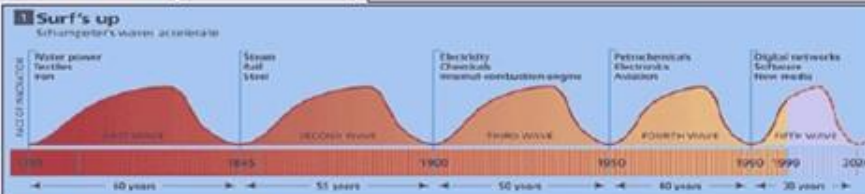


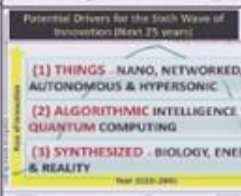


# IEEE-IISc Student Branch

In Association with  
**CRAFITTI**, Bangalore



One day workshop on (6WoI)  
**INVENTING** in and for  
**THE SIXTH WAVE OF INNOVATION**  
ECE Dept, Indian Institute of Science  
**7 July 2018 (Saturday)**



### About the workshop

We have already entered or are entering the **Sixth wave of Innovation** by the year 2020. The current ongoing fifth wave of innovation (Schumpeter/Kondratieff Waves/Cycles- as they are called historically) started in 1990. It was driven by digital networks, software and new media, and is rapidly giving birth to the new wave – **The Sixth Wave of Innovation (6WoI)**.

- This new wave of innovation, we propose will be driven by
- (a) *Networked, Autonomous, Nano and Hypersonic – Things,*
  - (b) *Algorithmic Intelligence and Quantum Computing and*
  - (c) *Synthesized – Biology, Energy and Reality.*

The key skill needed in this rapidly changing and transformative new wave is our ability to “*invent strong, fast and continuously*”. Inventing is the process of providing “technical solutions” to “problems”. Inventions are those technical solutions that should pass the filters of newness/novelty, non-obviousness and having industrial application. If the solutions pass through these filters they are qualified for getting Patent protection as per the modern laws. Inventing methods however has not evolved from the serendipitous trial and error that has been the way humanity evolved. Although there are methodologies from psychology, such as lateral thinking and six thinking hats and historical and empirical analysis of inventions/patents such as TRIZ and its many variants such as USIT, ASIT etc, their proliferation, usage and importance has not been enough to upgrade our method of inventing from the trial-and error used by ancient man. The sixth wave of innovation is emerging in a rapid eclectic mix of trends and transformations – be it emergence of machine learning/deep learning, Industry 4.0, Digitalization, hypersonic vehicles, Nano-technology or Synthetic Biology. In this sixth wave, “inventing” will require much more nuanced, mature and structured approach to win instead of the ancient way of serendipity and trial and error.

One day workshop cum seminar will expose the participants to new ways and means of Inventing for the rapidly changing world and responding to the Sixth Wave of Innovation that has started embracing the world.

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### Registration

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Fees: Rs. 1000/-per participant; 500 for students/faculty/Startup.  
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### Coordinators:

Dr. Priyaranjan Mishra, CRAFTITI ([priya.r.mishra@ieee.org](mailto:priya.r.mishra@ieee.org))  
Kundan Kumar, IISc, ([kundankumar@ieee.org](mailto:kundankumar@ieee.org))

# the Sixth Wave of Innovation

# Nikolai Kondrateiff and Joseph Schumpeter

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## Godfather of Innovation

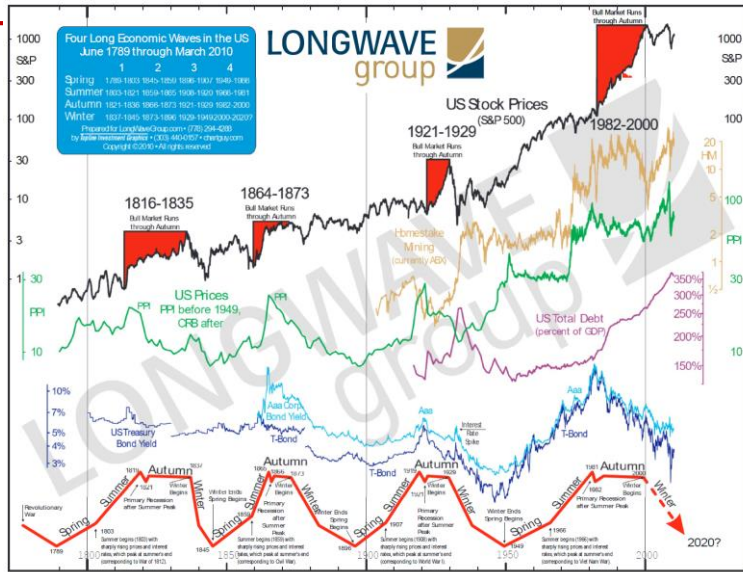
- the “creative destruction” associated with industrial cycles 50-60 years long.
- first to challenge classical economics as it sought (and still seeks) **to optimise existing resources** within a stable environment—treating any disruption as an external force on a par with plagues, politics and the weather.

