Digital Innovation and Strategic Transformation

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Digital technologies—and how we use them in our personal lives, work, and society—have changed the face of business and will continue to do so. Moreover, research organizations such as Gartner and Accenture, along with MIT professor Erik Brynjolfsson,[1] indicate that the digital technologies that underlie computers, robots, and smart equipment are changing rapidly, becoming more powerful, and transforming organizations much faster than in the past (that is, the second machine age). We are in the Fourth Industrial Revolution, the digital revolution of cyber-physical systems that has been unfolding since the middle of the last century.[2] The possibility of billions of people connected by mobile devices, in conjunction with unprecedented processing power, storage capacity, and access to knowledge via smart machines, creates enormous opportunities for entrepreneurs and innovative managers alike.

Transformation Defined

Digital transformation is the profound and accelerating transformation of business activities, processes, competencies, and models to fully leverage the changes and opportunities brought by digital technologies and their impact across society in a strategic and prioritized way. According to a recent study by Accenture and Oxford Economics, the increased use of digital technologies could add US$1.36 trillion to the total global economic output in 2020.[3]

Today, smart machines (digital cognitive systems) are gaining human capabilities (biological cognitive systems), such as recognizing voices, processing natural language, and interacting and learning with the physical world through vision, smell, touch, other senses, mobility, and motor control. In some cases, these machines do a much faster and better job than people at recognizing patterns, performing rule-based analysis from very large amounts of data, and solving structured and unstructured problems.[4] Business processes and whole industries will be transformed.

The digital disruption has already started:

- Uber is the world's largest taxi company but owns no taxis (cloud-enabled mobile location-based services).

Cognitive Assistants: A Growing List

- Apple Siri
- Amazon's Alexa
- Google Now
- Anki's Cozmo
- Google's Brain and AplhaGo
- Microsoft's Adam, Braina, and Cortana
- IBM Watson
- Chinese Baidu's Minwa
- Samsung's S Voice
- LG's Voice Mate
- BlackBerry's Assistant
- SILVIA (Symbolically Isolated Linguistically Variable Intelligence Algorithms)
- HTC's Hidi
- Facebook's M
- Nuance's Vlingo
- AIVC (Artificial Intelligence Venture Capital)
- Skyvi
- IRIS (the Artificial Intelligence that Reads Science)
- Everfriend
- Evi
- Alme
- Viv
- Wolfram Alpha
- Saffron 10
- Vicarious

- Airbnb is the largest accommodation provider but owns no real estate (cloud-enabled lodging services).
- Skype is one of the largest phone companies but owns no telecommunications infrastructure (cloud-enabled communication services).
- Alibaba is the world's biggest online commerce company but has no inventory (cloud-enabled retail services).
- Facebook is the most popular media owner but creates no content (cloud-enabled social network services).
- Netflix is the largest movie house but owns no cinemas (cloud-enabled entertainment services).
- Amazon is the largest retailer but produces no products or services (cloud-enabled retail services).
- Massive open online courses (MOOCs) are the largest schools but have no campuses (cloud-enabled education services).
- Apple and Google are the largest purveyors of software applications but don't write apps (cloud-enabled mobile app services).
- IBM Watson is emerging as the largest cognitive solutions platform but does not require customers to hand over their proprietary and unique datasets (cloud-enabled cognition as a service).

The digital revolution is rapidly transforming the fundamental nature of a wide range of public and private organizations and revitalizing their digital business models across industries—including healthcare, finance, logistics, education, manufacturing, retail, hospitality, transportation, telecommunication, e-government, energy, utilities, agriculture, and more. This revolution provides the means to improve the efficiency, effectiveness, sustainability, and innovativeness of product and service offerings through the following:

