selling their products, these companies can simply pay the fees charged by social media and e-commerce platforms to develop deep relationships with customers, who can be encouraged to buy straight from the company and post favorable product reviews. This means smaller companies no longer have to suffer any "scale penalty" for lacking the funds to build capital-intensive manufacturing infrastructure and asset-heavy marketing and sales operations.

In addition to accessing pay-as-you-go platforms and providers, small companies can access digital technologies that are negating the need for them to build big scale-advantaged data sets for developing insights and innovations. With the invention of simulation, replication, anonymization, and other digital technologies, it is becoming increasingly easy for subscale companies to draw insights from little data "ponds" by combining AI-powered self-learning algorithms with the rented capabilities of cloud computing—as showcased by a company such as Snowflake, which last year had the biggest initial public offering for any U.S. software business in history. You don't necessarily need to be big to be smart.

THE RISE OF "DEEP TECH" INNOVATION

When the COVID-19 pandemic emerged last year, the frantic race to identify a vaccine was won not by one of the global pharma giants—most of whom had launched their own vaccine development programs—but by two startups, BioNTech and Moderna. (BioNTech partnered with Pfizer, which it had previously worked with on an mRNA-based influenza vaccine, to codevelop the COVID vaccine and bring it to market.) We are seeing such scale-disrupting innovation playing out not just in drug discovery but across a range of products, including chemicals, food, mobility, green products, and even highly sophisticated industrial products such as space rockets—traditionally the exclusive domain of governments and very large companies.

How can startups disrupt larger companies' natural scale advantage in R&D to produce new industry-leading products? They are doing so by exploiting the emergence of the so-called "deep tech" innovation process, allied with the rapid growth of high-risk-funding venture capitalists. Deep tech innovation is fundamentally a high-risk game which at its heart has four radical concepts. First, deep tech innovators, despite their name, focus on developing breakthrough solutions by redefining the problem and exploiting *existing* science and technologies in clever, innovative ways. As often as not, they operate at the convergence of two or more very different technologies, and this interdisciplinary approach allows them to find unexpected answers to difficult problems. Industry incumbents, meanwhile, are often deterred by the complexity and cost risk of an engineering challenge, which prevents them from translating the science from their laboratories into highly innovative products.

Second, deep tech innovation takes a scale-disruptive generative approach, working up from the molecular level and "growing" the solution rather than taking a (relatively) scale-intensive extractive approach—working down from the existing raw material and modifying it to make the final product. This requires scientific brains, not corporate brawn, and it means that small companies can be as competitive as their bigger rivals, if not more.

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BioNTech drew on the proven generative technology of synthetic biology to create or grow a strand of mRNA that carries instructions to the immune system to recognize and

fight Covid-19. Similarly, food startups have grown proteins of the kind normally found in animal-derived products such as meat and dairy from plant-derived, lab-developed microbes, using generative technologies (including precision fermentation) at a lower cost and bringing them faster to market—and emerging as the industry leaders for these products.

Third, deep tech innovators follow a novel design-build-test-learn process that harnesses the power of artificial intelligence and machine learning to lower the costs and time involved in developing and manufacturing new products—by reducing the number of design options to be developed and tested, for example—thereby undermining the traditional global scale advantage of the big, global companies. And fourth, they exploit the capabilities of a network of external partners rather own proprietary set of internal capabilities. This reduces capital needs, lowers the barriers to scaling up, and also helps in speeding time to market.

Historically, such boutique product-innovation companies suffered from a scale disadvantage which was nearly impossible to overcome—lack of capital. As the power of deep tech innovation to deliver breakthrough products and solutions becomes clearer, such startups have found it increasingly easier to find support from venture capital investors, despite the high investments and potential risks. According to analysis by BCG and Hello Tomorrow, a Paris- based technology think tank, venture capital funding for deep tech startups increased from $15 billion in 2016 to more than $60 billion in 2020, covering a wide range of industries. (Significantly, this is happening even as the R&D budgets of many incumbents are shrinking, along with their appetite for risk, as they pursue greater efficiencies in R&D operations.)