*A normal, healthy economy was not one in equilibrium, but one that was constantly being “disrupted” by technological innovation.*

- Analyzed the work of a Russian economist, **Nikolai Kondratieff**, (recombination of History and Economics) - long cycles of Innovation (**17.9.1938 – Shot Down By a firing Squad**) - **Long Cycles/Waves** Theory of Economic development/evolution through technological innovation



# Long Cycles/Waves of Innovation



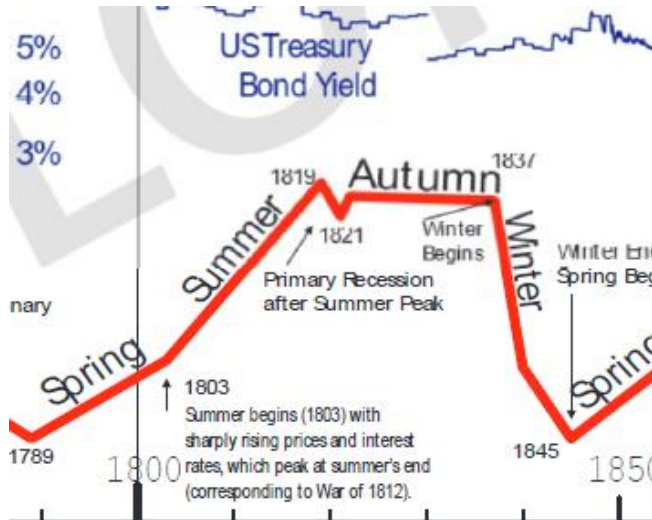
## Part II: Successive Industrial Revolutions

### Introduction: Technical Change and Long Waves in Economic Development

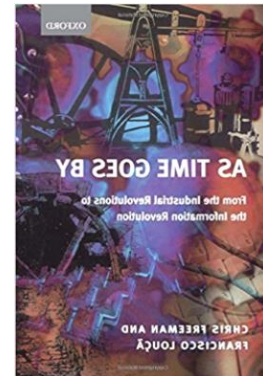
- 5 The British Industrial Revolution: The Age of Cotton, Iron, and Water Power
- 6 The Second Kondratiev Wave: The Age of Iron Railways, Steam Power, and Mechanization
- 7 The Third Kondratiev Wave: The Age of Steel, Heavy Engineering, and Electrification
- 8 The Fourth Kondratiev Wave: The Great Depression and the Age of Oil, Automobiles, Motorization, and Mass Production
- 9 The Emergence of a New Techno-economic Paradigm: The Age of Information and Communication Technology (ICT)

