

Business Revolution in the Digital Era

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I. The future is here

Companies are no longer debating whether or not to embark upon a digital journey, as the digital era is revolutionizing every business. No company or country can afford to overlook this phenomenon – the scale and speed of change empowered by digitalization are irreversibly altering the industry landscape and the fundamentals of business.

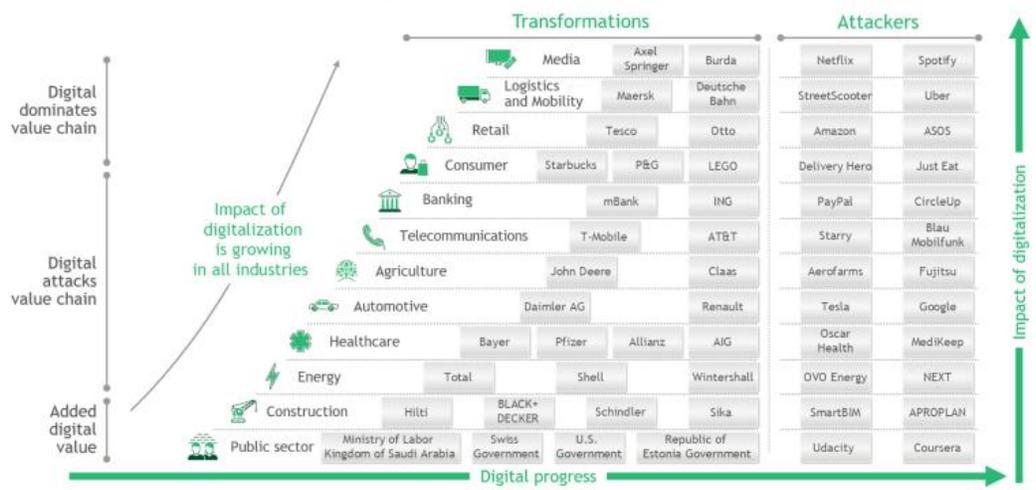
A decade ago, only one of the top ten global firms by market capitalization was a technology company. Today, seven companies dominate the list (See Exhibit 1.), and digital disruption has become the “new norm” across almost every industry. Digital natives have entered the market with completely redefined business models and incumbents have made significant efforts to compete in the race towards digitalization. (See Exhibit 2.)

Exhibit 1 | Top 10 companies by market capitalization (\$bn)



Source: Bloomberg.
Note: Based on closing price on January 31st each year.

Exhibit 2 | Digital has already revolutionized many industries



Source: BCG analysis.

Digitalization is not a new phenomenon, however the opportunities it represents and the capabilities that are required to win shift over time. Competitive advantage flows to the

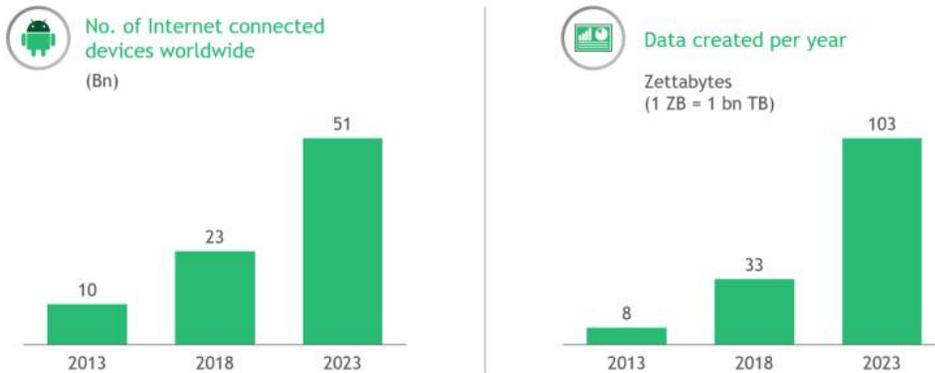
companies that see, understand and act on these shifts first. We are still only at the beginning of a new wave empowered by digital and data technologies, which will completely change the ways companies interact with their customers and manage their value chain. It will allow new entrants to attack the fundamentals of all industries, and eventually hugely increase the efficiency of interaction, communication and cooperation in the whole of society. Four major trends are emerging from this round of business revolution.

i. New technologies are maturing

New technologies are being adopted at varying speeds. Some have been around for years and are finally hitting their strides, while others are taking off in commercial applications. The advancement of technology is the key driving force of this revolution.

