Leveraging Emerging Technologies toward Digital Transformation with Digital Business Strategy

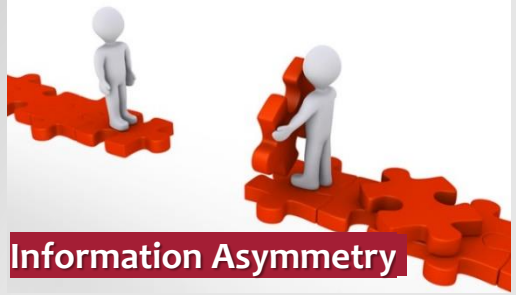
Paul A. Pavlou
Senior Associate Dean
Milton F. Stauffer Professor
Director, Data Science Institute

Fox School of Business
TEMPLE UNIVERSITY®

FOX | RESEARCH

Research Portfolio in Digital Environments

Consumer Engagement



Information Asymmetry

Online Trust

Mobile Commerce

Online Marketplaces

Online Decision Aids

Online Privacy

Online Advertising

Online Labor Markets

indiegogo

tinylightbulbs

KICKSTARTER

Crowdfunding Platforms

Online Reviews

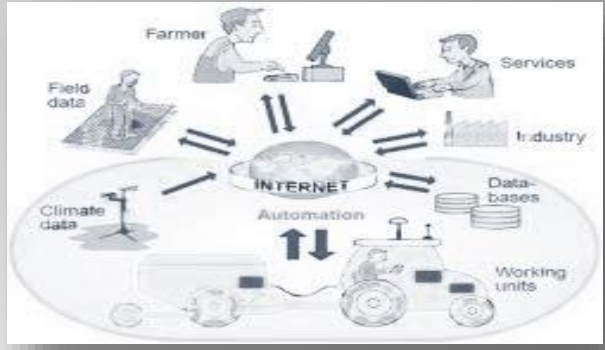
Online Social Networks

Digital Business Strategy

Societal Effects of IT

- Employment,
- Societal Well-Being
- Police
- Healthcare

Societal Transformation due to IT



IT and Societal Well-Being

- Kartik, Ganju, **Paul A. Pavlou**, and Rajiv Banker (2016), "Does Information and Communication Technology Lead to the Well-Being of Nations? A Country-Level Empirical Investigation," ***MIS Quarterly***, 40, 1, 417-430.

IT and Employment

- Atasoy, Hilal, Rajiv Banker, and **Paul A. Pavlou** (2016), "On the Longitudinal Effects of IT Use on Firm-Level Employment," ***Information Systems Research***, 27, 1, 6-26.
- Atasoy, Hilal, Rajiv Banker, and **Paul A. Pavlou** (2018), "Information Technology Skills and Employment Opportunities for Workers," (under review).

IT and Policing

- Pang, Min-Seok and **Paul A. Pavlou** (2018) "Armed with Technology: The Impact on Fatal Shootings by the Police" (under review).

IT and Healthcare

- Ganju, Kartik, **Paul A. Pavlou**, and Hilal Atasoy (2018), Do Electronic Medical Record Systems Inflate Medical Reimbursements?" (under review).

AGENDA

1. Digital Transformation
2. Digital Business Strategy
3. Dynamic Capabilities & Digital Transformation
4. Research Framework on Digital Transformation
5. Examples of the Evolution of Emerging Technologies
6. Digital Transformation and the 4th Industrial Revolution
7. Digital Transformation, Augmented Intelligence, and the Future of Work

1. Digital Transformation

- Pervasive transformation of business processes and products and services with technology and digitization

- Digital transformation described as the "profound and accelerating transformation of business activities, processes, competencies, and models to fully leverage the changes and opportunities brought by digital technologies" (Dermirkan et al. 2016, p. 14)

- Digital transformation involves a radical rethinking of how firms strategically use technology in pursuit of new revenue streams or business models (Clint, 2017)

- Digital transformation aims to increase individual productivity, create business value for organizations, and also enhance societal welfare (Ebert and Duarte, 2018)

How pervasive is Digital Transformation?

- Global phenomenon with $1.3 Trillion to be spent in 2018
- Core technologies include cloud computing, data analytics, mobility, IoT, machine learning, and artificial intelligence
  - 2.5 quintillion bytes of data each day (90% of all data generated in the last 2 years)
  - New technologies, such as IoT, will accelerate from $42b in 2018 to $120b in 2028

- Pervasive transformation in organizations due to increased **automation**, **transparency**, and **data-driven decision making**
  - Need for <u>change management</u> and <u>leadership development</u>
  - Need for <u>radically rethinking business processes</u> and <u>products/services</u>
  - Need for an overarching strategy for <u>cultural transformation</u>

Key Technologies in Digital Transformation

Challenges in Digital Transformation

- The secret to successful digital transformation has proven elusive in practice, as only one in six organizations see the results they expect (Gayle & Aarons, 2018)
  - Over 70% of digital transformation projects fail in practice!

