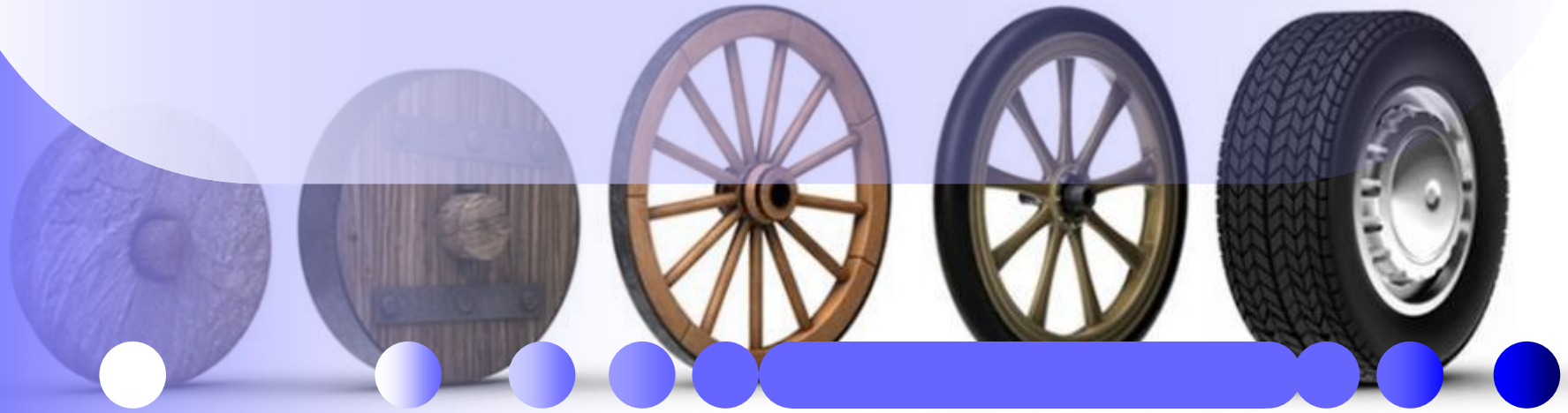
Scaling-up Innovation



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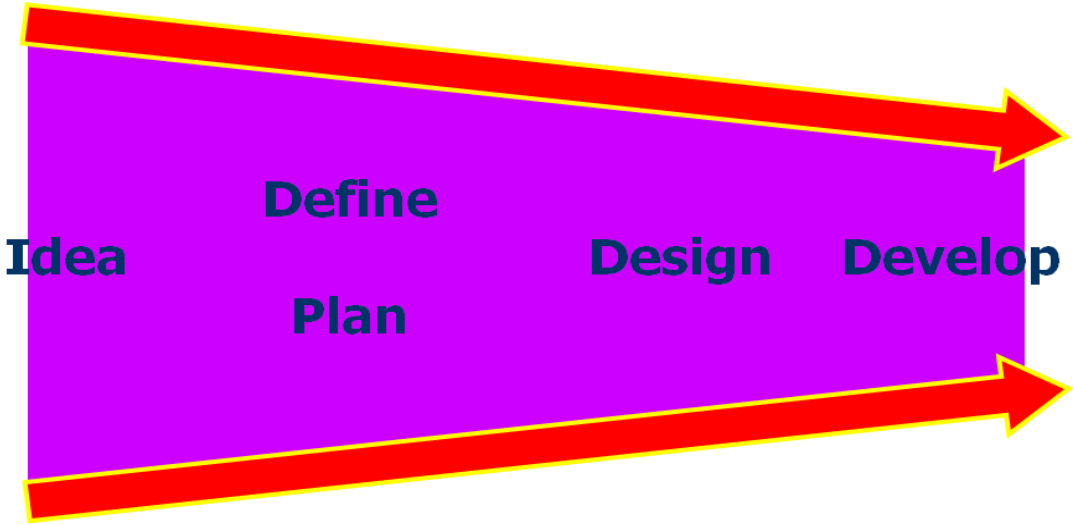
Capacity for Technology Development

- Depends on:
  1. **Scaling-up** existing technologies;
  2. Leapfrogging;

  While Developing innovation capacity.