Artificial intelligence is becoming more widely available thanks to the development of cloud computing and open source (e.g., TensorFlow). Big data & analytics are starting to pay off by generating actionable insights and creating business value. The Internet of Things, together with immersive experiences powered by augmented and virtual reality, are not only leading to a data boom (See Exhibit 3.), but also enable the creation of a 1:1 scale digital world that will eventually create tremendous value in terms of efficiency improvements, and fundamentally change customer engagement and product development.

Exhibit 3 | Explosion of data and connectivity



Sources: HIS; IDC.

ii. Customer centricity is for real now

Customers are now the starting point for business model design, and their demand for personalization has reached a new height. “Customer centricity” or “customer first” has been on the minds of business leaders for decades, but its application has been limited by the high cost of customization and the difficulty of scaling up. But that is about to change.

- A high degree of customization has already been achieved and consistently optimized in digital products: accurate customer profiling is enabled by collecting and tracking real-time behavioral data at a high level of granularity.
- The cost of customization for physical products is expected to fall dramatically in the future with the development of precision marketing, flexible manufacturing systems and digital supply chains.

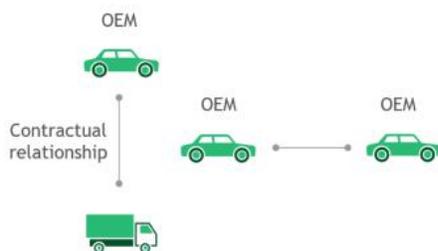
iii. Ecosystem building is the new way to compete and collaborate

Traditional value chains are increasingly being deconstructed and reshaped by ecosystems orchestrated by companies such as Amazon, Alibaba, Apple, Tencent, Google, and Facebook.

- The DNA of the collaboration model has changed in the digital era: the different magnitude of participants calls for faster and more open fluidity, as well as increasing diversity (e.g. industry, geography, development stage) and level of novelty (e.g. innovative digital theme, value web). As a result, the typical bilateral model has transformed into a multilateral model. (See Exhibit 4.)
- There are three main types of ecosystem emerging: “Digitizer networks” unleash digital potential with individual strategic partners, “Platforms” create connections in the digital world with countless platform contributors and “Super platforms” scale up digital opportunities with select partner platforms and their countless contributors. (See Exhibit 5.)

Exhibit 4 | Shift from bilateral to multilateral collaboration model (example of auto industry)

Bilateral intra-industry partnership



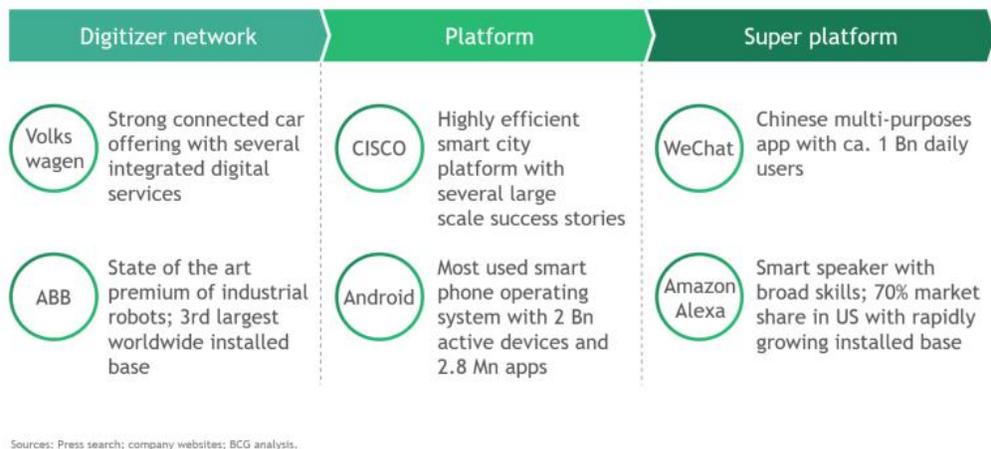
Partners: 2 # Deal types: 1 # Countries: 1 # Industries: 1

Multilateral cross-industry partnership



Partners: >30 # Deal types: -5 # Countries: >5 # Industries: >5

Exhibit 5 | Three main types of ecosystem



iv. Change-embracing governance and regulation

Governments of leading digital economies have put significant effort and resources into supporting the growth of the digital economy, with varied focuses (e.g. supportive policies, digital infrastructure investment).

