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The Digital Transformation of All Businesses and Industries

By: Thomas Ricketts, CFA

What's Evolving on the Innovation Frontier:

The Digital Transformation of All Businesses and Industries

Most new technologies that come along are mere tools, incremental in impact to a given company or industry. There are certain types of technologies, however, that have the power to transform companies and even entire industries. Academics call these technologies "general-purpose technologies." Their development and evolution have often been the underlying engine of economic development and productivity jumps. This thought piece focuses on the current general-purpose technologies transforming all industries today, collectively described as Digitization.

The Importance of General-Purpose Technologies

Academics define general-purpose technologies (GPTs) as foundational technologies that enable many applications with broad, significant cumulative impact on society. GPTs go all the way back to the stone age. Examples of GPTs include stone tools to aqueducts, the water mill to steam engines, and on to electricity and the computer. Each of these GPTs was profound in its power to create new applications that transformed society, and in the process spawned new industries while impacting existing ones. With each new GPT, society as a whole is challenged to embrace and integrate it into their economic and political systems. When done successfully over time, this process may lead to economic growth and improvement in standard of living. If not, then societies may fall behind. Clearly, GPTs have great power.

This fundamental economic and societal adjustment process occurs at all levels of society, from whole economies down to companies and individual workers. This adjustment process starts with making sense of the importance of the GPT, then shifts to education and training, and, ultimately, to its application for creating new value, improving productivity and efficiencies, and gaining competitive advantage. This process takes a long time. As waves of GPTs get absorbed over decades, they sneak up on companies and workers alike. Those with a vision to recognize their importance get a jump on the competition and profit.

We are now living through one of the most important GPT waves in history: the Digital Transformation of all businesses and industries. Called different things over the years—the Digital Age, the Digital Revolution, the Fourth Industrial Revolution (Industry 4.0), or just Digitization—its impact is accelerating and broadening. Like a frog being slow boiled in water, entire industries are now feeling the heat of Digital Transformation. This heat comes from all directions, with consumers expecting an Amazon-like user experience, younger digital native workers pushing for more end-to-end digital processes, or, competitively, to the emergence of digital startups and non-traditional players disrupting an industry using innovative new digital business models.

In the widely acclaimed book, *The Second Machine Age*, authors Erik Brynjolfsson and Andrew McAfee describe general-purpose technologies as being defined as "pervasive, improving over time, and able to spawn new innovations." They say that "digital technologies meet all three of these requirements. They improve along a Moore's Law trajectory, are used in every industry in the world, and lead to innovations like autonomous cars and nonhuman Jeopardy! champions."[1]

Shifting from Tech-as-Tool to Tech-Enabled Business Models

Digital technology is shifting from merely a discrete tool to enhance productivity to now becoming weaved throughout the foundation of every business and across every value chain, sometimes creating entirely new business models that threaten old ones.

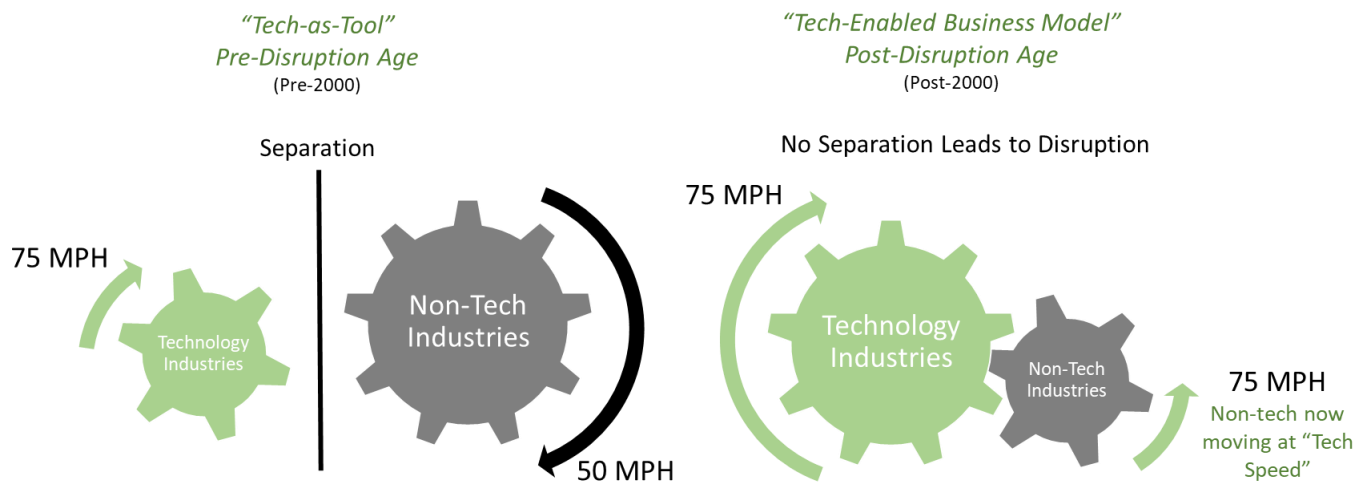
In many ways, digital technology *is* the new value chain, from a chain of stuff to a flow of bits. Digitization, defined as the use of information technology, from computers and communication networks to software and cloud-based technologies, to improve productivity and value creation, has been felt on the margins for years. Recently, however, its power has grown to new heights. *Think of this change as moving from the "tech-as-tool" stage to a "tech-enabled business model" stage*.