Scaling-up

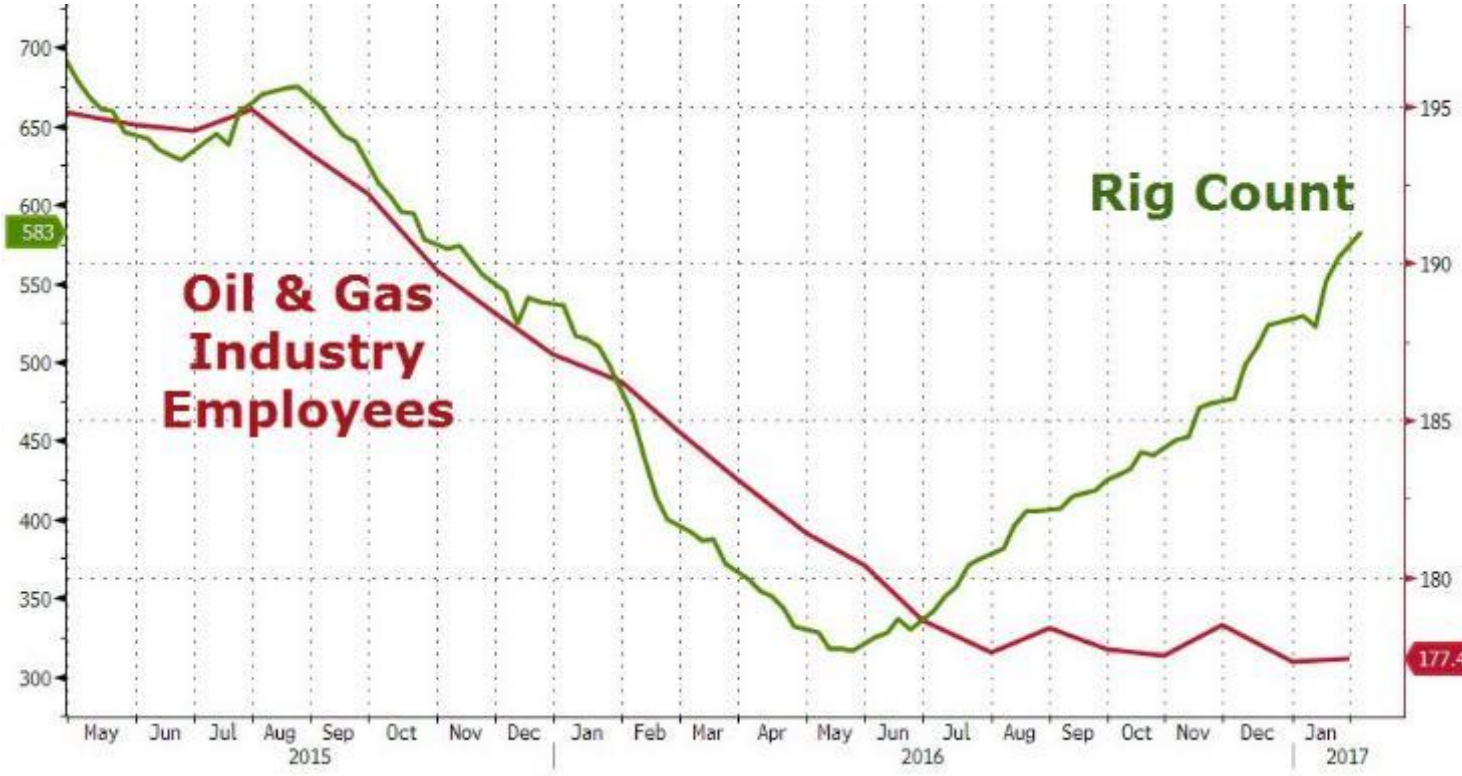
- Mature Technologies:
  - In use for long enough / most "kinks" = fixed
  - Scientific background = well understood



  - Marginal Improvements:
    - "aggregation of marginal gains";
    - "micro-inventions";
    - as use spreads: "learn by doing" + add improvements

Scaling-up: "pick the winners"

- Possible: Identify transformative technology
- Hard: Identify best implementation.
  - Automobile: gasoline, diesel, or electric?
  - Blockchain: Bitcoin or its "forks"?
- Hard: What is the long-term impact?



Scaling-up: “forecast” impact

- Real impact: Hard to grasp early on

1889: *“Fooling around with alternating current (AC) is just a waste of time. Nobody will use it, ever.”* — Thomas Edison

2007: *“There’s no chance that the iPhone is going to get any significant market share.”* — Steve Ballmer, Microsoft CEO.

Dead-End

- Radical innovations or Dead End?
  - New paradigm shift
  - Risk of knowledge loss

Opportunities: Digital

Crucial Emerging Technology	SDG Opportunities	Threats
Big Data and Data mining; "Internet of Things" and networked tools and appliances; distributed and "cloud" computing; open data and open source development; data sharing and online learning; mobile telephony; 3-D printing/additive manufacturing; micro-simulation; e-distribution; Integrated data acquisition and remote sensing systems; Virtual reality and tele-presence; Smart power grid and digital monitoring & security.	Development, employment, manufacturing, agriculture, health, cities, finance, governance, participation, education, citizen science, environmental monitoring, resource efficiency, social networking and collaboration	Unequal benefits, job losses, skills gaps, social impacts, poor people priced out; global value chain disruption; concerns about privacy, freedom and development; fraud, theft, cyberattacks.