- There is limited understanding of the challenges facing digital transformation in both academia and industry (Heavin & Power, 2018)

- Digital transformation requires rethinking of existing theories and models, especially moving from traditional functional technologies to emerging technologies that would be critical for truly effective digital transformation (Liu et al., 2011)

- Academic and practitioner research on digital transformation has used a functional lens on IT and a strategic lens on business strategy (Bharadwaj et al., 2013)

What do we know about Digital Transformation?

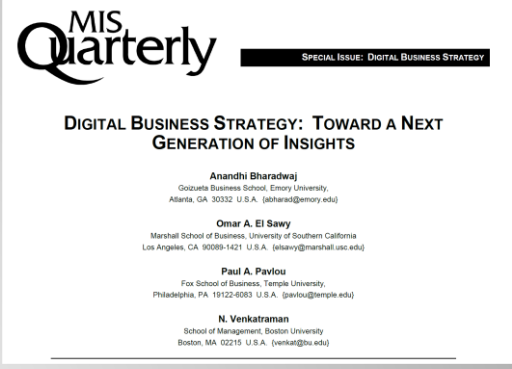
- Well-accepted technology adoption models may be insufficient for prescribing how to successfully achieve a deeply-rooted digital transformation (Liu et al., 2011)

- There is a gap in our understanding of how digital transformation should be pursued and how it would affect the organization (Krantz et al., 2017)

- Confusion around the optimal mix of resources needed for digital transformation (Hess et al., 2016)

- A clear digital business strategy for digital transformation is needed with the key underlying technologies, key capabilities, and measures of business outcomes (Demirkan et al., 2017)

2. Digital Business Strategy?


MIS Quarterly

SPECIAL ISSUE: DIGITAL BUSINESS STRATEGY

DIGITAL BUSINESS STRATEGY: TOWARD A NEXT GENERATION OF INSIGHTS

Anandhi Bharadwaj
Goizueta Business School, Emory University,
Atlanta, GA 30332 U.S.A. {abharad@emory.edu}

Omar A. El Sawy
Marshall School of Business, University of Southern California
Los Angeles, CA 90089-1421 U.S.A. {elsawy@marshall.usc.edu}

Paul A. Pavlou
Fox School of Business, Temple University,
Philadelphia, PA 19122-6083 U.S.A. {pavlou@temple.edu}

N. Venkatraman
School of Management, Boston University
Boston, MA 02215 U.S.A. {venkat@bu.edu}

- Information Technology (IT) has been viewed as a functional resource to support the organization's strategy (Bharadwaj, El Sawy, Pavlou, and Venkatraman 2013)

- Digital business strategy rethinks the traditional role of technology strategy, from a functional-level—aligned but essentially always subordinate to business strategy—to one that reflects a fusion between the two, termed "digital business strategy"

- Digital business strategy is a corporate-level, cross-functional strategy that leverages technology and integrates physical and digital resources to inform the firm's corporate vision, operations, functions, capabilities, and business processes

- Digital business strategy can help to leverage emerging technologies, such as analytics, social media, Artificial Intelligence (AI), Internet of Things (IoT), plus other cutting-edge technologies to guide the firm's digital transformation

Characteristics of Digital Business Strategy

- Digital business strategy is an organization-wide, prominent, embedded, and encompassing strategy that includes all functional areas

- Digital business strategy is a cross-functional strategy, not only for the marketing and IT departments, or other functional areas in silos

- Digital business strategy includes the digitization of business processes and of new products and services and the information around them

- Digital business strategy extends the scope beyond traditional firm boundaries and supply chains to dynamic ecosystems that cross traditional industry boundaries, including strategic alliances and inter-firm partnerships

Digital Transformation & Digital Business Strategy

- Digital business strategy is the underlying foundation of digital transformation (Bharadwaj et al., 2013)

- Digital transformation captures how emerging technologies help to transform business process and product/services for competitive advantage (Resca et al., 2013)

- Digital transformation requires a clear digital business strategy:
  - Involves an organization-wide, cross-functional, and even inter-firm strategy that addresses opportunities and risks from rapidly-changing environments;
  - Leverages emerging technologies (e.g., social media, mobility, analytics, IoT, AI);
  - Requires technology capabilities and dynamic capabilities as a foundation;
  - Specifies how transformed business processes and new products and services help to create a competitive advantage

