



THE UNIVERSITY OF
NEWCASTLE
AUSTRALIA

The DIGITAL ECONOMY

I. Introduction

(➔ Pearlson et al. 2022, Introduction; Tapscott, 2014, Ch. 1)

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Educational Objectives for Today

- Foundations of the (digital) economy
- Similarities and differences between analog and digital goods
- Understand the basic concepts of the digital economy
- A brief overview of the history of IT
- Creative destruction and digital disruption

*"These **Google** guys, they want to be billionaires and rock stars and go to conferences and all that. Let us see if they still want to run the business into two to three years."* (Bill Gates, Microsoft, 2003)

*"\$100 million is way too much to pay for **Microsoft**."* (IBM, 1982)

*"I think there is a world market for maybe five **computers**."* (Thomas Watson, IBM CEO, 1943)

*"Information technology and business are becoming **inextricably interwoven**. I don't think anybody can talk meaningfully about one without the talking about the others."*
(Bill Gates, Microsoft)

*"By 2005 or so, it will become clear that the **Internet's impact on the economy** has been no greater than the fax machine."* (Paul Krugman, Professor of Economics, 1998)

*"There's no chance that the **iPhone** is going to get any significant market share. No chance."* (Steve Ballmer, Microsoft CEO, 2007)



The ongoing advances in information technology have a strong impact on the economy. At ever increasing speed, this creates a **winner-take-all** environment that is characterized by high levels of insecurity and risk.

(Pearlson et al., 2022; Ryan, 2013)

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I.1 What is a (Digital) Economy?

I.2 The Architecture of Firms & Markets

I.3 A Brief History of Information and Communications Technology

I.4 Digital Disruption

Let's get started!

What is an economy?

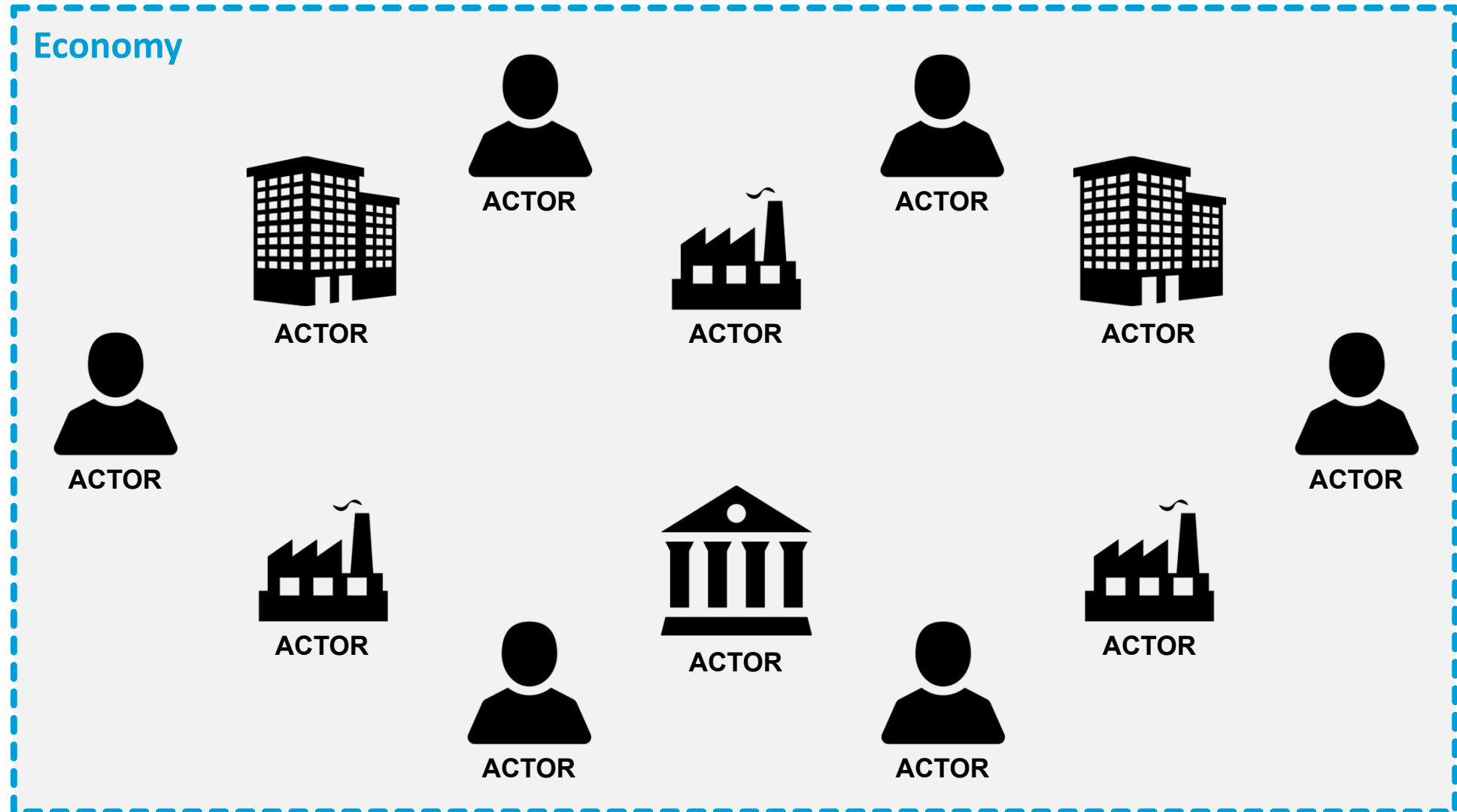
What is a *digital* economy?