For example, the United States, as the first nation that truly embraced and invested in the digital economy, is the leader in cutting-edge technologies and the reinvention of manufacturing. The European Union is focusing on establishing a single digital market, and has made meaningful progress in tearing down unnecessary regulatory barriers and building up the legislative foundation for the data economy. China is leading the way in the development and adoption of big data and AI technologies, and racing ahead in building a digital infrastructure (e.g. 5G deployment).

II. Key implications for business leaders

i. An adaptive approach to digital strategy

There is no universal digital strategy for retailers, financial institutions, and food & beverage manufacturers, but there is a better way to think about and formulate strategy in the digital age that applies to all companies. While the strategic concepts of scale, segmentation, and cost position remain valid and relevant, the traditional way of looking at those concepts – in terms of three to five-year planning cycles – is out of date.

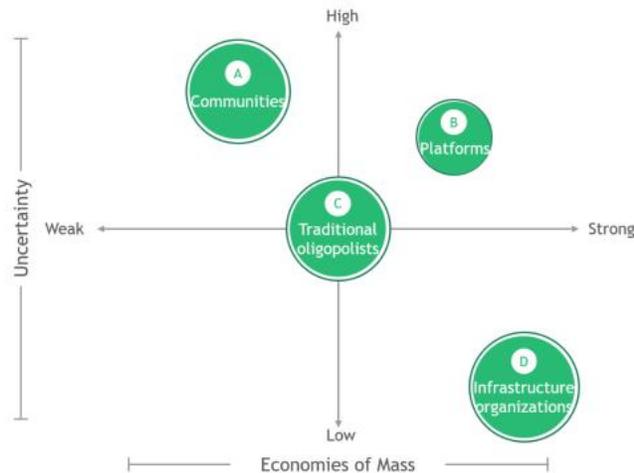
Today's business operating environment is becoming increasingly unpredictable, therefore companies need to be able to recognize relevant data patterns and generate insights, which could be leveraged further to optimize operational activities in real time, and continuously refine and reinvent their business model. As a result, the key guiding principle for companies to devise a strategic approach is to ensure they place sufficient focus and value on real-time data and experimentation.

ii. A clear and holistic view of ecosystem architecture

With the blurring of industry borders, the breakthrough in traditional value chain steps, and the emergence of digital ecosystem giants, the business structure in most industries will evolve from a classic oligopolistic structure – where a small number of companies compete on a similar vertical value chain – into a diverse architecture of horizontal layers with a shared infrastructure on the bottom, producing and consuming communities on the top, and traditional oligopolists competing in the middle, forming a “stacked” ecosystem architecture.

The ecosystem stack consists of a large number of institutions of varying size, scale and capability – they coexist in a mutually sustaining structure and focus on activities with competitive advantages. There are four types of layers within a stack. (See Exhibit 6.)

Exhibit 6 | The digital ecosystem has enabled new institutional options



Source: BCG analysis.

- **Communities of users, professionals and small entrepreneurs** are typically found towards the top of the stack, receiving services from lower layers. They flourish when uncertainty is high but economies of mass are weak. The communities are, at one extreme, small developers competing to write apps for the iPhone without much, if any, social capital; or at the other extreme, Linux hackers or Wikipedia writers collaborating to build a massive body of shared intellectual property.
- **Infrastructure organizations** are typically found at the bottom of the stack, since they provide services to other layers with receiving services in return. They are most useful when uncertainty is low and economies of mass (especially scale) are overwhelming. Their core competence is in long-term, numbers-driven capacity management. Their vision is to be efficient and maximize access. It is not, in general, their job to innovate, though they may deploy successive generations of technology innovations generated by others.