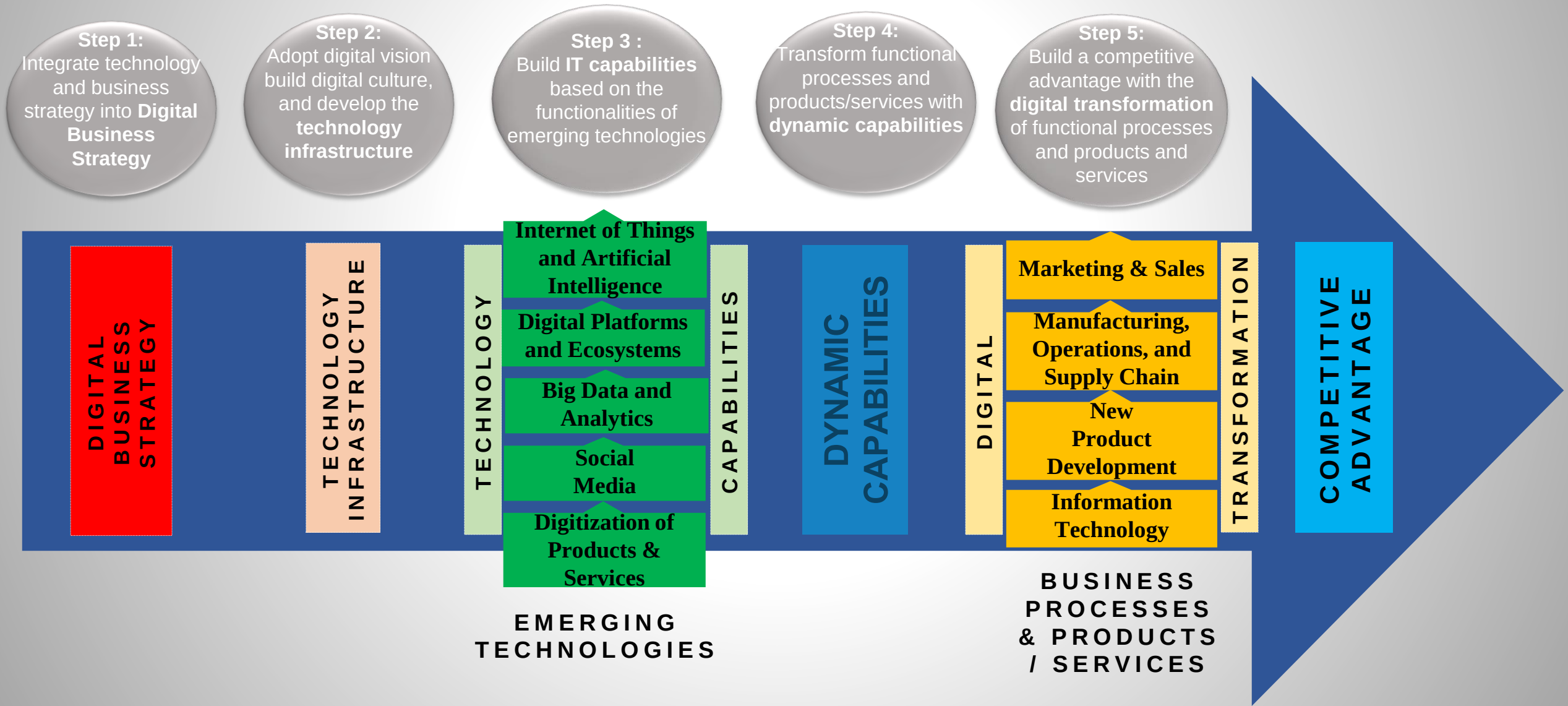
3. Dynamic Capabilities & Digital Transformation

- Dynamic capabilities are the “firm's ability to integrate, build, and reconfigure internal and external competences to address rapidly changing environments” (Teece et al. 1997, p. 516)

- In the context of new product development, dynamic capabilities help:
  - (1) market understanding helps to fit customer’s expectations with suitable products;
  - (2) coordination of tasks to save time in the NPD process and new product implementation;
  - (3) knowledge acquisition, assimilation, transformation, and exploitation help to convert employee and customer knowledge in specific new products;
  - (4) collective knowledge reduces communication errors, ensuring timely product launch;
  - (5) operational and structural flexibility to bring products to market faster

- Dynamic capabilities key drivers of digital transformation by reconfiguring existing business process and developing new products and services

4. Research Framework



Leveraging Emerging Technologies toward Digital Transformation

How can companies develop a digital business strategy with emerging technologies to succeed in their digital transformation initiatives?

