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# The Sixth Wave of Innovation: Challenges and Opportunities

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# Dangers of Prediction

**“This ‘telephone’ has too many shortcomings to be seriously considered as a means of communication. The device is inherently of no value to us”**

***Western Union Internal Memo, 1876***

# Dangers of Prediction

**“Everything that can be invented has been invented”**

***Charles H. Duell, Commissioner,  
US Office of Patents, 1899***

# Dangers of Prediction

**“I think there is a world market for maybe five computers”**

***Thomas Watson, Chairman of IBM, 1943***

# Dangers of Prediction

**“Computers in the future may weigh no more than  
1.5 tonnes”**

***Popular Mechanics, 1949***

# Dangers of Prediction

**“There is no reason anyone would want a computer in their home”**

***Ken Olson, Present, Chairman and Founder of Digital Equipment Corp, 1977***

# Dangers of Prediction

**“640k [of RAM] ought to be enough for anybody”**

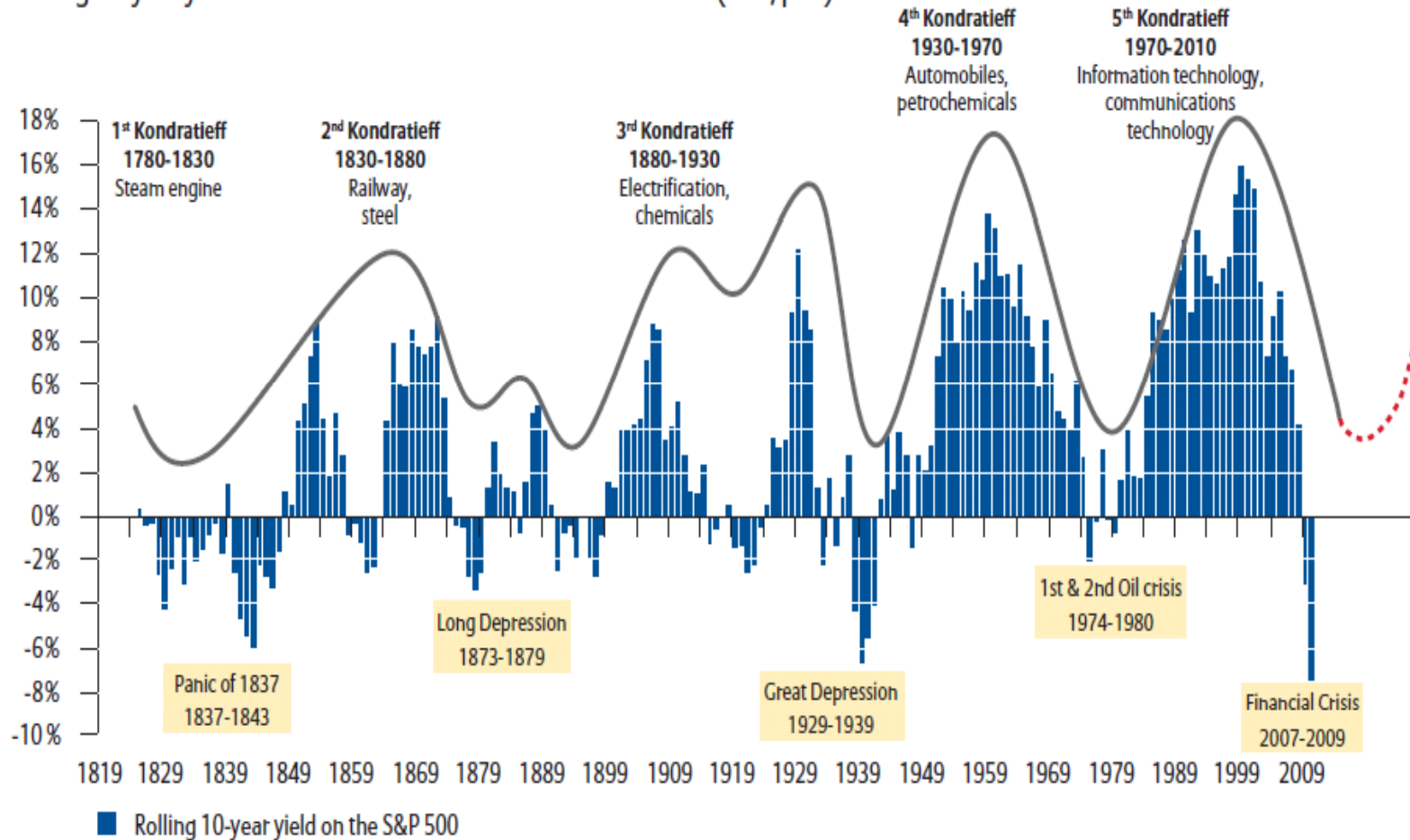
***Bill Gates, Chairman of Microsoft, 1981***

# Timeframes...



# Waves of Innovation

Rolling 10-year yield on the S&P 500 since 1814 till March 2009 (in %, p. a.)