- **Curatorial platforms**, narrowly defined as organizations that exist solely as hosts for communities, are a hybrid. In the stack, they lie immediately below the community members. But they can grow into something resembling infrastructure, sometimes with stunning speed.
- **Traditional oligopolists** occupy the broad middle of the stack. They have the advantage when uncertainty is high but not incalculable, and economies of mass (scale, scope and experience) are significant but not overwhelming. They exploit economies of scale and scope by placing big bets on technologies and facilities. They make incremental improvements in products and processes.

A company can choose to play in any of the four layers in a stack. Most of today's companies are traditional. Curatorial platforms can be either non-profit organizations (e.g. Wikipedia), or corporations such as Facebook and Airbnb. While some infrastructure organizations are owned by governments or municipalities, others are for-profit corporations, such as Amazon Web Services and Alibaba Cloud. Companies can even participate in communities as small ventures or venture capitalists, or indirectly by encouraging employees to contribute to projects such as Google and Linux.

But what cannot be overemphasized are the differences in participating and competing in the four layers. A company can flourish on multiple layers – as Alibaba and Amazon do – but most organizations constantly underestimate the enormous challenges. They require vastly different capabilities and motives, present different financial profiles to investors, and need to be managed on different time horizons.

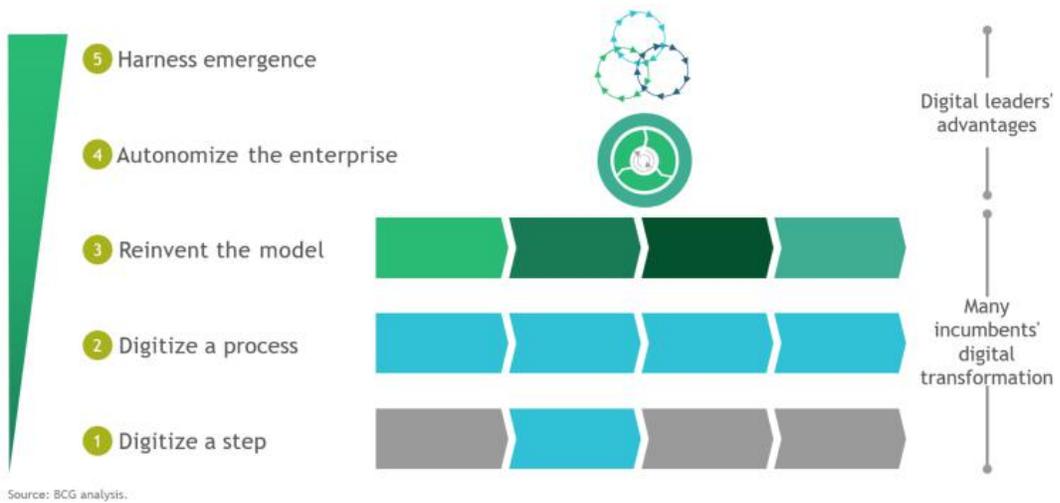
In light of evolving technologies, a company should reevaluate their value added to the stack from first principles, reconceptualize the industry and strive to orchestrate a new

industrial stack. However, not all companies have the scale and scope to be orchestrators, and they need to seek advantaged roles in stacks where they cannot curate their own. Take smart homes as an example: Google, with its acquisition of Nest and Apple, with the launch of HomeKit, are building stacked architectures for granular integration of sub-systems. It is not clear how the battle will play out, but the implications for other players are evident and imminent: they must hedge their bets and focus on defensible niches.

iii. A reinvented self-tuning business model

Many of today’s incumbents are currently carrying out “digital transformations.” Such programs generally have two aims: to automate the supply chain and internal processes, and to innovate by creating digital offerings. However, leading digital players, such as Google, Amazon, Alibaba and Netflix, have gone way beyond to fundamentally reinvent the operating system of the company itself. (See Exhibit 7.)