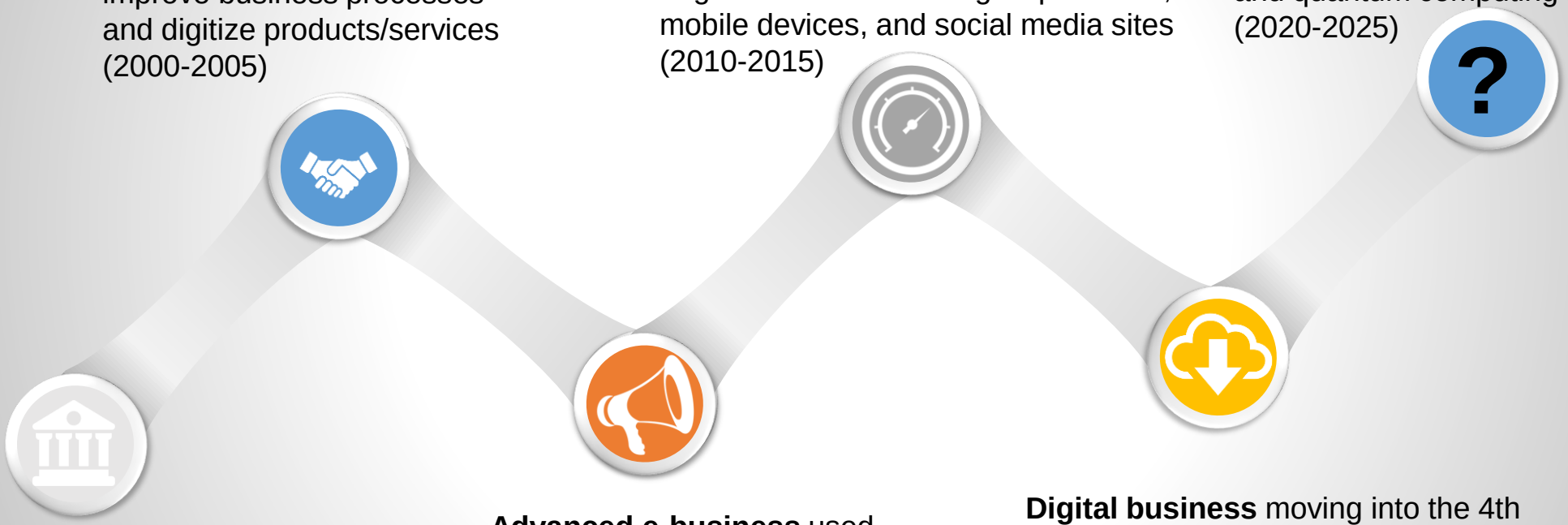
1. Integrate the company's technology strategy and business strategy into an overarching **digital business strategy**
2. Adopt a digital vision, institute a digital culture, and **implement a robust technology infrastructure** to match the evolving technological environment
3. Build **IT capabilities** based on the functionalities of emerging technologies, coupled with existing resources
4. Develop **dynamic capabilities** to transform existing business processes and/or redesign new products and services
5. Create a sustainable **competitive advantage** from the digital transformation of existing business processes and new products and services

5. The Evolution of Emerging Technologies

Electronic (e-business) used the internet and websites to drive efficiencies between consumes and businesses to improve business processes and digitize products/services (2000-2005)

Early digital (d-business) extended business by connecting consumers, business and things to bringing potential customers by collecting large-scale data from digital platforms, mobile devices, and social media sites (2010-2015)

Advanced digital business into the 4th Industrial Revolution with advanced technologies, such as genomic data, nanotechnology, and quantum computing (2020-2025)



Early e-business used the web and internet to extend relationships between consumers and businesses (1995 – 2000)

Advanced e-business used digital marketing (Web 2.0) to optimize interactions between consumers and businesses using social media, analytics, the cloud, and mobile devices (2005-2010)

Digital business moving into the 4th Industrial Revolution to maximize business models through platforms, digital ecosystems, Internet of Things (IoT), artificial intelligence, big data, and other advanced technologies (2015-2020)

Digitization of Products and Services (2000-2005)

- Digitization of products and services and their interoperability with other complementary technologies was an early form of digital transformation
- Products and services increasingly have embedded digital technologies and data, and digitized personalized solutions for consumers have created differential value
- **New product development capabilities** to digitize products/services and develop new technology products (e.g., apps) can support digital transformation
- **Examples:**
- Amazon's Kindle expanded the retailer's strategy from physical to digital products (books to e-books)
- Netflix's transformation from physical DVDs by mail to streamlined TV experience over the Internet
- Sony's digitized product architecture in game consoles and televisions for virtual group playing
- Nest's thermostats with remote real-time Internet capabilities for remote access by consumers

IT Capabilities in New Product Development

- IT capabilities facilitate the digital transformation of NPD processes, both within and across organizations, and they enable dynamic capabilities (Pavlou & El Sawy 2006)
- Technology-based new product development capabilities to digitize products were shown to be a source of sustainable competitive advantage (Ettlie and Pavlou 2006)
- IT capabilities are more valuable in turbulent environments (El Sawy & Pavlou 2008)

- Pavlou, Paul A. and Omar A. El Sawy (2006), "From IT Leveraging Competence to Competitive Advantage in Turbulent Environments," *Information Systems Research*, 17, 3, 198-227 (Lead Article). (Won the 2007 'ISR Best Paper' award and the 2006 'IS Publication of the Year' award).
- Ettlie, John and Paul A. Pavlou (2006) "Technology-Based New Product Development Partnerships," *Decision Sciences*, 37, 2, 117-148 (Lead & Featured Article) (Runner Up to Best Paper Award).
- El Sawy, Omar and Paul A. Pavlou (2008), "IT-Enabled Business Capabilities for Turbulent Environments," *MIS Quarterly Executive*, 7, 3, 139-150.