The Fractal Advantage

How should global companies respond to these disruptive forces? We have observed three distinct "antiscale" strategies. First, big companies are pivoting from focusing on global scale to customizing their strategies for individual markets, driving market share and profitable growth through a higher degree of attention to local context. Second, they are looking beyond their core profit centers to the fast-growing "value pools" emerging at the edge of their businesses. Third, they are shifting away from big data and toward the smart-data capabilities of AI-powered learning models to draw insights from local, fragmentary, incomplete data.

Individually, these antiscale strategies may sound modest, but together they constitute the best way of tapping a powerful new source of competitive strength: the fractal advantage.

The local market, the edge business opportunity, and the smart-data learning model can each be viewed as fractals of the larger company, self-similar pieces of a bigger whole. Business leaders who can win on each of these fronts *and* replicate their successes repeatedly—in effect, aggregating and scaling up these fractal strategies across their businesses and the different markets where they compete—will transform their companies into the competitively advantaged global corporations of the future.

Let's look at each of these fractal strategies in turn.

LOCAL (NOT GLOBAL) ADVANTAGE

"Think global, act local" used to be one of the winning formulas for successful companies. If they deployed a global, scale-driven, efficiency-focused business model, they could achieve higher profitability in multiple local markets. But in the new postglobal environment, (relatively) small, nimble, incredibly innovative, highly competitive, locally rooted companies are advantaged in a way they never used to be.

One company building its entire growth strategy on what we would call local advantage is Arrival, an electric vehicle startup founded in the UK. Traditional automakers have long built their advantage on global scale by producing hundreds of thousands of vehicles in massive plants for sale to consumers worldwide. Arrival, on the other hand, is building local advantage in every market it enters. It plans to make vehicles in smaller numbers, producing them in the tens of thousands for local customers in rapidly scalable "microfactories" in the UK, the US, and eventually in other markets.

The company is betting on two innovations: first, a vehicle design that is much less asset intensive, using proprietary composite materials from readily available thermoplastics rather than the steel used by traditional automakers; second, a reconfigured production process that uses 3-D printing technology to mold the vehicle bodies into shape rather than the traditional asset-heavy manufacturing process required to stamp, weld, and paint the steel body of the typical vehicle. In leveraging these innovations, Arrival hopes to offer a local service and local solutions that will allow it to challenge its much larger rivals.

Companies might need to scale down their operations in some markets and withdraw entirely from others. But that doesn't mean they have to get smaller.

It's too early to say whether Arrival will succeed in that regard—although, to its credit, it has already attracted $1.2 billion of orders for its vehicles.[1] Nevertheless, global corporations in every industry should draw lessons from Arrival and other companies that are competing against their bigger rivals by taking a more local approach to global production. According to Nitin Paranjpe, chief operating officer of Unilever, the winning formula for these larger companies should now be: "Think Local. Act Global."[2]

This is not a semantic difference. It means that, to achieve higher profitability, companies should think about what it takes to win in every local market where they compete for business. Necessarily, this means companies must be more selective about where (and against whom) they compete. It also means they must scale down their operations and become smaller in some local markets—and (perhaps) withdraw entirely from others.

This change of strategy does not mean companies must inevitably become smaller on the whole. Instead, it means they should scale up and become *bigger* in some local markets—and replicate their successes in as many local markets as possible. Following

this fractal approach, and in effect reversing the traditional strategy of deploying global ideas in local markets, will be key to achieving profitable growth in the years to come.

EDGE (NOT CORE) ADVANTAGE

Global companies have long espoused the importance of building scale advantage through their core businesses. But in our increasingly fragmented, data-driven, and innovation-hungry world, companies can no longer afford to exclusively follow the "profit from the core" mantra. That's because new, high-growth business opportunities are emerging at the edge of every industry. We call these opportunities "value pools," and for the most part they are being seized by small, local, speedy, specialist, entrepreneurial startups—not least because the big, global, scale-driven (and by necessity slower) companies remain focused on their core business.

Among the most exciting edge opportunities are customer-oriented value pools. To explain, let's look again at the automobile industry. It used to be that automakers competed by building global scale advantage in their core business of making and selling cars and in ancillary services, such as car financing and servicing. Now, as customers are looking not so much to buy automobiles as mobility solutions, carmakers have shifted toward differentiating themselves by the myriad digital services and entertainment options they provide. Indeed, the share of auto industry profits represented by such emerging value pools could rise to as much as 40% by 2035, according to BCG analysis.