Exhibit 7 | Levels of digital sophistication



Autonomize the enterprise

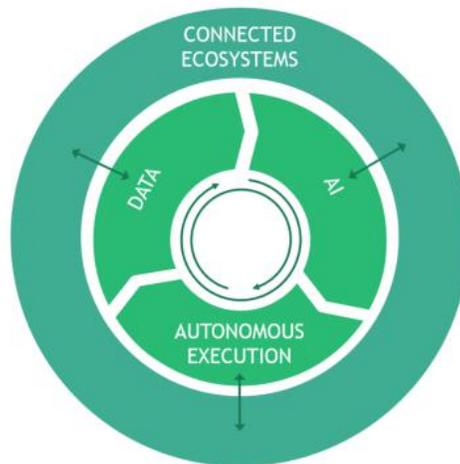
Beyond the digitalization of the core business, companies need to create an integrated, autonomous learning system to build the next level of digital competitiveness. This involves not only adopting individual technological modalities (e.g. end-to-end digital platforms, data, and analytics), but also connecting them in a self-reinforcing system. (See Exhibit 8.)

- Digital leaders develop platforms that match suppliers and customers. By nurturing both sides of the market, companies create vast ecosystems of commercial activities that surround their platform services.
- These ecosystems generate enormous amounts of proprietary data, conferring an information advantage to the platform orchestrator.
- Companies can then leverage AI to generate real-time insights on consumer and supplier behavior from the data.
- Digital leaders wire these insights directly to action systems, enabling them to learn autonomously and optimize their offerings to changing conditions.
- The effect of these actions then reverberate throughout the ecosystem, generating new signals to fuel further decisions.

Such autonomous learning systems allow for a much higher level of segmentation and personalization than would be possible with a traditional real-time managerial system, which is constrained by the bandwidth and speed limits of human cognition and

hierarchical organizations. More importantly, autonomous systems can easily outcompete traditional models on their rate of learning in a business environment that is becoming increasingly complex and dynamic.

Exhibit 8 | The integrated, autonomous learning system



Source: BCG analysis.

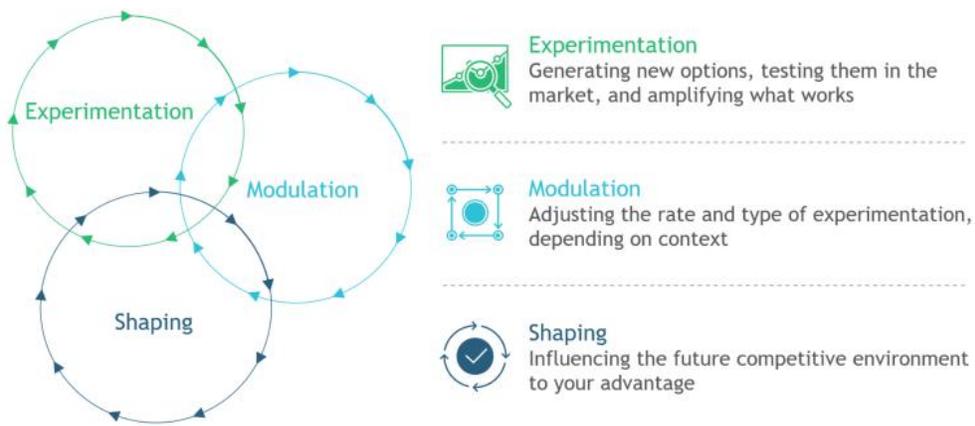
Harness emergence

Autonomous learning systems can also unleash the power of emergence – the creation of a plethora of options beyond those explicitly planned or foreseen by a managerial process. In today’s ever-changing business environment, it is unrealistic to think that leaders will be able to envision or predict all relevant scenarios and the optimal responses to each. Thus, harnessing emergence becomes a strategic imperative in the fast evolving digital age – effectively liberating the company from the constraints of classical planning and unlocking the creative potential of an evolutionary process.

Three learning loops are harnessed. (See Exhibit 9.)

- Experiment to learn more about customer needs and discover what works (e.g. using A/B testing). First, this means generating new options. A growing library of choices is vital to a system's success. Second, it means testing options economically: providing recommendations that are based on knowledge of content and customer behavior, but with a degree of randomness or stretch to avoid getting stuck in a rut. Third, it means amplifying what works. The systems track click rates, purchases, and ratings to learn more about personal preferences and then use that information to improve future recommendations.
- Modulate the rate of experimentation to optimize the long-run payoff. For example, with new customers, higher rates of experimentation are necessary to unearth what they do and don't like. This can be scaled back as the algorithms learn more about them. However, experimentation should never drop to zero, because all users should experience a degree of exploration and surprise.
- Shape the environment to customers' advantage and influence preferences. Much of the delight of recommendation engines comes from discovering products and content you would not have otherwise found. Being directed to a new category or product both reveals and shapes what a user finds interesting. It plays the same role that advertising does in traditional marketing – not only reinforcing existing preferences but also creating new ones.