Social Media (2005-2010)

- By using technologies, such as social media, mobility, analytics, and the cloud, businesses can transform the structure of their relationships with both their consumers and other stakeholders within and outside the organization

- **Social media capability** as the firm's proficiency in leveraging internal and external social media to gather business intelligence and digitally transform traditional consumer relationships and products/services with personalization

- **Examples:**
- Nestle ("Ideas4all"), Ducati ("Tech Cafe"), Heineken, and Danone leveraged creative ideas provided by employees and customers through social media

(Beyersdorfer et al. 2011; Dong and Wu 2015, Lee and Van Dolen 2015; Nambisan and Baron 2009)

Social Media & Digital Transformation

- **Social media capability** composed of: (1) social media mindful planning, (2) social media management, and (3) social media exploitation

- Social media capability was shown to enhance NPD performance through digital transformation of products with dynamic capabilities (Benitez et al. 2018)

- Social media capability pertains to optimizing social media posts to consumers to increase sales and reduce unfollowing (Wang, Greenwood, and Pavlou 2018)

- Benitez, J. Braojos, J. Pavlou, P.A., and Lorrens-Montes, F.J. (2018), Social Media Capability and New Product Development Performance: An Empirical Investigation," *Academy of Management Proceedings,* Chicago, IL.
- Wang, S. Greenwood, B. Pavlou, P.A. (2018), "Tempting Fate": *Social Media Posts by Firms, Customer Purchases, and the Loss of Followers*" Under Review.

“Big Data” and Analytics (2010-2015)

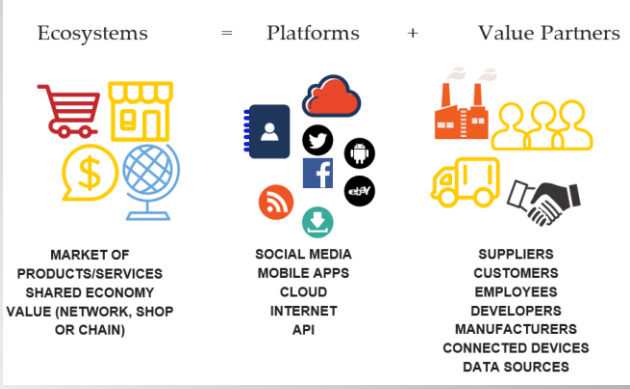
- Proliferation of social media, cloud computing, and mobile phones has enhanced the quality and quantity of data generated every day, driven by exponential increases in computing power and availability of large-scale data

- Digital business strategy helps to leverage analytics functionalities and skill to develop the analytics capabilities at the organizational level to harness the power of “big data”

- **Analytics capabilities** enable data-driven decision-making in organizations, enhance business processes, and create personalized products and services

- **Examples**
- Kaiser Permanente analytics capability to create personalized patient solutions in healthcare insurance
- Merck’s MANTIS analytics platform that streamlined manufacturing, warehousing, and logistics
- Bechtel’s big data solutions to analyze large volumes of qualitative data from social media
- Disney’s MagicBand that leverages IoT to collect and analyze large-scale customer data
- Roche’s patient-centric approach to personalized medicine with genomic data

Digital Platforms and Ecosystems (2010-2015)



- Digital platforms are enabling multi-disciplinary industry disruptions and creating new forms of business strategies based on the logic of the "sharing economy"
- Digital platforms take advantage of networking technology and its connective functionality to create business value for both sides of multi-sided networks
- **Platform capability** to go beyond traditional organizational boundaries and supply chains to leverage digital platforms and ecosystems to disrupt traditional industries

Examples

- Amazon retail ecosystem on its digital AWS platform fundamentally disrupted the retail industry
- Apple's mobile entertainment ecosystem on its IoS platform disrupted the entertainment industry
- Wal Mart invested heavily on a new e-commerce platform and blockchain to compete with Amazon
- Other digital platforms in auctions, car sharing, housing, crowdfunding, crowdsourcing, and labor

Internet of Things (IoT) (2015-2020)

- Proliferation of billions of machine-to-machine sensors and devices connected on the cloud in manufacturing, energy, transportation, logistics, mining, and healthcare, allows smart inter-connected products to collect and share data with each other
- IoT is triggered by autonomous systems powered by big data analytics from IoT devices
- **Internet of Things (IoT) capability** merges the physical and the virtual worlds to achieve digital transformation through efficiencies, transparency in the value chain, transformed business processes, and real-time data to create new products/services

Examples

- Monsanto uses real-time data from sensors in the field to evaluate the effectiveness of new crops
- GE's healthcare devices connected to the Internet to provide remote real-time patient monitoring
- Schindler Group collecting and analyzing real-time data from its elevators for preventive maintenance
- Many examples in energy management, water conservation, transportation, public safety, smart cities

Artificial Intelligence (AI) (2015-2020)

- Artificial Intelligence (AI) technologies, such as machine learning, deep learning, computer vision, natural language processing, and big data analytics, have led to autonomous systems, such as smart homes, smart cities, and smart energy grid

- Computers and humans have complementary strengths and problem-solving skills; human beings generally outperform machines when dealing with ambiguity, vagueness, and incomplete information, and when requiring emotional intelligence and judgment, elements that are still considered the most critical limitation of AI

- **AI capability** can optimize the computational power of computers with the cognition, intuition, and "common sense" of human beings to help with digital transformation

Examples: Multiple AI solutions in drug discovery, healthcare, and cancer research

- IBM Watson "cognitive computing" is an AI solution for reasoning, decision, language, speech, vision
- Integration of AI with IoT to automatically analyze data collected from IoT to make real-time decisions