In the 80s and 90s, computers were largely supplementary to business processes. The advent of the web and e-commerce in the late-90s began to show the contours of how digitization could more substantially threaten or reshape industries, in this case mostly retail and distribution. *Now, with Web 2.0 technologies, mobile computing, cloud computing, and "software eating the world" driving greater end-to-end automation, all industries are now seeing varying degrees of transformation*. It is not just retail being upended; we now see it in media (shift to digital streaming), banking (newer forms of electronic payments), transportation (on-demand taxi services), and many other industries.

The bottom-line is that we now live in an age where the underlying technologies of digitization can be combined to transform entire industries and create a new species of tech-enabled companies. Leading companies are doing more than re-tooling, they are fundamentally re-architecting their businesses using these new digital tools. This is forcing so-called non-tech companies and industries to embrace digitization and now move at "tech speed" (see diagram below).

Shift from "Tech-as-Tool" to "Tech-Enabled Business Model"

This is Disrupting Existing Industries Through Digital Transformation



In the past, technology industries were separate from non-tech industries and technologies were used as productivity tools for all industries. Technology evolved faster than non-tech, but because of their separation, this didn't cause disruption.

The separation between tech and non-tech industries has broken down, and now, increasingly, all industries are being tech-enabled. This is speeding up innovation cycles for so-called non-tech industries and creating disruption for companies that cannot embrace digital transformation and tech-enabled business models.

For example, digital video streaming is upending the traditional TV and movie production and distribution industries. All the old industry assumptions, from how shows are consumed (e.g., viewers must watch a show at a certain time) to how you pay for them (e.g., viewers must sit and endure endless ads) are radically changing. This creates both opportunity and risk, depending on whether a company (or investor) is embracing these evolutionary changes or ignoring them.

Media, while an obvious example of Digital Transformation, is not the only one. Industries that are not known for being technologically advanced, from insurance and financial institutions to auto manufacturers and healthcare companies, are feeling the heat to embrace digitization and experiment with new digital business models.

The reasons for embracing digitization are both defensive (as described above) and offensive. Recent studies have shown that companies that invest in and develop digital business models deliver better financial performance. The MIT Center for Information Systems Research (CISR) conducted a study of 130 businesses and found that *regardless of industry*, those companies that scored in the top third of financial performance (growth and profitability metrics) had 20-40% higher measures on adoption and deployment of various digital processes and models.[2]

A PwC study of more than 2,000 respondents showed that companies with greater digitization of operations and supply chains experienced efficiency gains of over 4% per year while adding nearly 3 percentage points to revenue growth.[3] It pays to go digital, and this process may be accelerating as the general-purpose technologies hit higher levels of performance and capability.