Exhibit 9 | Learning loops of the self-tuning enterprise



Source: BCG analysis.

Combining the effects of autonomization and emergence, a self-tuning operating model is reinvented, one that learns and innovates at the “speed of data” and able to create significant competitive advantages. Organizations can better understand customers by leveraging data from their own ecosystems, developing granular insights, and automatically upgrade or customize their offerings. They can develop more new, marketable products by experimenting with offerings and leveraging proprietary data. And they can implement change more quickly and at lower cost by acting autonomously.

One example of a self-tuning organization is Alibaba. Not only does its e-commerce platform provide a mass of user data, but the company is able to generate granular insights and tunes its offering in a real-time and highly segmented manner (e.g. in search results, product displacement). And it continuously reshapes the company to enable it to do these things more effectively.

Case study: Alibaba

After its establishment in 1999, Alibaba Group initially focused on building a B2B website for small Chinese manufacturers. But in the years since, it has expanded its portfolio in many directions. Today, the group spans ten businesses with over 60,000 employees and \$40 billion in revenue. In China's fast-changing e-commerce market, it could not have achieved that level of success without constantly retuning itself at all levels.

In the early years, Alibaba's goal was to be "an e-commerce company serving China's small export companies." This led to an initial focus on Alibaba.com, which created a platform for international sales.

However, when the market changed, so did the vision. As Chinese domestic consumption exploded, Alibaba saw an opportunity to expand its offering to consumers, launching the online marketplace Taobao in 2003. Soon Alibaba realized that Chinese consumers needed more than just a site for buying and selling goods. They needed greater confidence in online shopping – for example, they needed to be sure that online payments were safe. So in 2004, Alibaba created Alipay, an online payment service. By providing both an escrow service and a merchant-rating system, Alipay introduced the ingredients for transparency and trust, which sped up the penetration of e-commerce in China. Ultimately, this led Alibaba to change its vision again, in 2008, to fostering "the development of an e-commerce ecosystem in China." It started to offer more infrastructure services, such as a cloud-computing platform, microfinancing, and a

convergence of digital and physical channels. By regularly retuning its vision, Alibaba has been able not only to respond quickly and effectively to new market realities but also to shape the way consumers and businesses interact.

At each juncture in its evolution, Alibaba continued to generate new business model options, letting them run as separate units. After testing them, it scaled up the most promising ones and closed down or reabsorbed those that were less promising. In 2006, for example, spotting two new trends, Alibaba decided to launch two units. To tap the growing B2C market, it began building Taobao Mall, a platform for established brands to reach Chinese consumers, which eventually became Tmall, and is a major part of the group portfolio today. To catch the software as a service wave, it started Alisoft, entering the market too early. Alisoft could not find a killer app that generated enough customers. Alibaba shut down the business in 2009.

In Alibaba's case, rapid advances in technology, shifting consumer expectations in China and beyond, and regulatory uncertainty made it difficult to predict the future. To deal with this situation, Alibaba adopted a continuous process of "replanning." Rather than meticulously executing a fixed, detailed blueprint, the company revises its strategy and tactics as circumstances change.

Case study: Amazon

Unlike many of his rivals, Jeff Bezos sees business architecture as a strategic variable, not a given. He did not harness technology to the imperatives of his business model; he adapted his business model to the possibilities – and the imperatives – of technology.

Bezos's initial idea was to exploit the Web to deconstruct traditional bookselling. With just a well-designed website that piggybacked on the inventory and the index of book wholesaler Ingram, Amazon offered a catalogue ten times larger than that of the largest Main Street superstore, at prices 10 to 15 percent cheaper.