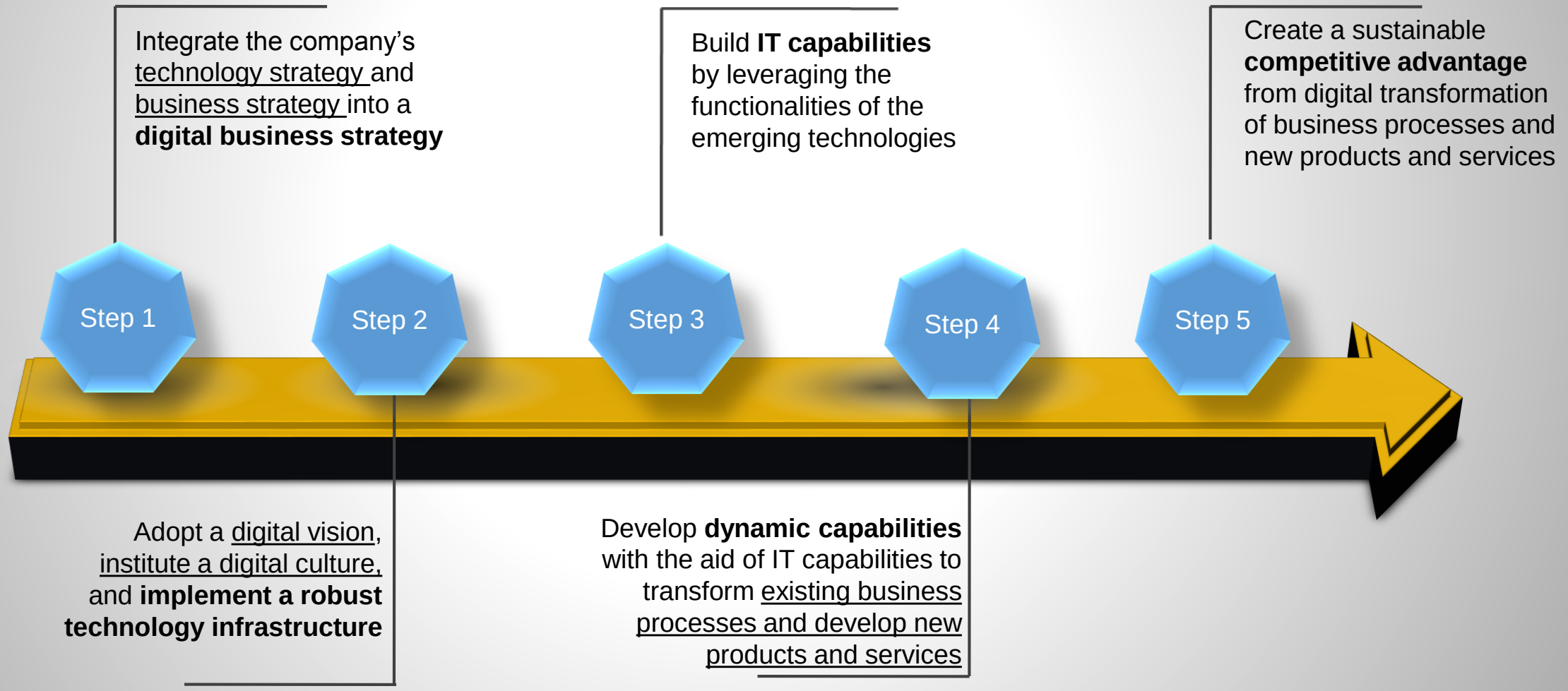
Future Emerging Technologies (2020-2025)

- As we evolve into advanced digital business and the 4th Industrial Revolution, more sophisticated technologies are likely to emerge, such as nanotechology, cryptocurrency, new materials, biometrics, and quantum computing

- Companies could leverage new technologies by (1) developing their existing infrastructure, (2) identify and adopt new technologies, (3) understand the technology functionalities (4) employ dynamic capabilities to transform business processes, and (5) seek to create differential value from digital transformation

- Learning how to manage emerging technologies toward digital transformation would be a source of competitive advantage during the 4th Industrial Revolution given the power, ubiquity and sophistication of next-generation technologies

Key Steps in Pursuing Digital Transformation with Digital Business Strategy and Emerging Technologies



