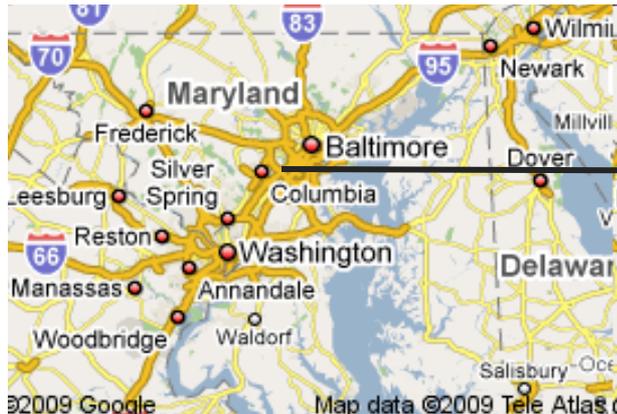# Technology Characterization, Technology Mind-Mapping and Value Proposition Towards Commercialization

Surya Raghu
Advanced Fluidics
& ET Cube International

WIPO EIE Project National Workshop 1
Bangkok, Thailand
June 12-16, 2017

About Me

Ph.D. Mechanical Engineering – Yale University
Academics – State University of New York, Stony Brook
Industrial Scientist – Automotive and Consumer Products
>20 inventions
14 patents
6 Products: Invention to commercialization
Entrepreneur: Started Advanced Fluidics (Small Company) in 2001

Training: ET^3 International (Non-Profit Organization)

About ET³ International and Advanced Fluidics

ET³ International

Entrepreneurship and Research Commercialization Training and Consulting

Advanced Fluidics LLC

Research and Product Development in

1. Aerospace Sciences – Aerodynamics, combustion
2. Micro/Nanofluidics/nanotech-based biosensors
3. Medical Instrumentation
4. Technology Roadmap Development and Training

Motivation

University researchers come up with many good ideas and invention disclosures….

Challenge for the TTO is to see how to evaluate and fit it into the big picture – identify who could be the potential buyers of the technology (Licensees).

Sometimes "mix-n-match" inventions for leveraging licensing ("solutions to problems" sell better than "technologies available")

Sometimes, feedback to inventors on possible directions for research

OUTLINE

Fitting the invention into a big picture

- Technology Road Maps
- Technology Mind Maps
- Technology Intersect Maps
- Technology Forecasting

Assessment and Feasibility Analysis
   (Filtering your ideas)

Conclusions

Practice exercise

Top 20 Inventions in each decade

1960s	1970s	1980s	1990s	2000s
■ software	■ microprocessor	■ eeprom	■ computer readab	■ bluetooth
■ read only memor	■ personal comput.	■ hard disk drive	■ world wide web	■ markup language..
■ laser beam	■ pixels	■ network lan	■ intranet	■ voip
■ liquid crystal ..	■ microcomputer	■ laptop	■ web page	■ information del..
■ memory ram	■ microprocessors	■ area network la..	■ web browser	■ storage area ne..
■ initialization	■ floppy disk	■ dna sequence	■ web site	■ instant messagi..
■ initialized	■ downloaded	■ monoclonal anti..	■ pcr amplificati..	■ removable non r..
■ memory rom	■ eprom	■ expression vect..	■ web server	■ session initiat..
■ only memory rom	■ eukaryotic	■ computer progra..	■ web pages	■ volatile nonvol..
■ silicon substra..	■ polyclonal	■ gene expression	■ bus usb	■ computing syste..
■ emitting diode	■ recombinant dna	■ transfected	■ pci bus	■ protocol wap
■ light emitting ..	■ performance liq..	■ polymerase chai.	■ pcr product	■ xml file
■ data bus	■ reactive ion et..	■ polymerase chai.	■ pcr products	■ protocol voip
■ laser light	■ microprocessor ..	■ dna sequences	■ polishing cmp	■ internet protoc..
■ data communicat	■ affinity chroma..	■ monoclonal anti..	■ interface gui	■ nonvolatile mag..
■ ion implantatio..	■ sepharose	■ codon	■ user interface ..	■ mp3 player
■ light emitting ..	■ diode led	■ genomic dna	■ mechanical poli..	■ nonvolatile opt..
■ glass transitio..	■ emitting diode ..	■ sequence encodi	■ internet servic..	■ mp3 players
■ initialize	■ communication p	■ gene encoding	■ pcr reaction	■ initiation prot..
■ mosfet	■ restriction enz..	■ expression vect..	■ jpeg	■ pci express

■ Chemical   ■ Computers & Communications   ■ Drugs & Medical   ■ Electrical & Electronics   ■ Mechanical   ■ Others

Field/Subject Matter of Invention

Chemistry
Physics
Electronics
Engineering   - Mechanical/Electrical/Civil/Chemical…..
Biotech
Agritech
BioMedical
Others???

Related Industry?

Agriculture

Aquaculture

Automotive

Bio-Instrumentation

Aerospace

Consumer Electronics

Healthcare

Others??