In the publishing industry, a big, traditional company that is effectively pursuing new customer-oriented value pools is the Financial Times. For most of its 130-year history, the FT was driven by the goal of producing a best-in-class newspaper. But since launching FT.com in 1995 and subsequently becoming a pioneer of the "pay wall" subscription model, the company has steadily shifted from its core business of publishing a newspaper to the "edge" business of developing customer-oriented solutions through a variety of media channels—including the website, its conference division, various networking forums, and other formats. The FT has made these moves to fight off challenges from small and large players alike: niche media companies that focus on highly specialized executive-class readerships, mainstream rivals such as The Wall Street Journal and The New York Times, and large digital news aggregators such as Google and Facebook.

By going digital and attracting loyal subscribers, the FT was able to generate and gather reams of new data about the identity of its customers and how they use the newspaper and website. (For instance, 32% are C-suite executives, 77% work for an international company, 20% are millionaires, and 29% own fine wine worth $2,500 or more, according to the FT.) This, in turn, allowed it to develop new editorial and commercial offerings for different subsets of consumers—and, in doing so, tap deep "edge" value pools. The FT now produces focused premium content (and associated commercial products) for a variety of niche users—including corporate lawyers, fund managers, mergers and acquisitions specialists, climate change policymakers and activists, Brexit cognoscenti, and avid followers of the famous Lex column.

Today, the FT boasts more than 1 million paying print and digital subscribers—and healthy profits. Indeed, its digital content revenues (including advertising) are three

times bigger than its print revenues. In a sense, what was once the FT's "edge" business has become its new "core" business.

Even for the world's biggest companies, the future lies at the edge.

Along with customer-oriented value pools, there are what can be called business-process value pools—edge opportunities awaiting those with sophisticated AI and other digital technology capabilities. Flexport, a tech-focused freight forwarder headquartered in the US, has spotted such an opportunity in the shipping business. It offers a platform powered by its AI and data analytics capabilities that not only accelerates the exchange of information between the key stakeholders—including shippers, brokers, manufacturers, warehouse owners, and retailers—but also reduces the costs and improves the delivery time of the core shipping process.

Flexport is still a relative newcomer. But its growth rate suggests that traditional shipping companies are failing to exploit the opportunities at the edge of their business. They, and indeed all big companies, need to understand that a new competitive frontier is opening up fast.

As companies move toward that frontier, they should not only be building the capabilities necessary to seize edge opportunities. They must also be searching for new collaborators—for example, startups that can contribute to the building blocks of the total customer experience. At the same time, they must be prepared to face new competitors that are following the fractal approach to the edge of *their* own businesses. And here, we don't just mean smaller rivals. We also mean bigger rivals that have the capacity to blast them out of the water. In the $5 trillion auto market, for instance, where app-based digital services and entertainment options are now an important part of the product offering, Apple has signaled its interest in joining the fray. Even for the world's biggest and most influential companies, the future lies as much at the edge as it does at the constantly evolving core.

SMART (NOT BIG) DATA ADVANTAGE

Ever since the term "big data" emerged in the 1990s, companies have focused on creating large proprietary data banks, or "lakes," as a source of competitive advantage—doing so on the assumption that the more data they have, the more insights they can draw, and the more innovations they can develop to power their profitable growth.[3]

Undoubtedly, the creation of these data banks—and the associated algorithms and data models developed to assemble and analyze the information—will remain an important corporate activity. Nevertheless, there is growing evidence to suggest that simply amassing a large amount of data is not as advantageous as commonly thought. As much as 55% of a company's data is so-called "dark data": unquantified and unused.[4] This suggests that business leaders are struggling to make use of their companies' own data, which are often incomplete and require cleansing, verifying, and standardizing before they can be analyzed.

But even if companies did make better use of their data, would they always have the advantage over rivals with less data? Not necessarily. There is also evidence to suggest

that simply being able to amass only a small amount of data is not the disadvantage it once was.