What is an information system?



What is an Economy?

Definition: An **economy** consists of the production, exchange, distribution and consumption of goods and services by different agents in a given geographical location. The economic agents can be individuals, businesses, organizations, or governments. Transactions occur when two parties agree to the value or price of the transacted good or service.

A Simple Economy



Analog vs Digital (1/2)

Analog	Digital
Mechanical, tangible, natural	Electronic, static, structured
<i>Varies continuously</i>	<i>Discrete and discontinuous</i>
	
Analog representations use tangible elements to create analogies of the real world. They do not involve processing numbers electronically.	For digital representation, information is first converted into numbers (digits) and then stored, transferred, or displayed.



An **analog-to-digital converter** (ADC) is a technology that converts a continuous physical quantity to a digital number that represents the quantity's amplitude.

Analog vs Digital (2/2)

Further examples of products where digital technology replaced analog representations?

What is a Digital Economy?

Definition: A **digital economy** is an economy that is based on digital technologies.

- According to the **Australian Government**, the digital economy is “the global network of economic and social activities that are enabled by information and communications technologies, such as the internet, mobile and sensor networks.”
- The **twelve key themes** of the digital economy are (i) knowledge, (ii) digitization, (iii) virtualization, (iv) molecularization, (v) integration/ networking, (vi) disintermediation, (vii) convergence, (viii) innovation, (ix) prosumption, (x) immediacy, (xi) globalization, and (xii) discordance (Tapscott, 2014, Ch. 2).
- Synonyms: new digital economy, new economy, Internet economy, web economy

Information Hierarchy

	Data	Information	Knowledge
Definition	Simple observations of the state of the world	Data endowed with relevance and purpose	Information from the <i>human</i> mind (includes reflection , synthesis , context)
Characteristics	<ul style="list-style-type: none"> • Easily structured • Easily captured on machines • Often quantified • Easily transferred • Mere facts 	<ul style="list-style-type: none"> • Requires unit of analysis • Data that have been processed • Human mediation necessary 	<ul style="list-style-type: none"> • Hard to structure • Difficult to capture in machines • Often tacit • Hard to transfer
Example	Daily inventory report of all inventory items sent to the CEO of a large manufacturing company	Daily inventory report of items that are below economic order quantity levels sent to inventory manager	Inventory manager knowing which items need to be reordered in light of daily inventory report, anticipated labor strikes, and a flood in Brazil that affects the supply of a major component

(Pearlson et al. 2022, Introduction, Figure I-6)

Things vs Information

Information has become a **critical resource** for any company. It is important to understand how information differs from things in order to take the right strategic decisions.

Things		Information
Durability	Wear out	Does not wear out, but can become obsolete or untrue
Replicability	Are replicated at the expense of the manufacturer.	Is replicated at almost zero cost without limit
Location	Exist in a tangible location	When sold, seller may still possess and sell again
Possession	When sold, possession changes hands	When sold, seller may still possess and sell again
Price	Price based on production cost	Price based on value to customer
Infrastructure	Based on a physical infrastructure	Based on a digital infrastructure
Handling	Are fixed units, each needing physical handling. Usually, cannot be combined to operate with other physical units	Can be repackaged/customized/generated on demand. Requires only translation software to be combined with, or augmented, by other data.

(Pearlson et al 2022, Introduction, Figure I-8)

What is an Information System?

Definition: An **information system** is the *combination* of technology (the “what”), people (the “who”), and process (the “how”) that an organization uses to produce and manage information.