### Conclusions to Part II: Recurrent Phenomena of the Long Waves of Capitalist Development

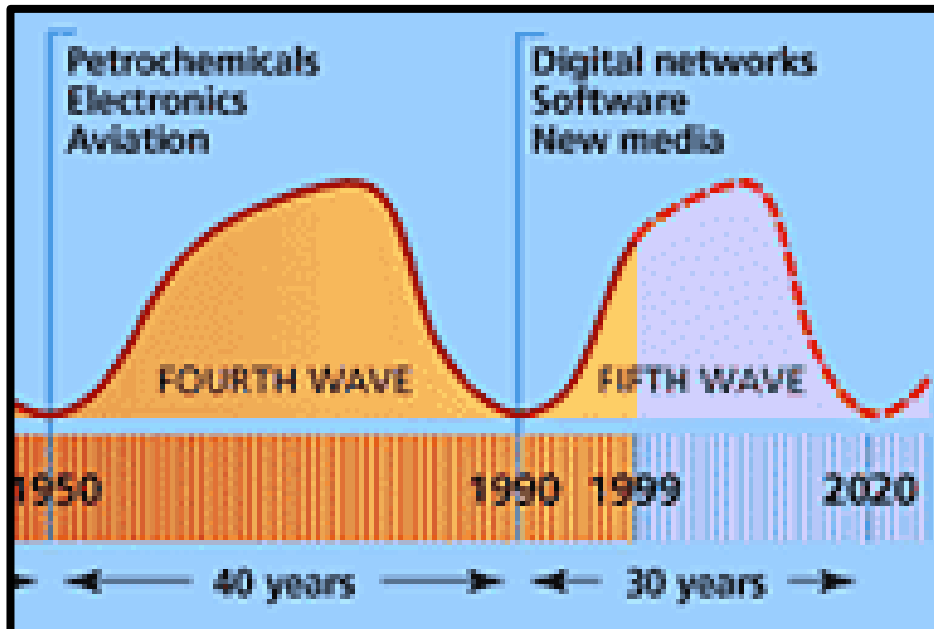
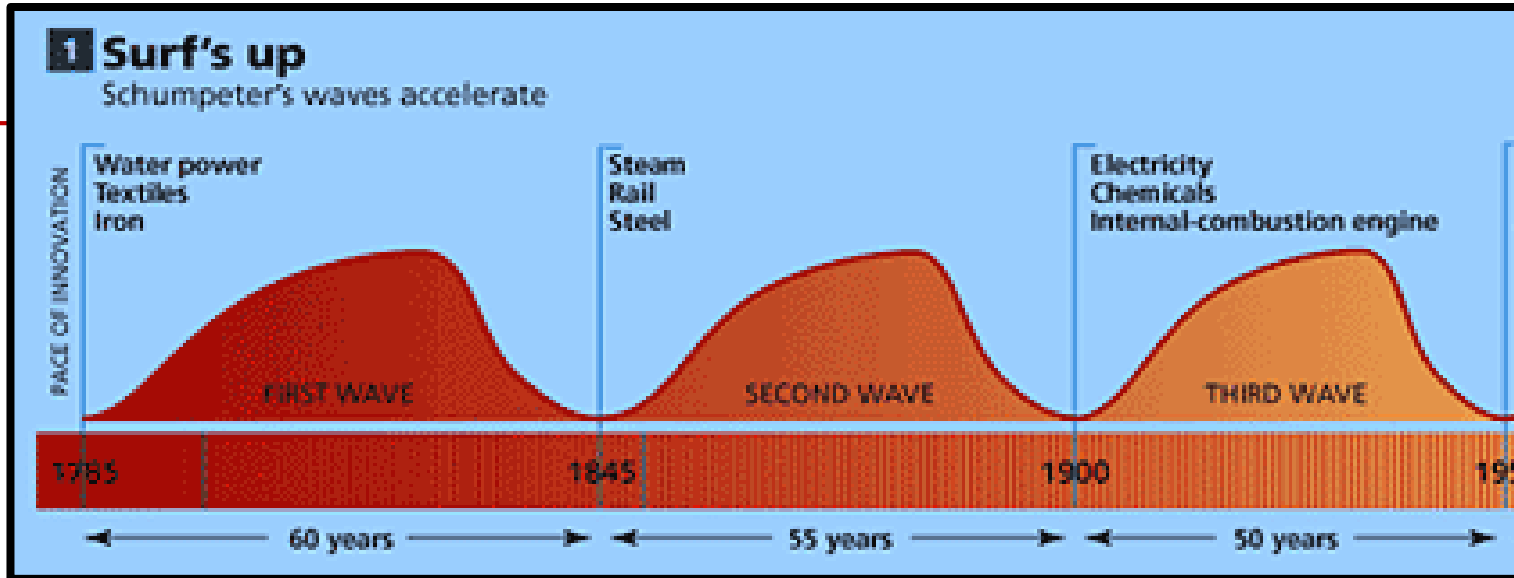
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Accessed on 17.4.2018  
<http://www.thelongwaveanalyst.ca/>



# The Economist 20th Feb 1999



**THE SIXTH WAVE ?**

**25 years**

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# The Sixth Wave of Innovation (Denial Smihula, 2009)