- the design and provisioning of new types of service offerings (Uber, Airbnb, Kindle, Google, Facebook, Twitter, Instagram, LinkedIn, online banking, and microfinance);
- the performance of some activities using automation (cognitive assistants, such as Apple Siri, IBM Watson, Microsoft Cortana, Google Now, and Amazon Echo; the sidebar lists several examples);
- industrialization that often improves existing service offerings by separating a service's traditional production (backstage) from customer contact (front-stage), thus enhancing storability, transportability, and access to knowledge-based service offerings (such as tax software, online classes, or patents);
- the design and delivery of outcome-targeted customer experiences (a key element, given that many digital transformations are a mix of customer experience optimization and process improvement—and cost savings);
- facilitations of new types of service system coordination through new and improved value propositions and governance mechanisms (Apple apps, ITunes, online broker systems, information markets, open innovation platforms, financial engineering, mechanism design, auction technology, and so on);
- reductions in the cost of backstage and front-stage service activities (such as semi- and fully automated call centers and other types of service centers);
- improvement in customer-perceived service quality (for example, the ability to standardize

elements of service as well as mass-customize or personalize to the individual when appropriate, or to transition from mass production to configure-to-order supply chains that achieve productivity and customer responsiveness);
- the integration of customers into service creation and delivery (self-service education, healthcare information systems, business-to-business solutions, IT outsourcing, and the commoditization of business processes, applications, and technology); and
- the delivery of knowledge-intensive professions (such as business consultant, physician, software engineer, legal counsel, financial advisor, or university professor) to labor-intensive employment in hospitality, personal services, transportation, and many others.

The overall goal of digital transformation is to increase the productivity and creativity (decision making, connectivity, innovation, and augmentation) of individuals and organizations. Digital transformation will let organizations address market needs much more quickly than used to be possible, enabling higher levels of collaboration for sharing information much faster. Greater innovation and outcomes result as businesses have access to pools of knowledge and resources outside their walls via advanced ICT (such as smart devices, mobile, cloud and fog computing, big data and analytics, social media and networking, cognitive computing, and artificial intelligence).[5]

Despite these benefits, digital transformation creates new challenges for individuals and organizations. In one of his recent articles, Tom Davenport mentions that substituting smart machines for human labor will be at the task level rather than the job level.[6] Many jobs include structured, codified, routine, and predictable tasks that can be performed by computers effectively, as well as tasks that involve emotions, creativity, judgement, trust, empathy, ethics, and human intuition. Research indicates that as a result of this automation, more than 47 percent of the US workforce is at high risk, including middle- and lower-skill-level jobs.[7] In the meantime, millions of jobs will likely be created by technology, including those involved in designing, creating, and repairing robots. Other jobs will be created in burgeoning industries and through new business models, such as the sharing and circular economies that are enabled by advances in these technologies. To get one of these new jobs, people must improve their skillsets and mindsets.

Staying on Course
Organizations must identify a clear business objective, start small, focus on one area to begin with, get that area right, and prove the value of digital transformation before expanding to other parts of the enterprise. They should understand and learn how to become flexible and agile, reduce costs, and increase quality by expending effort on digital solutions. This includes building the skills required by changes in technology, and bringing in outside expertise to help with transformations and build skills with employee training. Leadership commitment to digital transformation is another key factor. The primary value of digital technologies comes not from their raw form but from processing and analyzing them, and the insights, decisions, products, and services that emerge from analysis to effect culture change. To ensure success in this environment, IT professionals, executives, and entrepreneurs need to understand the new business models, technology paradigms, cultural evolutions, and management practices that foster innovation in emerging next-generation digital-centric businesses and public organizations. Organizations should start this journey and stay on course by answering a few key questions:

- What should our digital transformation roadmap look like to achieve our business objectives?
- What business outcomes would we like to influence by leveraging digital solutions around customers?
- What capabilities and services should we develop by leveraging digital solutions that enable a strong competitive advantage?
- What technology options will enable our digital transformation journey?
- Do we have the appropriate skills and resources in-house to embark on this journey?

Finally, changes will be required in the employee workforce, corporate culture, partner ecosystems, law, and regulations.