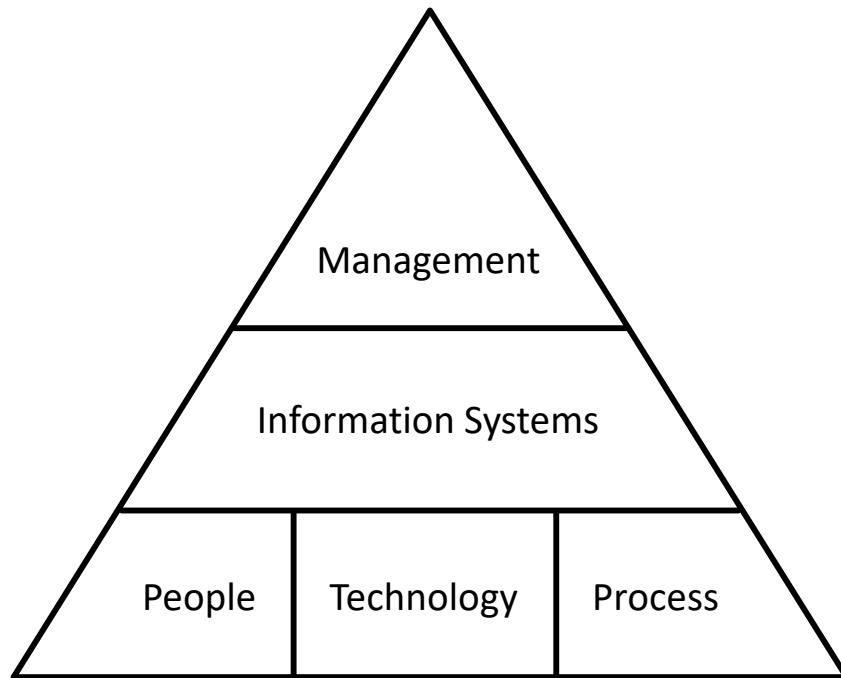
- **Information technology (IT)** is the technology component of the information system, usually consisting of the hardware, software, networking, and data. In other words, the IT focuses only on the technical devices and tools used in the system.
- A **business system** is a set of business components working together in order to achieve a defined purpose. The components of a system include people, IT, processes and equipment. Each component may be a system in its own right.
- Aligning information systems and business decisions is imperative for business! Every business operates as an information-based enterprise.



Organisations and their members are usefully conceptualised as (business) systems designed to accomplish predetermined goals and objectives through the people and other resources that they employ.

(Pearlson et al, 2022, Introduction)

System Hierarchy



- An **information system** is the *combination* of technology (the “what”), people (the “who”), and process (the “how”) that an organization uses to produce and manage information.
- **Management** develops the business requirements and business strategy that the information system is meant to satisfy.



Even those businesses not typically considered to be information businesses have business strategies in which information plays a critical role.

(Pearlson et al. 2022, Introduction, Figure I-9)

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The Nature of the Firm



Ronald H. Coase
(Nobel Laureate)

In 1991, Ronald H. Coase was awarded the 1991 Nobel Prize in Economics "for his discovery and clarification of the significance of **transaction costs** and **property rights** for the institutional structure and functioning of the economy."

- "I found the answer by the summer of 1932. It was to realize that there were costs of using the pricing mechanism. What the prices are have to be discovered. There are negotiations to be undertaken, contracts have to be drawn up, inspections have to be made, arrangements have to be made to settle disputes, and so on. These costs have come to be known as **transaction costs**." (Coase, 1992, p. 715)
- **Transaction costs include:**
 - (1) **Search costs**: e.g., finding different suppliers and determining whether their goods are appropriate.
 - (2) **Contractual Costs**: e.g., negotiating the price and contract conditions.
 - (3) **Coordination Costs**: e.g., meshing the different products and processes.

(http://www.nobelprize.org/nobel_prizes/economic-sciences/laureates/1991/; Coase, 1992; Tapscott, 2014)