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“The frequency and radicality of technological innovations **are not distributed uniformly in the course of time**. Revolutionary innovations in such modern society tend to come in **waves** rather than continuously. Each of these waves has its **innovation phase** (inventions occurs in a form applicable in practical life and their first real application- which we call a **technological revolution**) followed by an **application phase** in which the number of revolutionary innovations falls and attention focuses on exploiting and extending existing innovations. “

- 9) Now (2008) we are in the 5<sup>th</sup> wave and in its application phase which followed after Information and telecommunications technological revolution (1985-2000).
- 10) The present economic crisis is a confirmation of the fact that Information and telecommunication revolution is over.
- 11) A new significant long-time economic boom can come only with a new (6<sup>th</sup>) technological revolution.
- 12) The 6<sup>th</sup> wave with its technological revolution could start about 2015 and could be rather quick (only 20-25 years?).
- 13) We can expect that the most rapid progress will be done in biomedical sciences, nuclear technologies, hydrogen engines and maybe in robotics.
- 14) The 7<sup>th</sup> wave (after 2035-40) and the following next waves (8<sup>th</sup>, 9<sup>th</sup> etc.) will be even shorter and probably in one moment (cca after 2080-90) the technological development will be so rapid that it will lose its character of waves distinguishable from shorter cycles (for example “business” cycle).
- 15) The best recommendation for governments how to overcome the existing crisis is to speed up a birth of the post-informational technological revolution (6<sup>th</sup> wave) by supporting an scientific and technical progress.

**Bio Medical Sciences, Nuclear Technologies, Hydrogen Engines and maybe Robotics**

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# RESOURCE EFFICIENCY: THE SIXTH WAVE OF INNOVATION

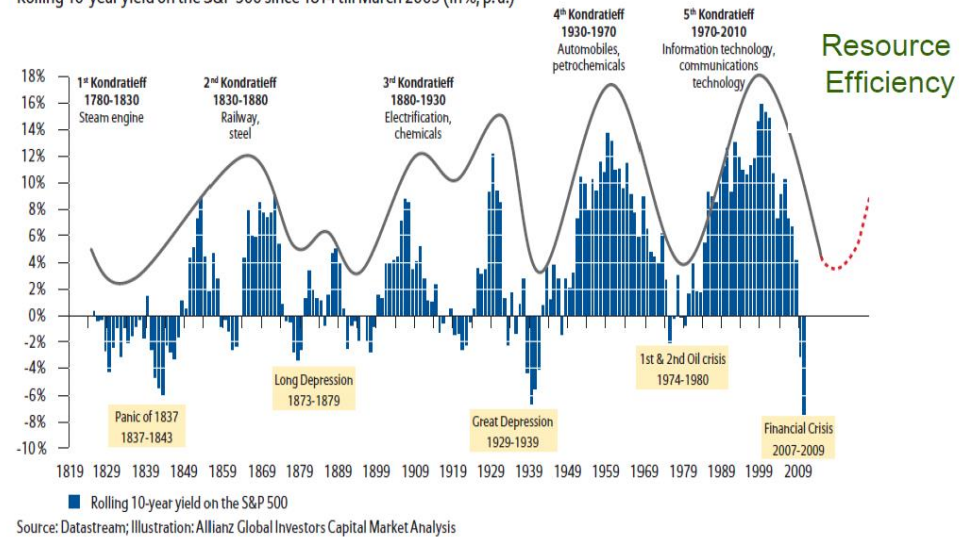
The global financial crisis of 2007-2009 heralded the start of a sixth major wave of innovation - that of resource efficiency, according to Dr James Bradfield Moody, author of *The Sixth Wave*, speaking at the Creative Sydney conference.

[partner id="wireduk" align="right"]The Russian economist Nikolai Kondratiev first postulated the major cycles of innovation in 1925. The five initial major economic cycles