Nearly 25 years ago IBM's "Deep Blue" computer beat Garry Kasparov, the world chess champion, by selecting match-winning moves after crunching data fed by a panel of grandmasters. Five years ago, this approach was adopted by Google DeepMind's AlphaGo, which managed to beat the South Korean Go champion Lee Se-dol after studying a dataset of more than 100,000 human games.[5] Next, DeepMind took a big step forward when it built AlphaGo Zero, which works out how to win not by being fed huge amounts of data from previous games but by learning from the experience gained by playing itself over and over again. Each replication of the learning algorithm makes it smarter and turns it into an unbeatable winner: it has defeated its predecessor countless times.[6]

Now, DeepMind has turned its attention to a puzzle that has stood as one of the great scientific challenges of the past 50 years: how do proteins, the workhorse molecules of life, fold their chains of amino-acid building blocks into 3-D structures? Answering this question is critical to understanding how bacteria and viruses interact with our bodies to cause disease, which could not only help improve current treatments but also pave the way to discovering treatments for diseases that have eluded effective therapies thus far. Traditional experimental methods—X-ray crystallography and cryo-electron microscopy—are slow, expensive, and sometimes unreliable, which explains why only about 180,000 protein structures have been solved, a fraction of the 100 million or so known proteins.

In a fragmenting world, the fractal approach means counting on experience rather than sheer scale.

Building on the success of AlphaGo, DeepMind has developed AlphaFold, a deep learning algorithm that was trained using a subset of the 180,000 known protein structures from previous research programs—and is using it to predict the structure of more than 100 million proteins, including an initial release of 350,000 structures on the AlphaFold database. As Arthur D. Levinson, former chairman and CEO of Genentech, said, "AlphaFold is a once in a generation advance" that shows how "computational methods are poised to transform biology and hold much promise for accelerating the drug discovery process."[7]

In other words, the ability to build, train (using simple rules and even the tiniest ponds of data), and replicate a variety of "smart data" learning models across a company is likely to become as important, if not more so, as the ability to build vast data lakes and large, complex algorithms. In a fragmenting world, the fractal approach means counting on experience rather than sheer scale—and it means the "scale curve," which plots how companies benefit as they amass more data, is less important than the "experience curve," which plots how companies benefit as they amass more experience with smart-data models.

Seizing the Fractal Advantage

Small, local companies and startups have been generally quicker to adjust to the changing competitive landscape, profit from these winning strategies, and achieve fractal advantage. But there is no logical reason why big, global companies should not be able to do the same.

To do so, however, CEOs will need to make fundamental changes to the way their companies are organized, the way they operate, and even the way they think. They will need to transform their scale-driven companies into fractal companies that can flourish in a world where there are many different competitors (including traditional rivals, major companies in adjacent sectors, and pioneering startups) as well as many potential collaborators and many different and fast-evolving battlegrounds. They'll need to become companies that not only push decision making from the scale-advantaged center to the customer-focused edge, but that build those edge teams with all the necessary internal capabilities and external partnerships to respond rapidly and innovatively to seize opportunities.

So how can you fast forward to this new future?

There is no easy roadmap to follow; the journey is a complex one, and your company's path will depend on its unique starting point as well as the impact of the various disruptive forces on your industry. Nevertheless, when it comes to building fractal advantage in local markets, edge business opportunities, and smart-data learning algorithms, there are three key questions every CEO and leadership team should answer:

1. How can you make your company more outward looking, more interactional, and more open in the way it operates, thinks, and collaborates with external partners and ecosystems—as opposed to maximizing efficiency and control within the internal value chain—while also promoting internal collaborations by encouraging teams to think and work outside traditional silos and hierarchical boxes?

2. How will you transform your company from an efficient "product-out" approach (which seeks to maximize revenue from its current portfolio) into a fast-response, customer-inspired business—one that works proactively with customers to develop new solutions and that truly "owns" the customer experience (and not just the product) life cycle?

3. What steps can you take to decentralize your company—to tear down the headquarters-controlled, hierarchical decision-making process and distribute power to local leaders—while breaking down internal barriers and fostering the fluid exchange of information and ideas across the organization?

These are difficult questions, and they force CEOs to make some hard choices. Leaders need to be prepared to abandon the scale-driven approach that led to success in the past—and they need to act quickly. It took several generations of CEOs and many decades for most big companies to become fully optimized to achieve global scale advantage. Today's CEOs do not have the luxury of time.

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