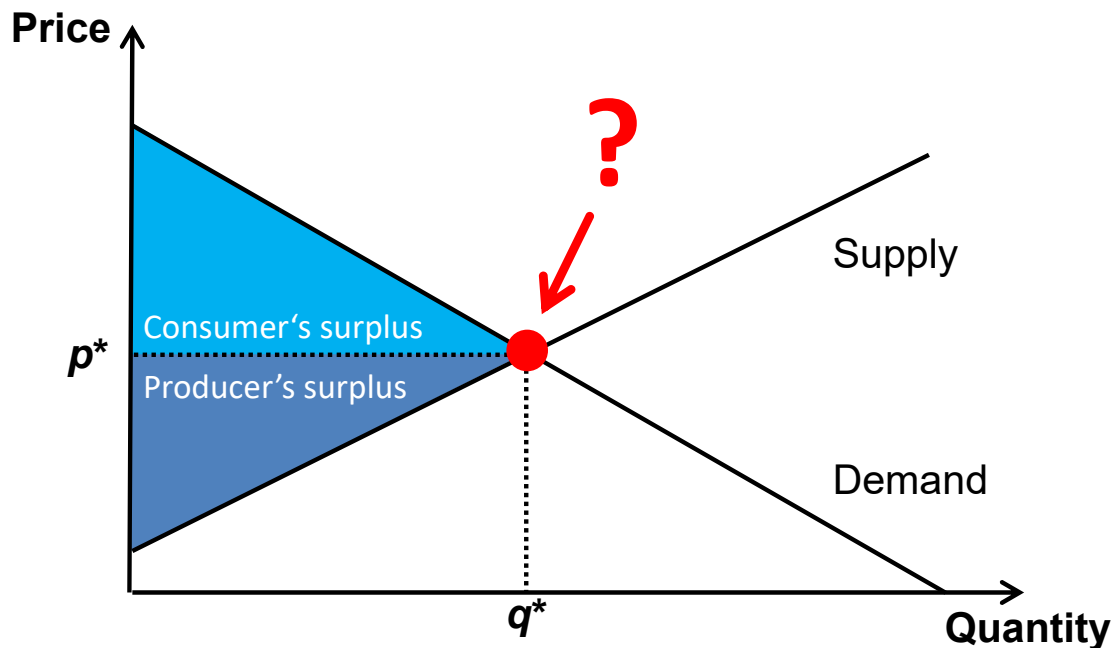
Transaction Costs in the Digital Economy

It makes sense for a firm to expand until the cost of performing a transaction **inside** the firm exceeds the cost of performing the transaction **outside** the firm.

- Digital technologies slash transaction and collaboration costs.
- They enable firms to create a platform where customers, partners, and other third parties can **co-create** value.
- In the old economy, the business model of many companies was based on the fact that the **search**, **contractual** and **coordination** costs of a reaching transaction were (much) higher than paying an intermediary
- Many **intermediaries** are no longer necessary, as ICT enables direct transactions. At the same time, however, globally operating intermediaries emerge that provide the platform for these transactions (e.g., AirBNB, Amazon, eBay, Taobao, Uber).

(Tapscott, 2014, Ch. 2)

Markets & Information Aggregation



- (1) Adam Smith's "Invisible Hand", i.e., individuals seeking their own interest achieve a Pareto optimal state.
- (2) Walras' Tâtonnement
- (3) A social planner sets the prices and quantities in order to maximize welfare.
- (4) A centralized market based on an (double) auction mechanism.



Digital technologies can reduce contractual, collaboration, and search costs, and thereby increase allocation efficiency and welfare in the global economy.



Sell

Buy

Sell

Sell

Buy

Sell

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A Brief History of ICT (1/6)

■ 1930's Alan Turing and his machine

- Alan Turing developed a hypothetical model of computational processing
- Spurred on later technological developments



Alan M. Turing
(Visionary Thinker)