In This Issue
We're now in an era in which significant competitive advantage is achievable from digital

innovation and transformation. This has been our prime motivation for this special issue, which was conceived as a vehicle for understanding some of today's issues and looking at opportunities for tomorrow. The authors' contributions in all the articles have implications for digital innovation and transformation that go beyond the immediate application settings on which they report. These articles also showcase the application of an array of research methods, including surveys, experiments, and design science.

The API Ecosystem

This special issue opens with "Accelerating Digital Transformation: Visual Insights from the API Ecosystem," by Rahul Basole. It has been argued that the true building blocks of digital transformation are the rapid prominence of APIs—that is, digital control points that set the terms for which data and services can be efficiently shared or "called" over the Internet. The vast number of available APIs and mashups (integration of two or more APIs) in various categories have created an API ecosystem. The author's methodology visualizes this ecosystem to answer the following questions: How are different segments shaping the strategic transformation of the API ecosystem? What market segments cluster together? Which ones are more peripheral? And what API segments are (re)combined to create new offerings?

Basole found that social, search, and tools categories indicate the importance of capabilities to digital services. The analysis of analytics, data, and visualization suggests growth in data-driven insight capabilities. Cloud, storage, and mobile appear to connect to much of the API ecosystem. Companies that want to play a central enabling role in the digital ecosystem must thus consider offering APIs in these core segments. To become a key enabler, a clear and differentiated value proposition in these core categories is needed. Decision makers must embrace the complex relationships between the various segments to understand their position in the ecosystem and identify possible opportunities for new collaboration and innovation.

Innovation and Social Media

Small- and medium-sized enterprises (SMEs) can be hindered in innovation by a shortage of labor, information, finances, and infrastructure. Collab-

orating with customers can help such enterprises mitigate these issues—in particular, by complementing internal resources and capabilities with external knowledge, referred to as *open innovation*. In "A Semantic Learning-Based Innovation Framework for Social Media," Kristijan Mirkovski, Frederik von Briel, and Paul Benjamin Lowry propose a framework to guide SMEs in using social media's analytical capabilities to innovate products or services. With the proliferation of the Internet, SMEs have added social media to their traditional marketing activities. The proposed framework suggests that innovators follow three consecutive stages—idea selection, idea refinement, and idea diffusion—to determine customer preferences through semantic analysis of customer posts and identify lead users and opinion leaders using user-directed social network analysis.

In the final article, "How Enterprise Social Media Can Facilitate Innovation," Joanne Patroni, Frederik von Briel, and Jan Recker examine the case of a global retailer that has adopted enterprise social media (ESM) to boost productivity and innovation. ESM use is becoming more commonplace for retailers, and the authors look at how organizations can leverage it to enable employee innovation. They examined the ESM implementation of one retailer in particular, and its influence on employee productivity and innovation.

Their research identified four key themes associated with employees' ESM use for productivity and innovation: social open minds, social digital natives, social collaborators, and social competitors. They also identified four key themes associated with culture that influenced ESM adoption: social open communication, social digital leadership, social digital strategy, and social fast-paced learning. Finally, they identified four lessons that can guide ESM implementation in large organizations: First, social digital natives will be quick to adapt their work practices to ESM communities and can drive adoption within the organization; second, open social communication underpins ESM use by employees and managers. Third, leadership style must incorporate social digital leadership to support ESM implementation, which is less traditional and more conversational, open, and collaborative. Finally, ESM supports social competition and social fast-paced learning, which, depending on strategic objectives, can be leveraged to nurture collaboration and organizational learning.

As we conclude our role in this special issue, we recognize that the research work we include here only scratches the surface of the issues that need to be studied. We expect enterprising future doctoral students and faculty to establish names for themselves by pursuing research agendas in digital innovation and transformation. We expect them to produce rich fundamental and applied work that leverages organizational and behavioral culture, economics, management science, and technical and design science research approaches toward the development of new managerial knowledge for digital innovation and transformation. ⬛

Acknowledgments

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