But that was not a sustainable advantage: competitors such as BN.com would rapidly establish comparable selections and price points. Amazon went on to exploit the emerging economics of community. The Amazon Associates program allowed bloggers to post widgets endorsing books and to earn a commission on click-throughs. Amazon curated its reviewer community, encouraging the rating of reviews and awarding badges to the best-rated reviewers. It extracted insights from the behavior of its community of customers and became an early adopter of collaborative filtering algorithms, goosing sales with messages that “people like you who bought X often buy Y.” On the selling side, the company launched Amazon Marketplace as a fixed-price rival to eBay: a platform hosting a community of small sellers that now numbers more than 2 million. All these strategies benefited from the network effect: the more participants, the more choices; the more reviews, the richer the experience.

Well ahead of others, Amazon also embraced what became the third wave of digital disruption, exploiting opportunities to hyperscale. It built a global network of 80 fulfillment centers and relentlessly broadened its product line to include almost any product that can be delivered by truck. It offered fulfillment services as an option for small merchants, which could thereby distribute almost as efficiently as Walmart. Amazon became the broad river of commerce suggested by its name.

From deconstruction to community curation to hyperscaling: at no point did Amazon sit back and wait for trends to emerge. Rather, it seized the strategic opportunities presented by each successive wave of disruption, ruthlessly cannibalizing its own business where necessary. E-books were inevitable, so it launched the Kindle; customer information and scale in data processing are critical, so it sells cloud services to its own competitors. And at no point did Bezos restrict one business to protect another – Amazon is now run as four loosely coupled platforms, three of which are profit centers: a community host, supported by an online shop, supported by a logistics system, supported by data services.

iv. A dynamic, flexible organization

A complete change of business model requires a fundamental redesign and upgrade of the organization. We have identified four key initiatives to enable organizations for the digital era:

Activate and reinvent the leadership mindset

- Activate from awareness to action. Leaders should proactively “expose” themselves to digital challengers and innovators, identify and define new sources of revenue, form relevant partnerships (e.g. joint ventures and ecosystem partnerships) or build in-house capabilities (e.g. incubators and accelerators), and develop and deliver digital solutions.
- Re-think the human-machine / algorithm relationship. As digital technology evolves, the comparative advantages of humans and machines are shifting. For problems that involve data acquisition, processing and decision making, algorithms should be given autonomy, removing the bottleneck of human decision making. People should instead be focused on “meta” tasks, such as building and refining autonomous learning systems and expanding ecosystems.
- Embrace biological thinking and the inherent complexity of business, recognizing that circumstances change, knowledge is always incomplete, causality is complex, and outcomes are unpredictable. Instead of relying on unchanged, rigid plans, leaders need to encourage and influence a collaborative environment to experiment and co-evolve to find the best path forward.

Redesign the organization structure

As the demand for agility and adaptability increases, the core objective of organizations is

shifting from management & incentivization to enablement, which will revolutionize the organizational structure of firms and make them more platform-like.

- Many autonomous front ends: formed mostly by cross-functional teams with a certain degree of autonomy and P&L responsibility, they are the “communities” within an organization that lead innovation.
- Large-scale, strong supporting platforms: they establish standards, develop user friendly interfaces, modulate key functionalities and build shared pools of resources (e.g. data and analytical tools).
- Ecosystem-based collaboration: diverse and flexible collaboration models for companies and business units within the ecosystem, enabled by a highly coordinated governance structure.

The redesign from a traditional to a digital organization is often a staged, evolutionary process:

- Isolated, lighthouse projects: many functions experiment with the idea of digital, and aim for relatively small-scale quick wins or product innovations. The company’s core business remains unchanged.
- Digital center of excellence: digital capabilities are developed and bundled into the digital COE within each individual function. Digitalization spreads across the organization and a dedicated leadership role is established to provide centralized management (e.g. Chief Digital Officer).
- Full digital business units: further development of digital COE capabilities to

expand responsibilities beyond supporting the functional digitalization efforts. Instead, business units are in the driver seat for the enterprise-wide digital transformation, with a full agile structure.

- Fully transformed digital organization: digitalization is exercised at all levels and built into the company's DNA. All teams are operating at full agile and an autonomous system is taking on a significant role in product development and process optimization.

Build talents and capabilities

Digital talents are rare and difficult to recruit. Companies can choose to massively upskill existing teams or build a compelling employer proposition to attract digital talents.