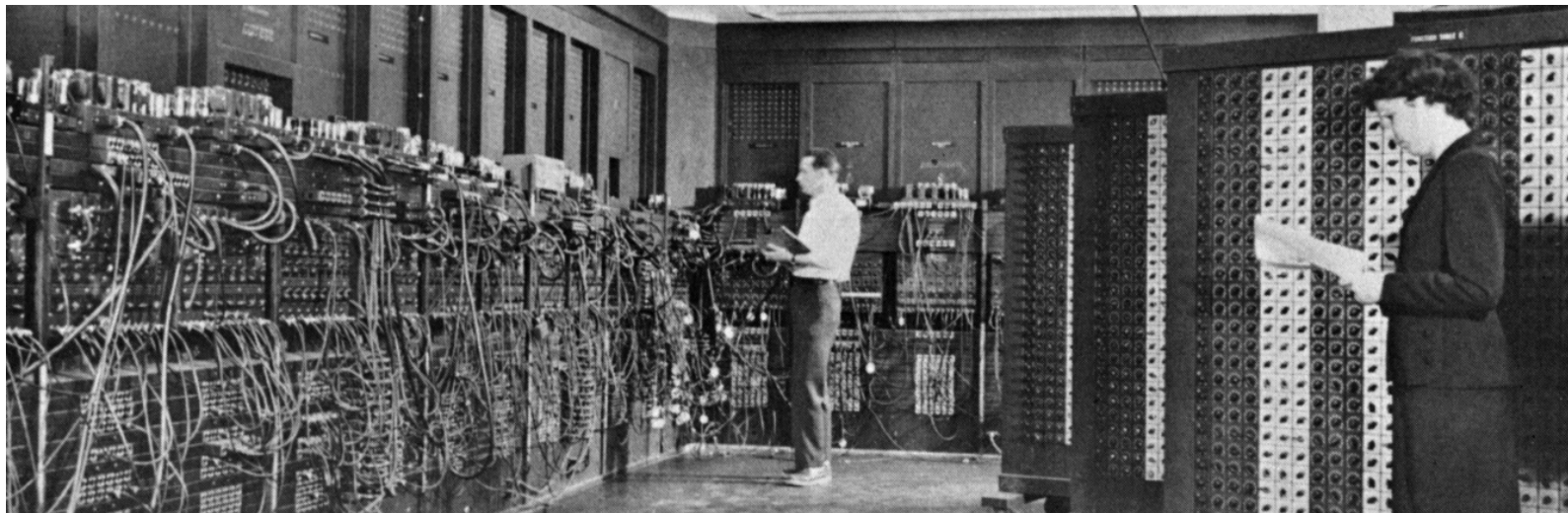
■ 1940's Enigma machine

- Turing was pivotal in decrypting the Enigma
- Economic impact – significant to ending WW2



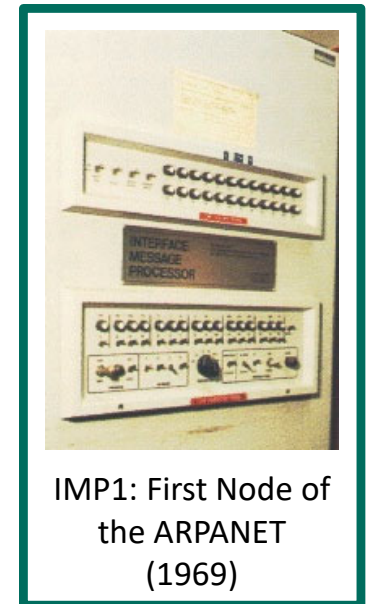
A Brief History of ICT (2/6)

- **1950's computers used in business for faster calculations (engineering and accounting)**
 - ENIAC (Electronic Numerical Integrator And Computer) was the first electronic general-purpose computer
 - Turing complete, digital, reprogrammable
 - Economic impact – gains in efficiencies and effectiveness



A Brief History of ICT (3/6)

- **1960's -1980 computers used for storing and processing data**
 - Economic impact – efficiency gains
- **September 2, 1969: Start of the ARPANET at UCLA**
 - ARPA = Advanced Research Projects Agency
 - ARPANET evolved into the Internet in the 1980's
 - Economic impact – backbone for e-commerce & digital economy



(http://www.lk.cs.ucla.edu/personal_history.html)

A Brief History of ICT (4/6)

■ 1977-1985 Microcomputer

- Eventually moving from hobbyists to business
- Economic impact – Mass market PCs in permeating business process



Apple I
(April 1976)



Tandy/Radio Shack TRS-80
(August 1977)



Commodore VIC-20
(January 1981)



IBM PC
(August 1981)



Commodore C-64
(January 1982)



Macintosh by Apple Computer
(January 1984)

A Brief History of ICT (5/6)

- **1985-2000 ICT to facilitate business process-design**
 - Business Process Management (BPM)
 - Enterprise Resource Planning (ERP)
 - Total Quality Management (TQM)
 - Economic impact – paradigm shift

- **1989: Start of the World Wide Web (WWW)**
 - Based on a proposal by Tim Berners-Lee (1989)
 - ICT supporting communication between people
 - Economic impact – foundation of e-Business

A Brief History of ICT (6/6)

- **Since 2007 Smart Mobile Devices**

- iPhone (2007) and iPad (2010) launch revolutionized IT
- Streaming and subscription replaces ownership models