Source: Datastream; Illustration: Allianz Global Investors Capital Market Analysis

# Waves of Innovation

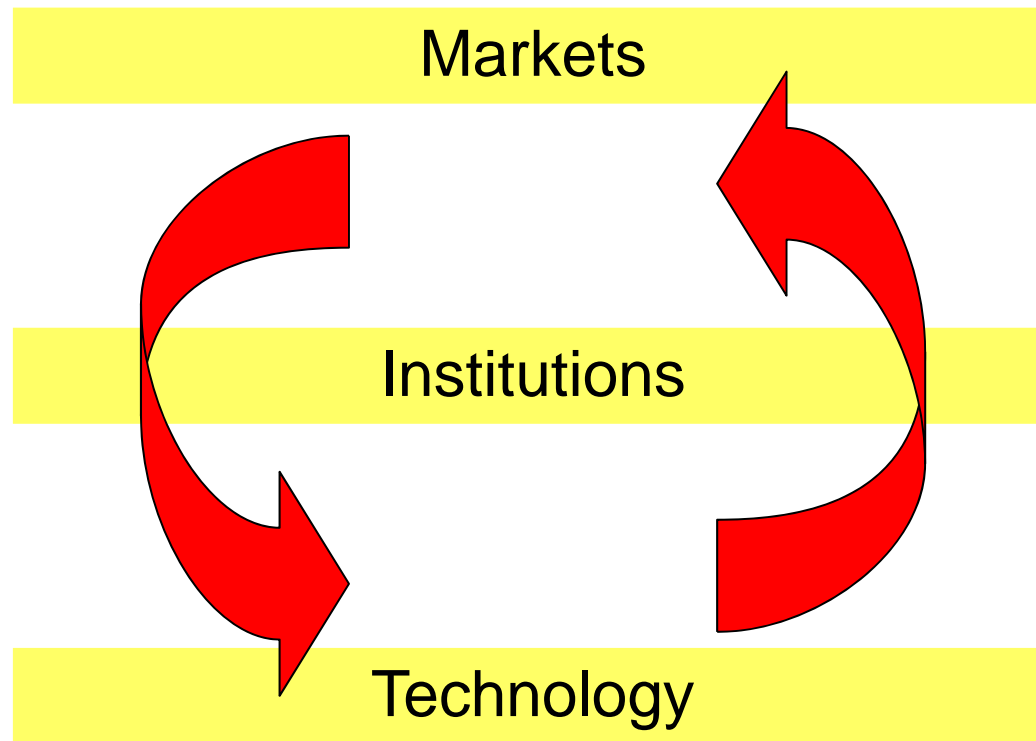
## Summary of Kondratiev waves

	Wave 1: Cotton, Iron and Water Power	Wave 2: Railways, Steam Power and Mechanisation	Wave 3: Steel, Heavy Engineering and Electrification	Wave 4: Oil, Automobiles and Mass Production	Wave 5: Information and Communication Technology
Upswing <sup>1</sup>	1780s–1815	1848–1873	1895–1918	1941–1973	1980–2001
Downswing <sup>1</sup>	1815–1848	1873–1895	1918–1940	1973–?	2001–?
Technologies <sup>1</sup>	Cotton-spinning and iron products, water-wheels, bleach	Railways and railway equipment, steam engines, machine tools, alkali industry	Electrical equipment, heavy engineering, heavy chemicals, steel products	Automobiles, trucks, tractors, tanks, diesel engines, aircraft, oil refineries	Computers, software, telecommunication equipment, biotechnology
Core inputs <sup>1</sup>	Iron, raw cotton, coal	Iron, coal	Steel, copper, metal alloys	Oil, gas, synthetic materials	Integrated circuits
Transport and communications infrastructure <sup>1</sup>	Canals, turnpike roads, sailing ships	Railways, telegraph, steam ships	Steel railways, steel ships, telephone	Radio, motorways, airports, airlines	Internet, 'Information highways'
Corporate organisation <sup>2</sup>	Owner-manager	Hierarchy	Division	Matrix	Network linkages