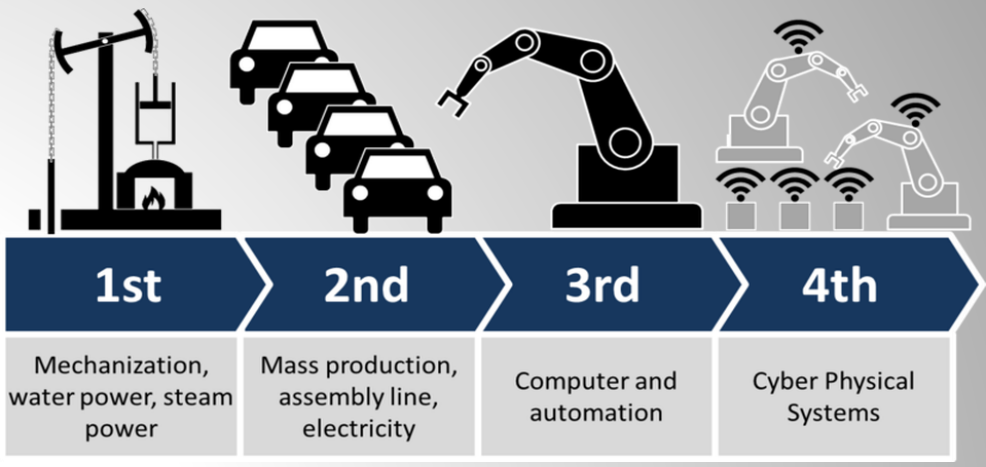
Caveats of Emerging Technologies

- Not all emerging technologies can create differential value for all organizations, and executives must be careful not to blindly follow the latest technology trend in an attempt to achieve digital transformation at all costs

- Digital business strategy with emerging technologies is integrating what is technologically possible with business priorities and emergent market needs (many other emerging technologies, such as blockchain, cryptocurrency, drones)

- Strategizing based on technology infrastructure, emerging technology trends, business models, and future market needs with a clear digital business strategy is essential toward successful digital transformation from emerging technologies

6. Are we already in the 4th Industrial Revolution?



- Emerging technologies blur the lines between the physical, the digital, and the virtual, and increasingly the biological, often termed "cyber-physical systems"
- Digital transformation in the 4th industrial revolution should leverage emerging technologies to merge the physical, digital, virtual, and the biological worlds
- Do we need to move beyond digital transformation in the 4th industrial revolution?

Digital Transformation and the 4th Industrial Revolution

- Organizations should consider the emergent forces of the 4th industrial revolution and seek to leverage emerging technologies as part of their digital business strategy to achieve digital transformation

- Organizations need to prepare for the next-generation of emerging technologies, such as adaptive biometrics, materials science, nanotechnology, quantum computing, and genomic data and leverage them toward digital transformation

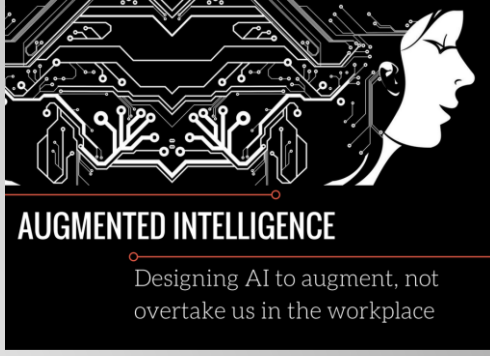
- What would the nature of transformation be for the 4th industrial revolution?

7. Digital Transformation & the Future of Work

What is the future of work given digital transformation?

- Similar to automation in manufacturing and agriculture, emerging technologies will inevitably replace existing jobs and create new ones that did not exist before
- New professions are being created, such as app developer, social media engineer, digital advertiser, cyber-security analyst, AI designer, and even "drone operator"
- Organizations must prepare for digital transformation and learn how to recruit and train employees who can work with increasingly sophisticated technologies
- Governments and policy makers must help workers to "retool" to complement emerging technologies versus to be "automated out" by digital transformation

Artificial Vs. Augmented Intelligence



- Augmented Intelligence is defined as computers enhancing human intelligence, while AI commonly refers to computers fully replacing human beings

- AI can perform well with large-scale data and without human input. In contrast, areas such as design of creative marketing ads, personal selling, hiring people, and strategic decision-making are prime examples where human judgment, managerial intuition, and human-computer symbiosis can still outperform AI

- Human intelligence is still needed to make human-oriented decisions about employees, customers, and partners that include personalized preferences, habits, emotions, and personalized information

- Human beings outperform machines when dealing with ambiguity, vagueness, and incomplete information, that requires emotional intelligence and judgment, elements that are still considered the most critical limitations of AI

Augmented Intelligence and Digital Transformation in the 4th Industrial Revolution

- Concerns about AI have been raised by Bill Gates, Stephen Hawking, and Elon Musk, among many other visionaries
  - Will human beings become meaningless in digitally transformed organizations?
  - Will powerful emerging technologies make the human workforce redundant?
  - Will AI systems fully replace human beings, or will AI enhance human intelligence and empower human beings to solve problems better?
- AI designs should maintain a reasonable level of human control and give people the opportunity to get acquainted with the appropriate level of control to AI solutions
- Augmented intelligence has the potential to address some of these challenges, possibly more so than pure AI, at least in the foreseeable future

ISR Special Issue on Augmented Intelligence

Information Systems Research

Publication details, including instructions for authors and subscription information:
http://pubsonline.informs.org

Call for Papers—Special Issue of Information Systems Research—Humans, Algorithms, and Augmented Intelligence: The Future of Work, Organizations, and Society

Hemant Jain, Balaji Padmanabhan, Paul A. Pavlou, Raghu T. Santanam,

Call for Papers

Special Issue of *Information Systems Research*—Humans, Algorithms, and Augmented Intelligence: The Future of Work, Organizations, and Society

Guest Editors: Hemant Jain,[a] Balaji Padmanabhan,[b] Paul A. Pavlou,[c] Raghu T. Santanam[d]

"What if we don't change at all ...
and something magical just happens?"