- **Since 2010 (Accelerated) Rise of Social Media**

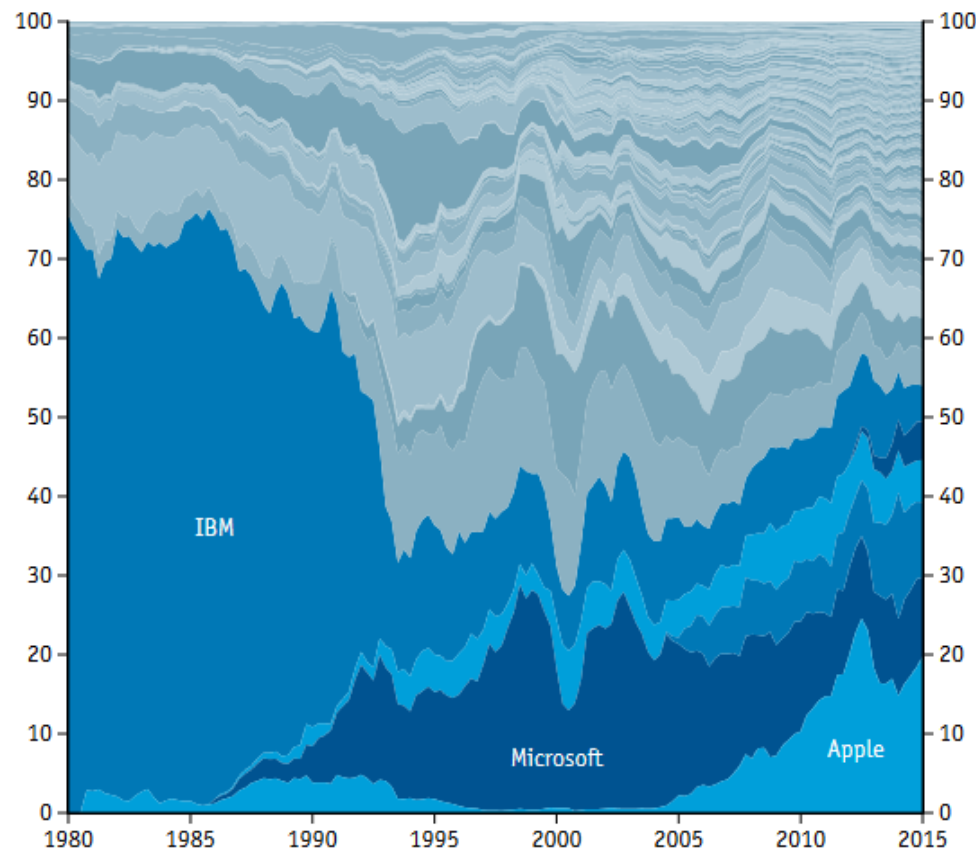
- iPhone (2007) and iPad (2010) launch revolutionized IT
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The Changing US Technology Sector

The changing US technology sector

Market value, top 100 firms*, % of total

% of total Nominal Real



Sources: Thomson Reuters; *The Economist*

*As of Q1 2015

*“Founded in 1911 as a manufacturer of punch-card machines, more than a century later **[IBM]** remains one of the largest technology companies in the world. Where once it made mechanical behemoths for reading and manipulating paper cards, today it focuses on providing computing services and software to clients across the world.”*

*“Though today’s **tech giants** are larger than ever, even Apple, now the largest publicly traded company in America, accounts for less than a quarter of the market. Many companies that supplanted IBM during the 1980s and 1990s, such as Hewlett-Packard and Microsoft, now find themselves in eclipse. All three are trying to make a comeback by **pushing into cloud computing**, meaning that data are stored and crunched on remote servers.”*

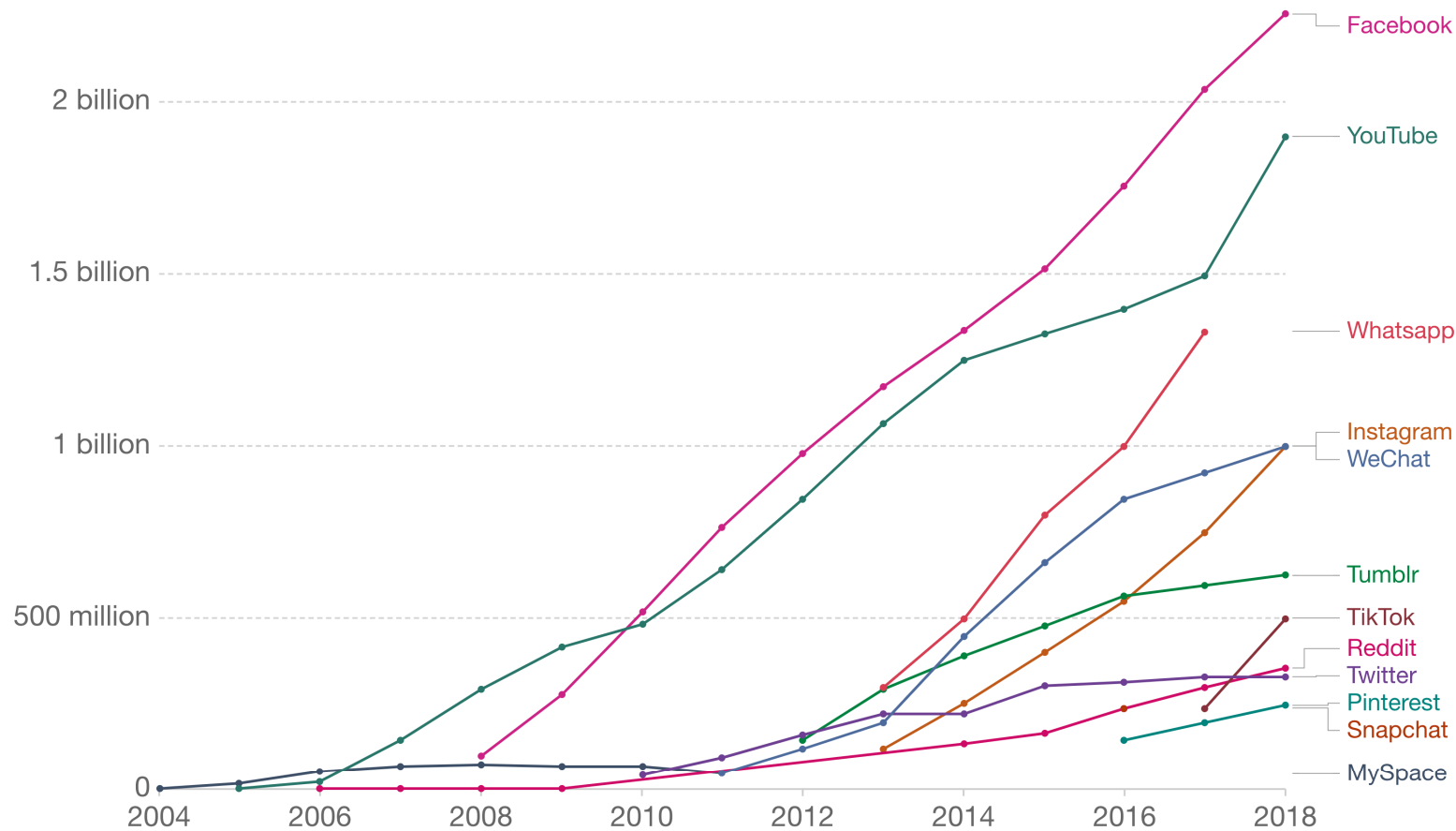
(The Economist, 2015, <http://econ.st/1QfdNNp>)