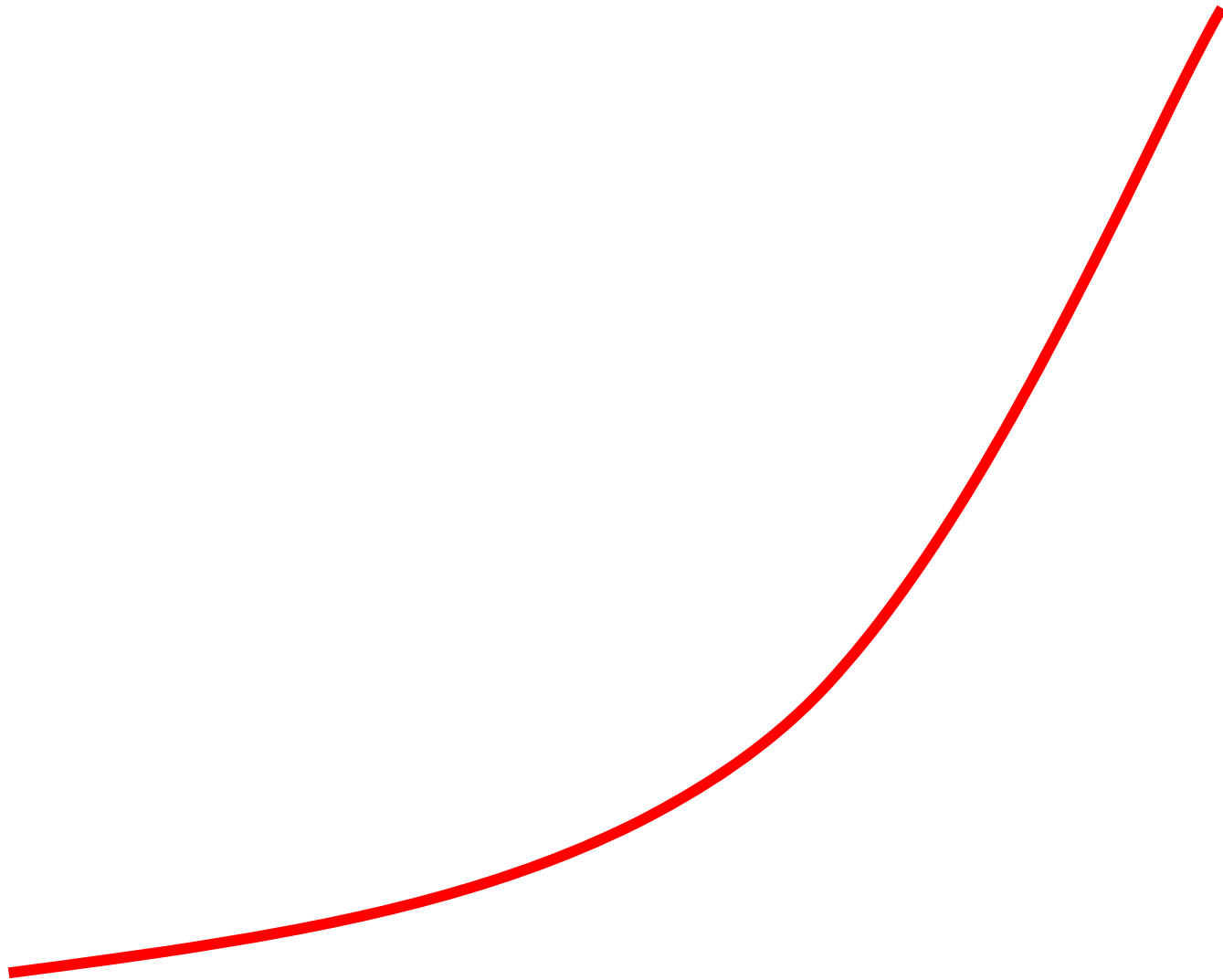
1. Freeman, C., Louca, F., *As Time Goes By: From the Industrial Revolutions to the Information Revolution*, Oxford University Press, Oxford, 2002