The Ingredients of Digital Transformation

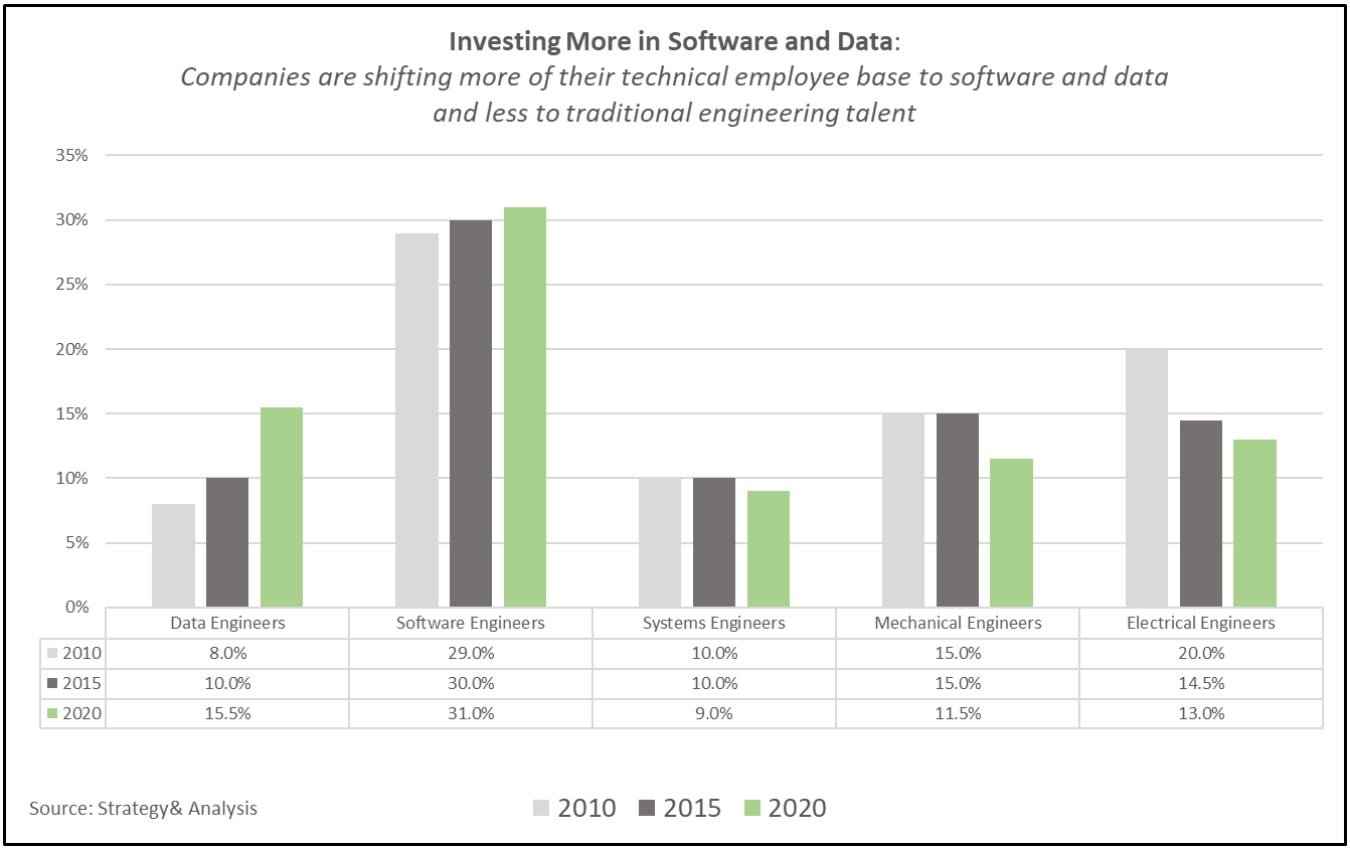
What are the actual main ingredients of digitization and Digital Transformation? According to a white paper entitled "World Economic Forum White Paper on the Digital Transformation of Industries," the primary components are a laundry list of technologies, including obvious ones (software and mobile, social, and cloud computing) to less obvious ones (personalization of apps and services, use of sensors to create smart products, and collection and analysis of big data).[4] How companies effectively bring these components together into differentiated digital business models is more important than merely deploying all of the above as a check-the-box exercise. As we see with the success of Amazon, consumers know when this orchestration is done well, and vote with their clicks.

Possibly the most important building block is software. In an article by the publication *Strategy+Business*, "Software-as-a-Catalyst," the authors argue that the most innovative companies are shifting more and more of their R&D spend toward software and services at the expense of investment in traditional engineering skillsets:[5]

> Most of the world's major innovators are in the midst of the same transformational journey. R&D is shifting more and more toward developing software and services. Software increasingly carries the burden of enabling product differentiation and adaptability, and enhancing customer experiences and outcomes. Services, offered along with or separately from physical products, now focus more on new customer needs, providing enhanced value and improved usability.

In the chart below we show data from the same article that illustrates a trend toward greater software-based R&D. The largest group of engineers employed by companies is software engineers, and this is

growing. By 2020, it is projected that the second-largest engineer group will be data engineers. Software and data are complements and core building blocks of tech-enabled companies.



	Data Engineers	Software Engineers	Systems Engineers	Mechanical Engineers	Electrical Engineers
2010	8.0%	29.0%	10.0%	15.0%	20.0%
2015	10.0%	30.0%	10.0%	15.0%	14.5%
2020	15.5%	31.0%	9.0%	11.5%	13.0%

Implications for Investors of Digital Transformation

The rise of Digital Transformation has multiple implications for today's investors. For example, the traditional sector and industry classifications are becoming increasingly less valuable. With the boundaries between industries blurring, especially as technology companies invade more non-tech industries, it is important to re-evaluate what constitutes an industry and who the relevant competitors are to monitor. Recent re-classifications of companies by MSCI in certain GICS categories demonstrate how digital-driven evolution is reshaping industries. Equally important, there are significant investment opportunities in companies that enable these digital transformations, from horizontal cloud providers to industry-specific software, data, and service providers.

The big picture is that it is becoming critical to understand how Digital Transformation will force radical changes throughout all industries, creating both opportunity for innovative leaders and risk for laggards. Industries are now evolving more rapidly due to these digital transformations, and these "digital evolution" changes create opportunity. Investment opportunity can be found in leading developers of general-purpose technologies, in specific new applications of the GPTs, and in industry leaders that apply these technologies to create competitive advantage and gain market share.

Digital Transformation is one of the primary megatrends in the Age of Innovation and will continue to create growth opportunities for those companies and industries that harness its power for creating value for users. Select leading companies that can create and capture this new value may offer attractive investment opportunities for investors. *Given that these GPTs are now impacting all industries, the ability for an investment firm to say that "technology" is not within their sphere of competence is over. Technology is no longer a discrete tool that enhances a business—it is becoming built into the fabric of every business and industry. We are all technology investors now*.

Sources:

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5. Jaruzelski, Barry, Volker Staack, and Aritomo Shinozaki. "Software-as-a-Catalyst." *Strategy+Business*. Issue 85 (2016).