Rise of Social Media Platforms

Number of people using social media platforms, 2004 to 2018



Estimates correspond to monthly active users (MAUs). Facebook, for example, measures MAUs as users that have logged in during the past 30 days. See source for more details.



Source: Statista and TNW (2019)

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(Our World in Data, 2019; <https://ourworldindata.org/rise-of-social-media>)

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Creative Destruction



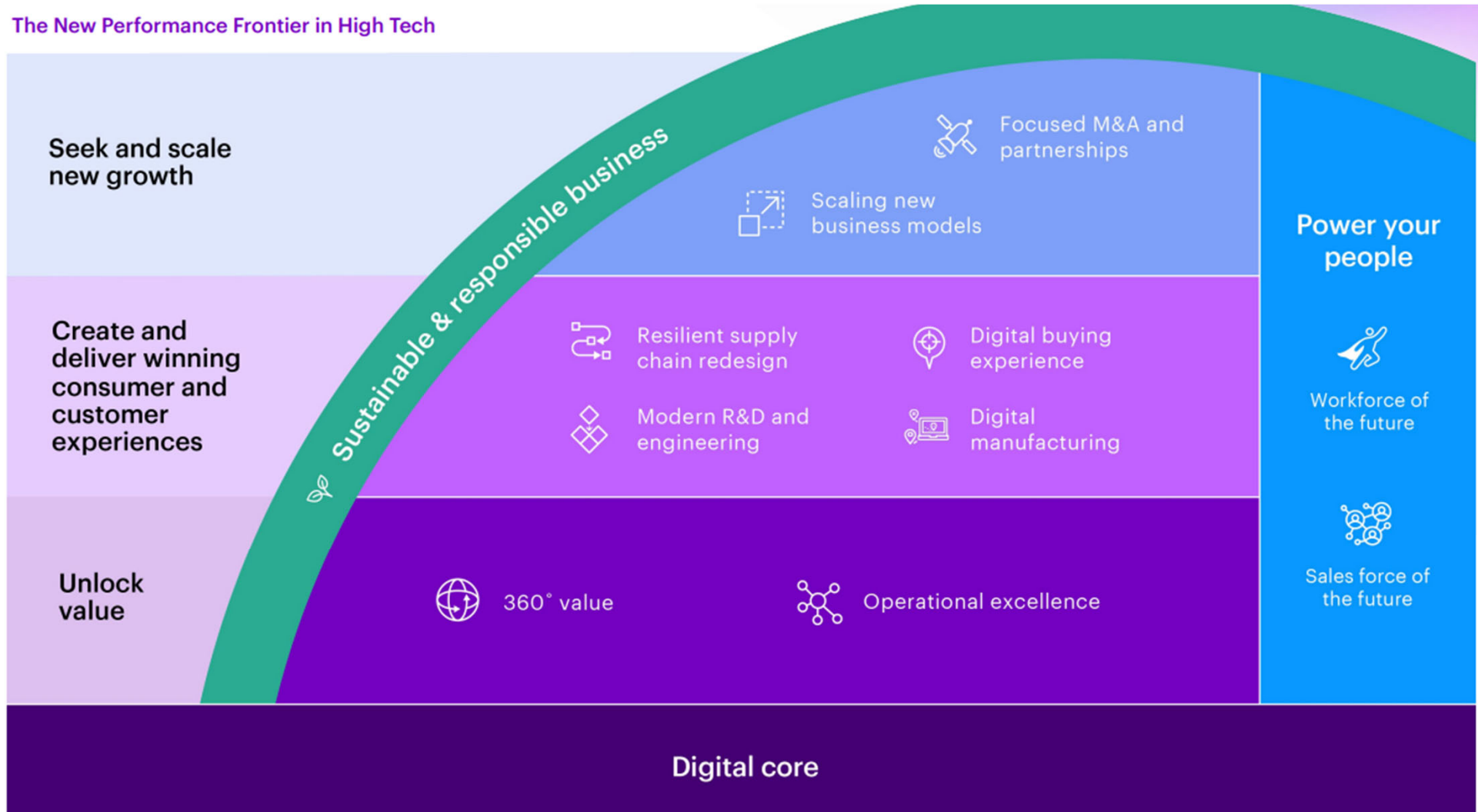
Joseph A. Schumpeter
(Austrian Economist)