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## Waves of Innovation

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



James Bradfield Moody, Cisco Live 2013, www.sixthwave.org

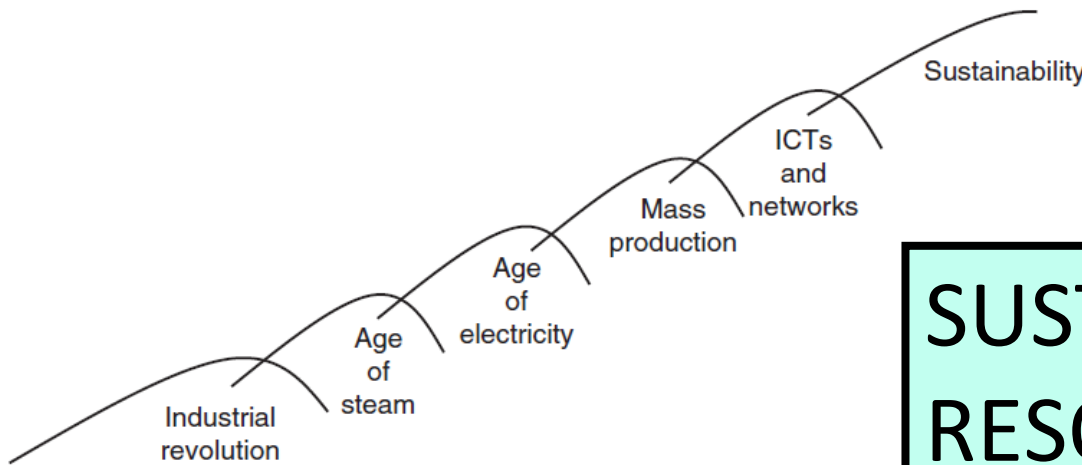


Fig. 1. The sixth wave of innovation.

**SUSTAINABILITY and RESOURCE EFFICIENCY**

## Sixth Wave Thinking

The next wave of innovation will be driven by resource efficiency, enabled through the pricing of waste and natural resources, and turbo-charged by clean technologies.

This is an enormous shift. Over the 200 years since the Industrial Revolution, we have seen economic growth strongly coupled with the consumption of more and more resources. The more we grew, the more we consumed. If the next wave of innovation really will be tied to resource efficiency, this equation is about to be turned on its head.

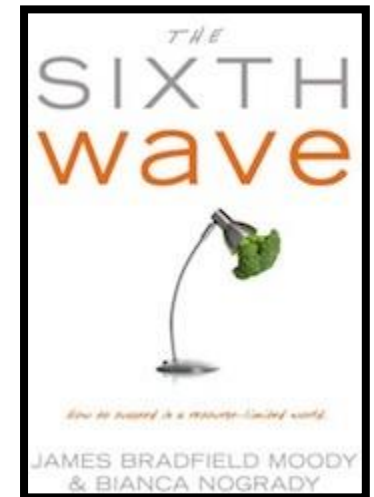
In a world that is 'decarbonised' or 'deresourced', we will have decoupled resource use from economic growth. The world economy will no longer be based on the transformation of inputs into outputs. This will not happen overnight; if resource efficiency really is at the heart of Kondratiev's sixth wave, it will be a journey of some thirty to forty years.

So what does this mean for the shape of the future? How do you catch the wave? The second part of THE SIXTH WAVE looks at five big ideas that will shape the sixth wave:

1. Waste = Opportunity
2. Sell the Service, not the Product
3. Digital and Natural Converge
4. Bits are Global, Atoms are Local
5. If in Doubt, Look to Nature

Have you got an example of Sixth Wave Thinking to tell us about? [Contact us](#).

And what about the seventh wave of innovation? Read more about it [here](#).





# Measuring the Sixth Wave



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SOLUTIONS

PRODUCTS

SERVICES & SUPPORT



Our guest, Shahriar Shahrani  
shares his views on the 6th Wave

Log in

The progress of humankind is marked by waves of innovation, periods in which bursts of disruptive inventions trigger rapid growth.

Experts predict the 6th Wave will be defined by connectedness, speed and resource efficiency.

Here are 6 areas where we see significant advances in technology and where we are working to enable test and measurement of these new technologies to bring them to realization.

- 5G & IoT
- 3D Sensing
- Power Efficiency
- Wired Communications
- IP Broadcasting
- Automotive