2. Linstone, H. 'Corporate planning, forecasting and the long wave', *Futures* 34: 317–336, 2002

# What happened in IT?



# Technology



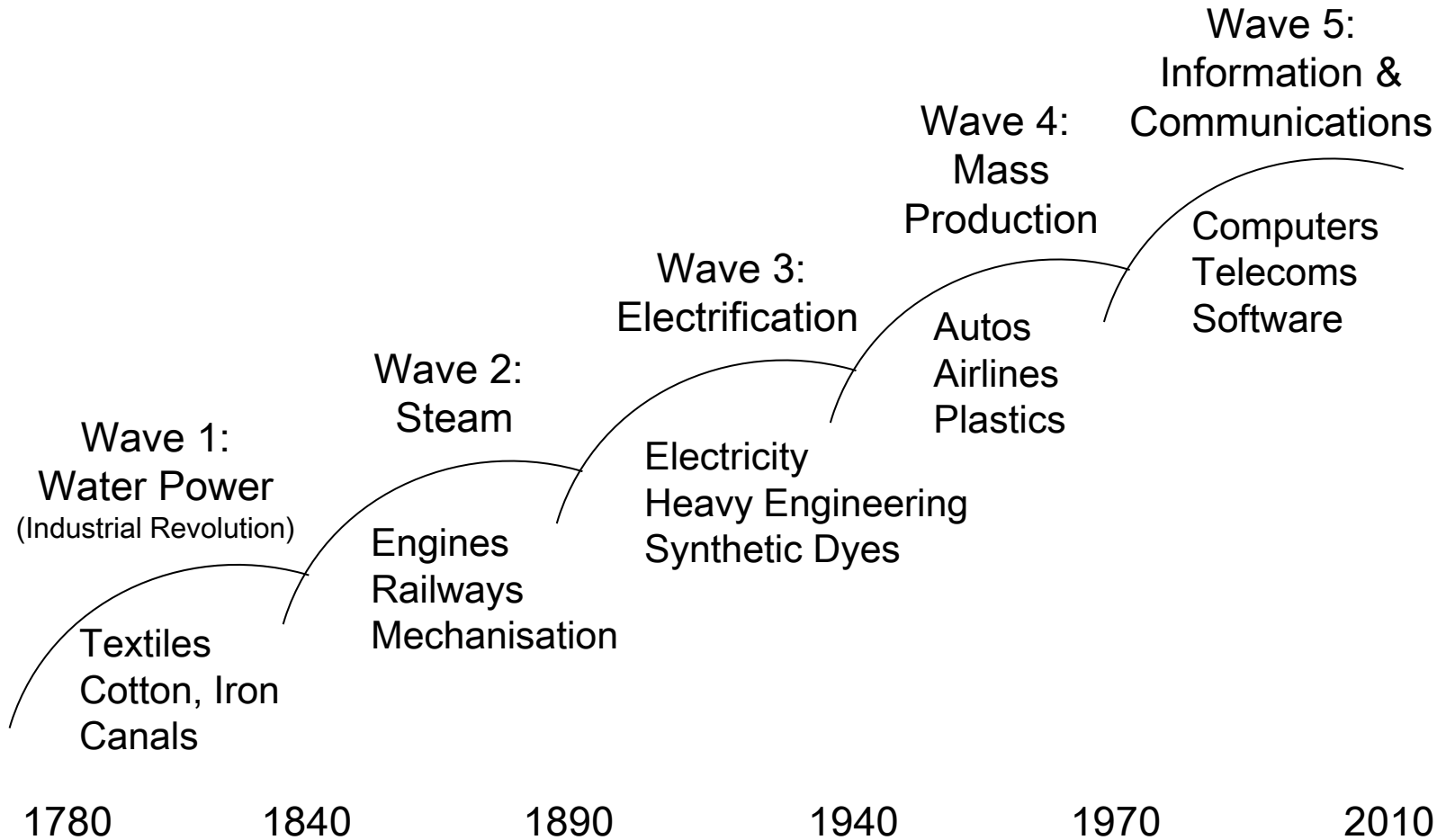
# Institutions



# Markets



# Waves of Innovation



Resource  
Efficiency



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# Resources

Human Resources  
Natural Resource  
Information  
Resources

Rights definition  
Mass  
Collaboration  
Services

Measurement &  
Modelling,  
CleanTech

# The Winning Formula

**In a resource-constrained world:**

**Old Mode  
of Operation**

**Harvesting  
resources that are  
plentiful and  
cheap**



**New Mode  
of Operation**

**Managing  
resources that are  
scarce and  
valuable**

# The Future?



# 1. Waste = Opportunity



## 2. Sell the Service, not the Product



# Biosphere vs. Technosphere

Bio-  
Sphere  
(recycle)