THANK YOU!

Digital Transformation in Small and Large Firms

- Companies are increasingly opening up to digital transformation, primarily due to competition, to create value through quick to market products and services

- Digital transformation initiatives can optimize innovation and create value for both the organizations and customers

- Traditionally large companies with their streamlined processes and systems reacted slowly to innovate and cater for emerging needs of the market

- Smaller agile and risk-taking companies may be able to answer to the market call thus eroding the economical "moats" of the traditional large companies

- Lessons from smaller companies and successful digital transformation initiatives have produced case studies with best practices and techniques

Leveraging New Emerging Technologies

Digital Transformation from Emerging Technologies

Create value with digital transformation with new businesses processes and new products and services supported by emerging technologies

Leverage Functionalities of Emerging Technologies to build IT Capabilities

Emerging technologies can be used by leveraging their functionalities to develop new IT capabilities along with other organizational resources

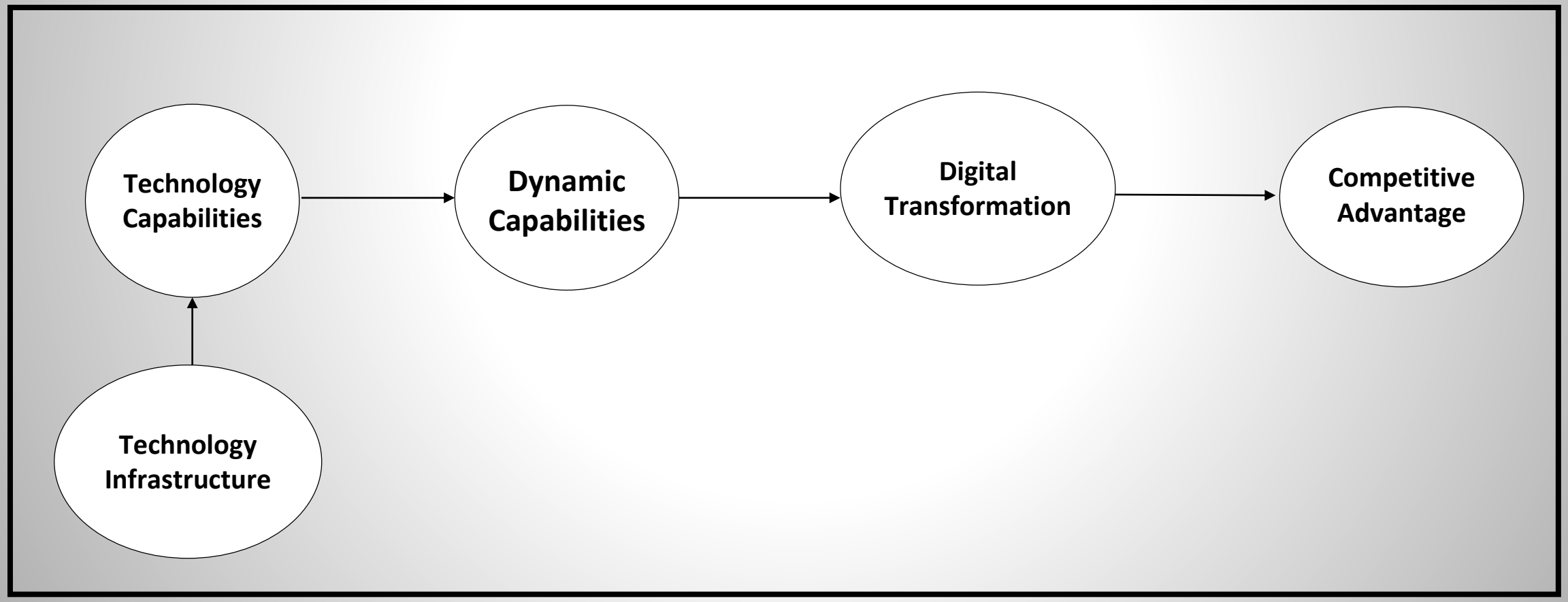
Develop Dynamic Capabilities with the aid of IT Capabilities

Business opportunities must be enabled by emerging technologies by transforming existing business process and building new products and services

Identify new Emerging Technologies

Understand your IT infrastructure and invest in emerging technologies by scanning the technology environment for emerging technologies that can be supported by the IT infrastructure

Overall Research Framework



Key Managerial Implications

- Digital business strategy must identify the drivers of value creation and capture with new products/services and business models based on emerging technologies

- Digital business strategy helps to manage complementary business resources to support the functionalities of the new emerging technologies

- Importance of developing employing a dynamic capability to transform existing business processes and build new business models to achieve digital transformation

- Importance of maintaining the company's backbone technology infrastructure to identify, evaluate, and harness emerging technologies into digital transformation

- Digital vision and culture to scan the technology environment for new technologies