- Digital upskilling requires a significant change in teams and a systematic change to traditional ways of working. Legacy organizations need to shift their focus to value creation by increasing automation, accelerating the decision process by leveraging data and analytics, and change the responsibility of managers from controlling activities to coaching and development. Employees should be required to master a new set of competences, such as agile methodology and project-based product development.
- Investment in digital talent acquisition is key. Although putting in place a compensation incentive is critical, digital talents are motivated by a much wider range of factors than traditional employees. For example, they are likely to be less concerned about long-term security. They are focused on learning and personal development, want to create impact through their work and require frequent acknowledgement and praise.

Develop a digital culture

Culture is the way things get done in an organization, represented by a collective set of characteristic behaviors. Digital leaders should develop the following five behavioral traits.

- Customer centricity: product development is user-centered; innovations rooted in customer needs.
- Data-driven: data is open and available to all employees to facilitate decision making. Data and evidence are favored over assertion.
- Agile: responsiveness to change and the ability to change course quickly is favored over following a process or plan.
- Engaged: people feel connected to the organization's purpose and are driven to go above and beyond to achieve results.
- Collaborative: people work horizontally across functions and vertically between reporting layers to enhance business outcomes.

III. Key implications for the policy making agenda

In the digital era, the economy is going through significant changes, with constant technological development and disruptive pressure on all industries. Governments around the globe are grappling with how to establish a solid foundation for modern, successful, and more importantly, adaptive economies.

The future holds many opportunities for countries and societies – improving productivity,

job creation, accelerating wealth accumulation and strengthening competitive positioning. However, achieving these objectives will be challenging, and will require bold steps that go beyond traditional approaches.

Policy makers can consider taking strategic actions in three areas to encourage growth and innovation, and build a robust and competitive digital economy.

i. Play an activist role

The countries that have emerged as global digital leaders are mostly led by governments that have taken a strong activist role in digital economic development. Governments can reduce the complexity of their operations, adopt agile principles in their policy and service delivery, and increase the use of data and analytics.

- Agile way of working: by bringing together multi-disciplinary teams and introducing an iterative, trial-and-error mindset and approach, the risk of large projects failing could be reduced by almost 50 percent compared to traditional waterfall methodologies.
- Data and analytics: governments urgently need to develop and strengthen data capabilities to analyze, interpret and take action on the growing and increasingly complex data in public sector.

ii. Encourage and stimulate innovation and entrepreneurial activities

Investment in digital infrastructure can only be capitalized through business innovation and entrepreneurship. Governments should further increase national research and development efforts to stimulate innovation, and support the growth of digital clusters.

- Increase investment: national research and development investment is critical to accelerate the digital economy. Investments should be targeted towards the areas and industries where global competitive advantages can be built.
- Support digital clusters: clusters have been widely recognized as a successful model for building a business environment for local and global innovators and entrepreneurs to incubate competitive ideas. Governments can expand their support to strengthen engagement with the digital cluster communities to deepen the understanding of their needs and challenges, and remove or minimize regulatory and financial constraints that foster growth.

iii. Prepare for the future of work

The rise of robotics, automation and AI have already replaced some jobs, as well as creating completely new ones (e.g. AI customer service trainers). This change will only accelerate and result in more profound shifts in the landscape of the future workforce. Governments should understand the impact of these changes and take the lead in preparing the workforce for the challenges ahead.

IV. Summary

Many of today's internet giants emerged only in the last 10 years, and we are only starting to unleash the potential of the digitally enabled business revolution, creating benefits for consumers, businesses and society.

Digital natives such as Alibaba and Amazon have been at the forefront of the revolution, and are constantly reinventing themselves in response to unrelenting technological

advancements. To win in the digital era, companies must take an adaptive approach to strategy, secure an advantaged position in the ecosystem, and strive to reinvent a self-tuning business model of leveraging data and technology, achieved through a dynamic and flexible organization. To help businesses succeed in the digital era, policy makers should consider taking an activist role by reducing complexity and adopting agile ways of working. They should stimulate innovation and entrepreneurship by ramping up investment in research and development and supporting digital clusters, while proactively positioning themselves and preparing the workforce for the future changes.

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