Creative destruction describes the “*process of industrial mutation that incessantly revolutionizes the economic structure **from within**, incessantly destroying the old one, incessantly creating a new one*” (Schumpeter, 1942).

- Schumpeter argued that the forces of creative destruction can eventually lead to the **demise** of a capitalist system.
- Agents act in their own interest and therefore continuously aim for innovation in an effort to **increase profits** or to avoid being **overrun by competitors**. This **continuous innovation** is the prime force of creative destruction and causes periodic cycles of crisis.
- Prominent examples for **digital disruption**:
 - Kodak (analog vs. digital cameras)
 - Polaroid (instant vs. digital cameras)
 - Xerox (laser printers)

Example: Resilience in High Tech

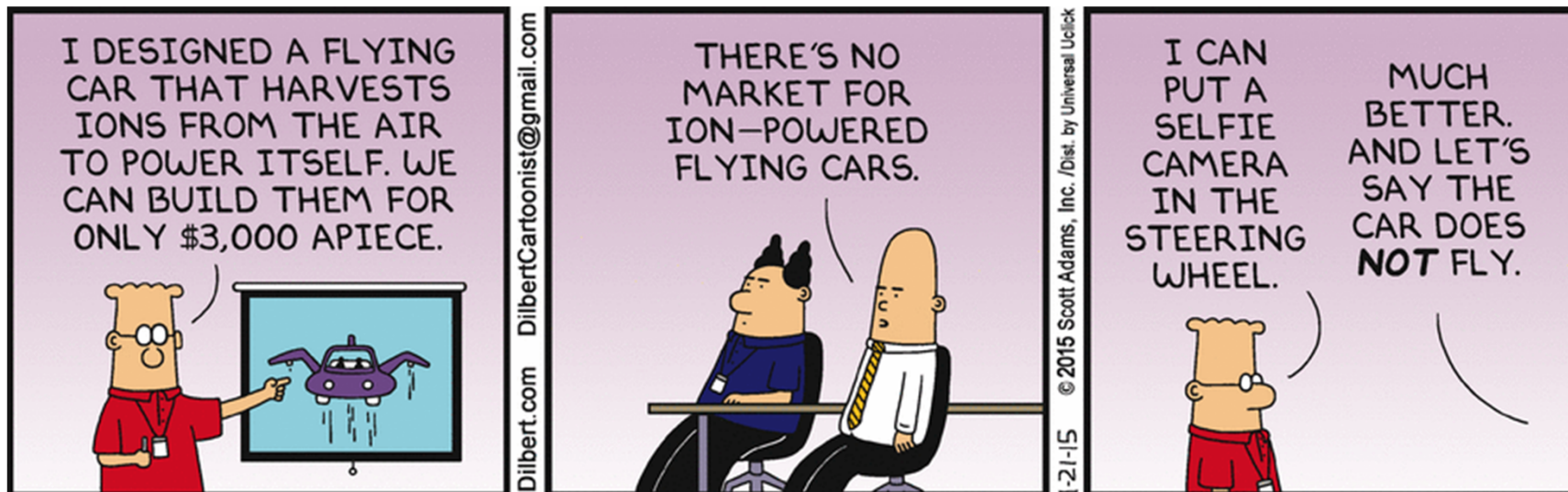
The New Performance Frontier in High Tech



(Alam et al. 2023, Figure 1)

Last Slide

... the one about *disruptive technologies*



(<http://dilbert.com/strips/comic/2015-01-21/>)

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