UN: 2016; *Global Sustainable Development Report 2016*, Department of Economic and Social Affairs (DESA), United Nations (UN), New York, NY. Available at (Last Accessed on June 17, 2017): https://sustainabledevelopment.un.org/globalsdreport/2016/

Opportunities: Biotech

Crucial Emerging Technology	SDG Opportunities	Threats
Biotechnology and proteomics; Genomics; gene-editing technologies and custom-designed DNA sequence; genetically modified organisms (GMO); Stem cells and human engineering; bio-catalysis; synthetic biology; sustainable agriculture; Mass-customization of pharmaceutics;	Food crops, human health, pharmaceuticals, materials, environment, fuels	Military use; irreversible changes to health and environment.

UN: 2016; *Global Sustainable Development Report 2016*, Department of Economic and Social Affairs (DESA), United Nations (UN), New York, NY. Available at (Last Accessed on June 17, 2017): https://sustainabledevelopment.un.org/globalsdreport/2016/

Opportunities: Nanotech

Crucial Emerging Technology	SDG Opportunities	Threats
Nano-imprint lithography; Applications for decentralized water and wastewater treatment, desalination, and solar energy (nanomaterial solar cells); artificial photosynthesis Organic and inorganic nanomaterials, metamaterials, and memory alloys; Enhance resource extraction and waste treatment;	Energy, water, chemical, electronics, medical and pharmaceutical industries; high efficiencies; resources saving; CO2 mitigation.	Human health (toxicity), environmental impact (nanowaste)

UN: 2016; *Global Sustainable Development Report 2016*, Department of Economic and Social Affairs (DESA), United Nations (UN), New York, NY. Available at (Last Accessed on June 17, 2017): https://sustainabledevelopment.un.org/globalsdreport/2016/

Opportunities: Neurotech

Crucial Emerging Technology	SDG Opportunities	Threats
Digital automation, including autonomous vehicles (driverless cars and drones); robotics; smart technologies; cognitive computing; e-discovery platforms, personalization algorithms, enhanced artificial intelligence and machine learning; Handicap mitigation; brain-machine interface; augmented reality.	Health, safety, higher efficiency, resource saving, new types of jobs, manufacturing , education.	Unequal benefits, de-skilling, job losses and polarization, widening technology gaps, military use, conflicts.

UN: 2016; *Global Sustainable Development Report 2016*, Department of Economic and Social Affairs (DESA), United Nations (UN), New York, NY. Available at (Last Accessed on June 17, 2017): https://sustainabledevelopment.un.org/globalsdreport/2016/

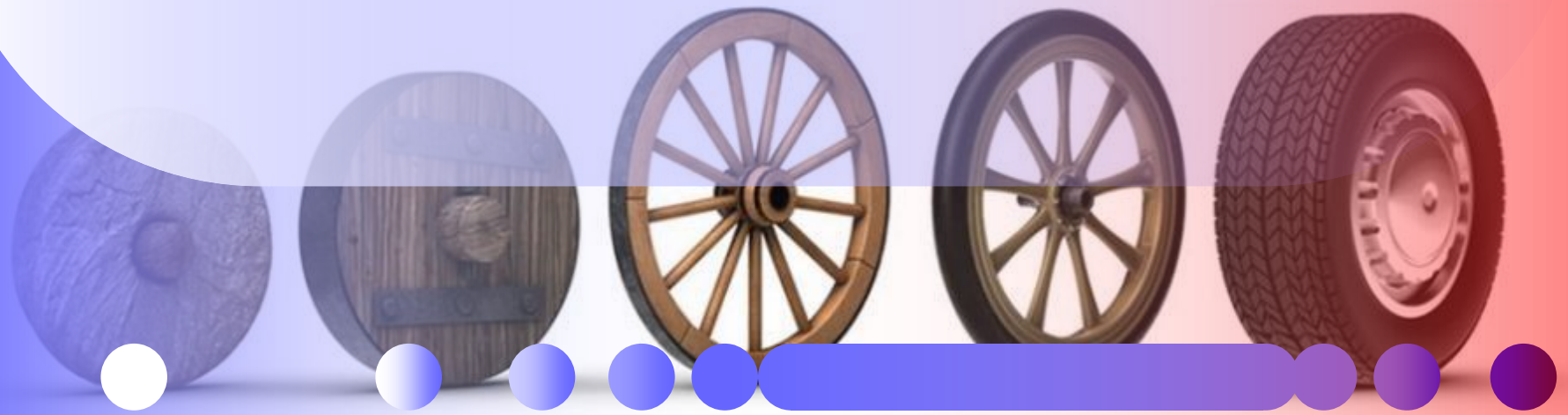
Key Factors Limiting Scaling-up

- Needs:
  - Resources,
  - Local Capacity: Implement / Develop / Absorb
- Naivety:
  - Political / Policy: actors / commitment
    - Vested Interests / "Sunk Costs"
- Physical Scale:
  - Time
  - Space / Geography

Arab Region:

- Efforts to "scale-up" successful technologies?
  - Large-Scale Projects
  - Small-Scale Projects
- Winning Techs / Locally relevant?
  - Where are they on the "innovation funnel"
- Local Risks of Dead-End?
  - Committed Investments
  - Regulations
- Key Regional Advantages
  - We know the limitations

Scaling-up Innovation



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Blockchain Forks