Techno-  
sphere  
(service)



### 3. Digital and Natural Converge



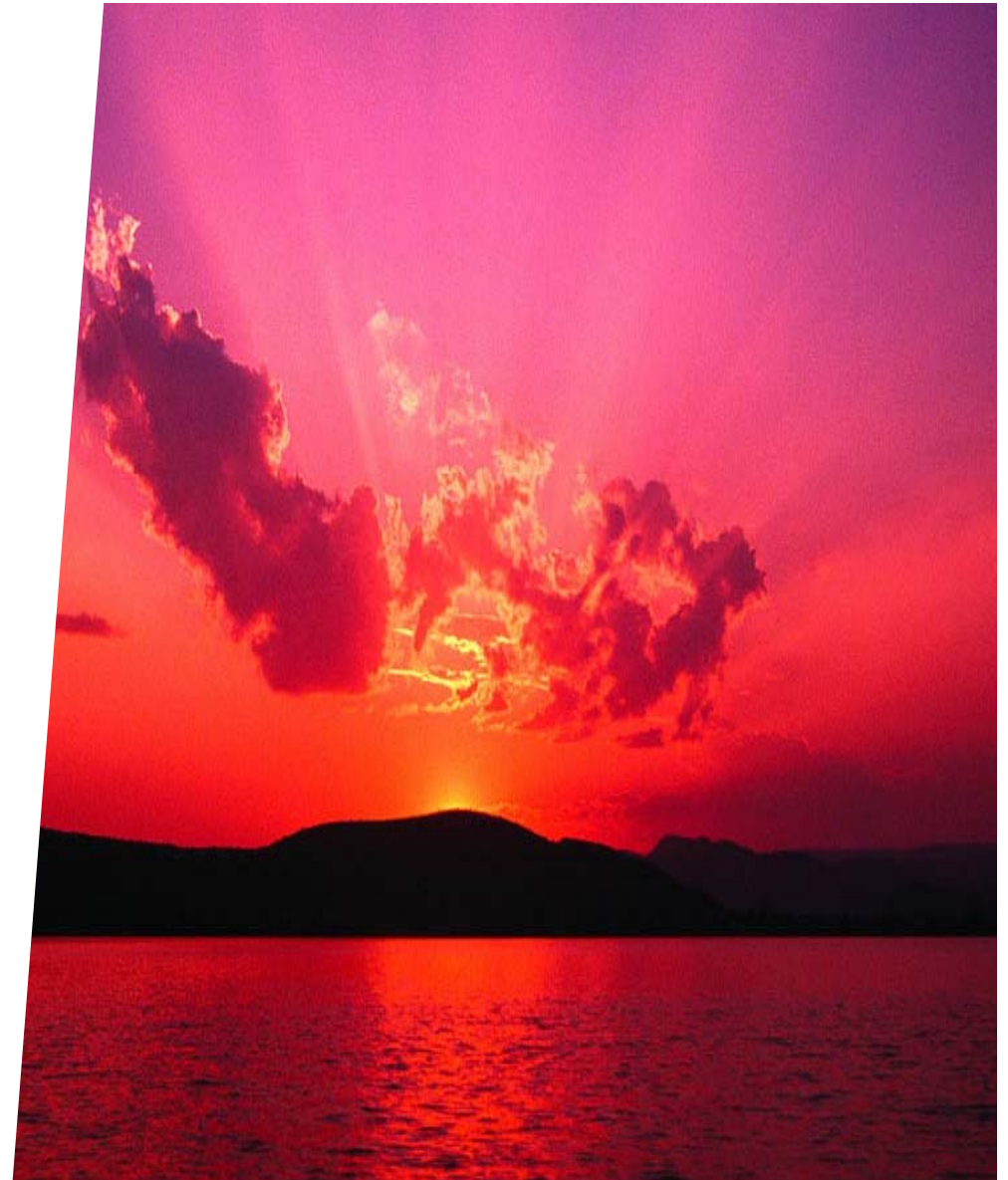
## 4. Bits are Global, Atoms are Local



## 5. If in doubt, look to nature



# The Future



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THE  
SIXTH  
wave



*How to succeed in a resource-limited world*

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& BIANCA NOGRADY

VINTAGE

Thank you

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