# Potential Drivers for the Sixth Wave of Innovation (Next 25 years)



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**(1) THINGS** – NANO, NETWORKED,  
AUTONOMOUS & HYPERSONIC

**(2) ALGORITHMIC** INTELLIGENCE WITH  
**QUANTUM** COMPUTING

**(3) SYNTHESIZED** – BIOLOGY, ENERGY  
& REALITY

Year 2020-2045

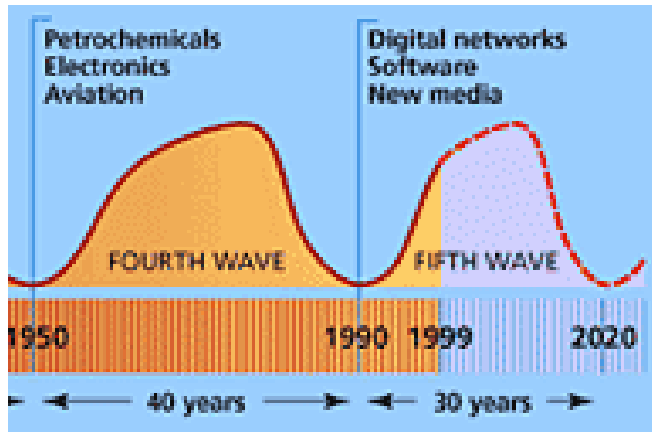
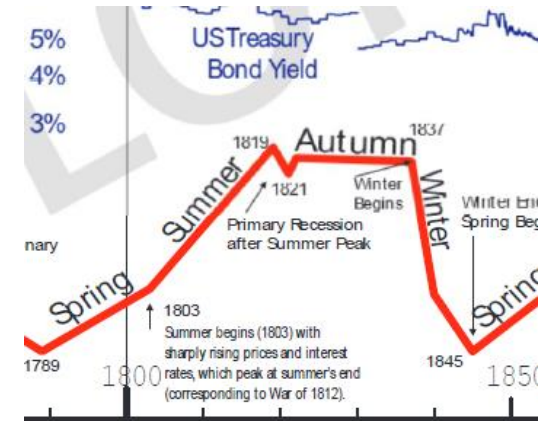
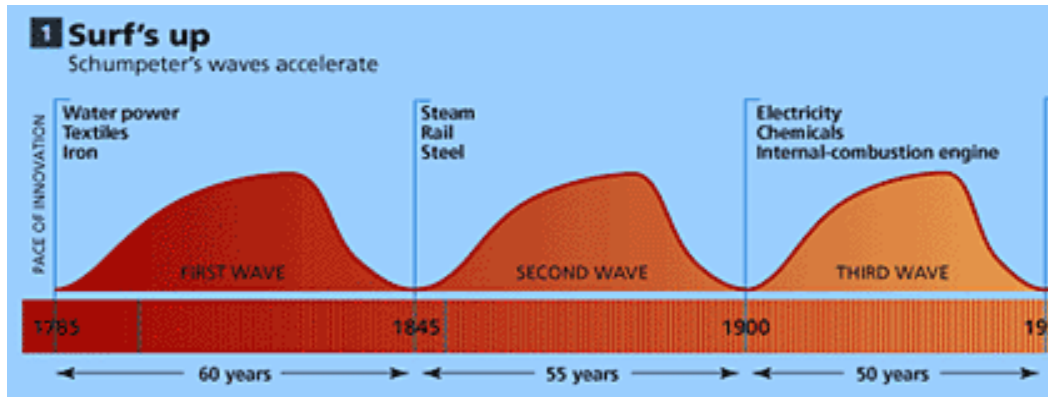
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Pace of Innovation

# The Economist 20th Feb 1999 + Crafitti's Sixth Wave of Innovation



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Year 2020-2045

**(The Sixth Wave) 25 years**

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# Top 10 skills

## in 2020

1. Complex Problem Solving
2. Critical Thinking
3. Creativity
4. People Management
5. Coordinating with Others
6. Emotional Intelligence
7. Judgment and Decision Making
8. Service Orientation
9. Negotiation
10. Cognitive Flexibility

## in 2015

1. Complex Problem Solving
2. Coordinating with Others
3. People Management
4. Critical Thinking
5. Negotiation
6. Quality Control
7. Service Orientation
8. Judgment and Decision Making
9. Active Listening
10. Creativity

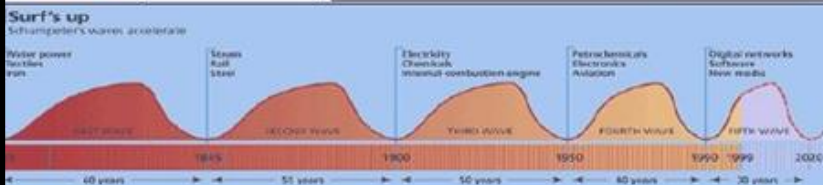
Key Skill needed: **INVENTING STRONG**



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Year 2045-2040

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