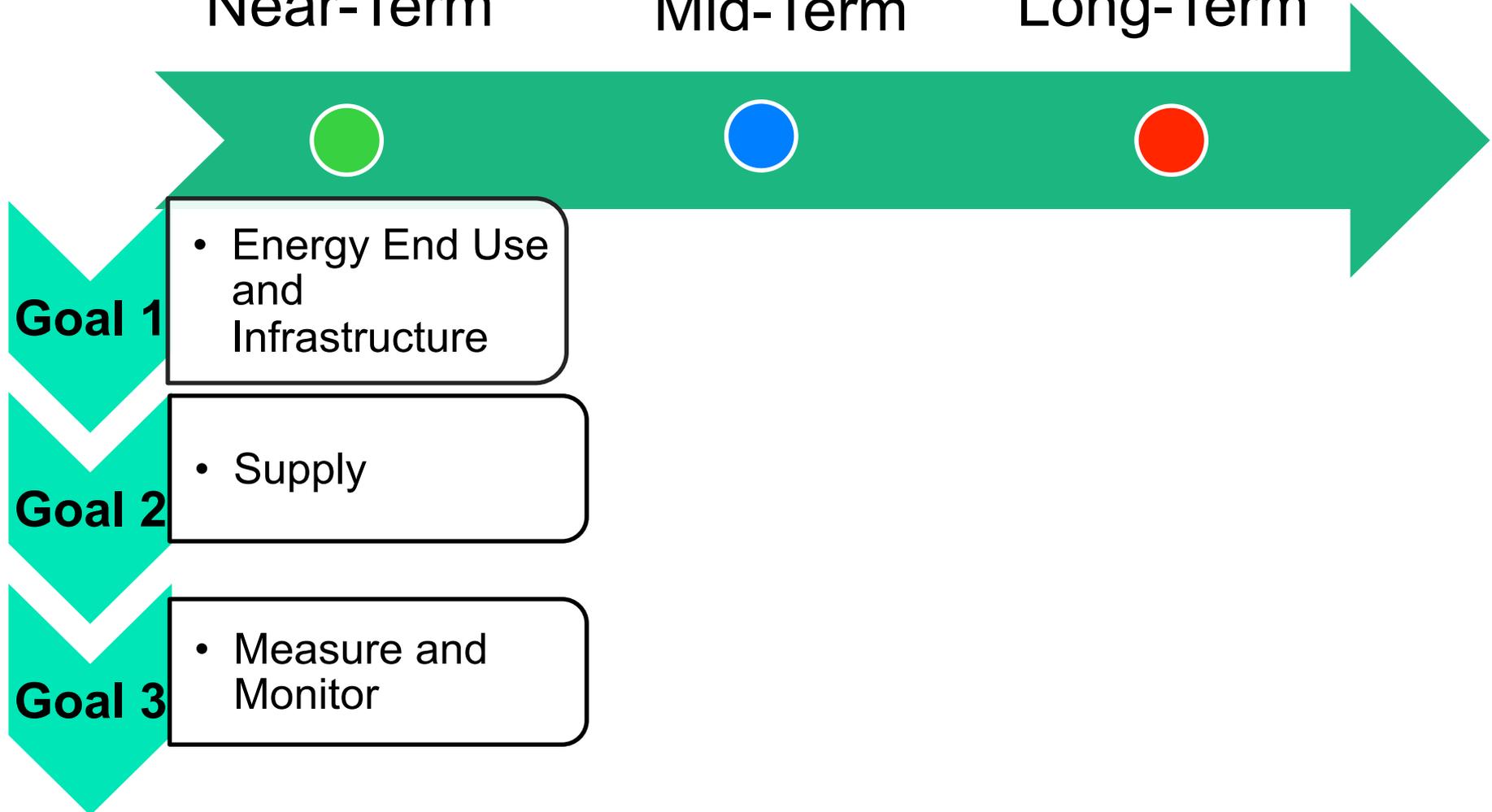By show of hands – what is the majority of inventions in your Universities?

Technology Roadmap

Shows where the invention fits in the "big picture"

Technology Road Map –Climate Change

Near-Term   Mid-Term   Long-Term

Goal 1
- Energy End Use and Infrastructure

Goal 2
- Supply

Goal 3
- Measure and Monitor

Technology Road Map

ET International

Near-Term   Mid-Term   Long-Term

GOAL 1
Energy End Use and Infrastructure

Near-Term
- Hybrid Vehicles
- Plug-ins
- Hi-Performance integrated homes
- High-efficiency appliances
- High-efficiency boilers and combustion systems
- High-temperature superconductivity demonstrations

Mid-Term
- Fuel cell vehicles and hydrogen fuels
- Low emission aircraft
- Solid-State lighting
- Ultra-efficient HVACR
- Smart buildings
- Transformational technologies for energy-intensive industries
- Energy storage for load leveling

Long-Term
- Widespread use of engineered urban design and regional planning
- Energy managed communities
- Integration of industrial heat, power, process and techniques
- Superconducting transmission and equipment

Your invention?

Technology Road Map

Near-Term **Mid-Term** **Long-Term**

GOAL 4
Capture, storage and sequestration

- Post-combustion capture
- Oxy-fuel combustion
- Enhanced Hydrocarbon recovery
- Geologic reservoir characterization
- Soils Conservation

- Geologic storage proven safe
- CO_2 transport infrastructure
- Soils uptake and land use
- Ocean CO_2 biological impacts

- Track-record of successful CO_2 storage experience
- Large-scale sequestration
- Carbon and CO_2-based materials
- Safe long-term ocean storage

Your invention?
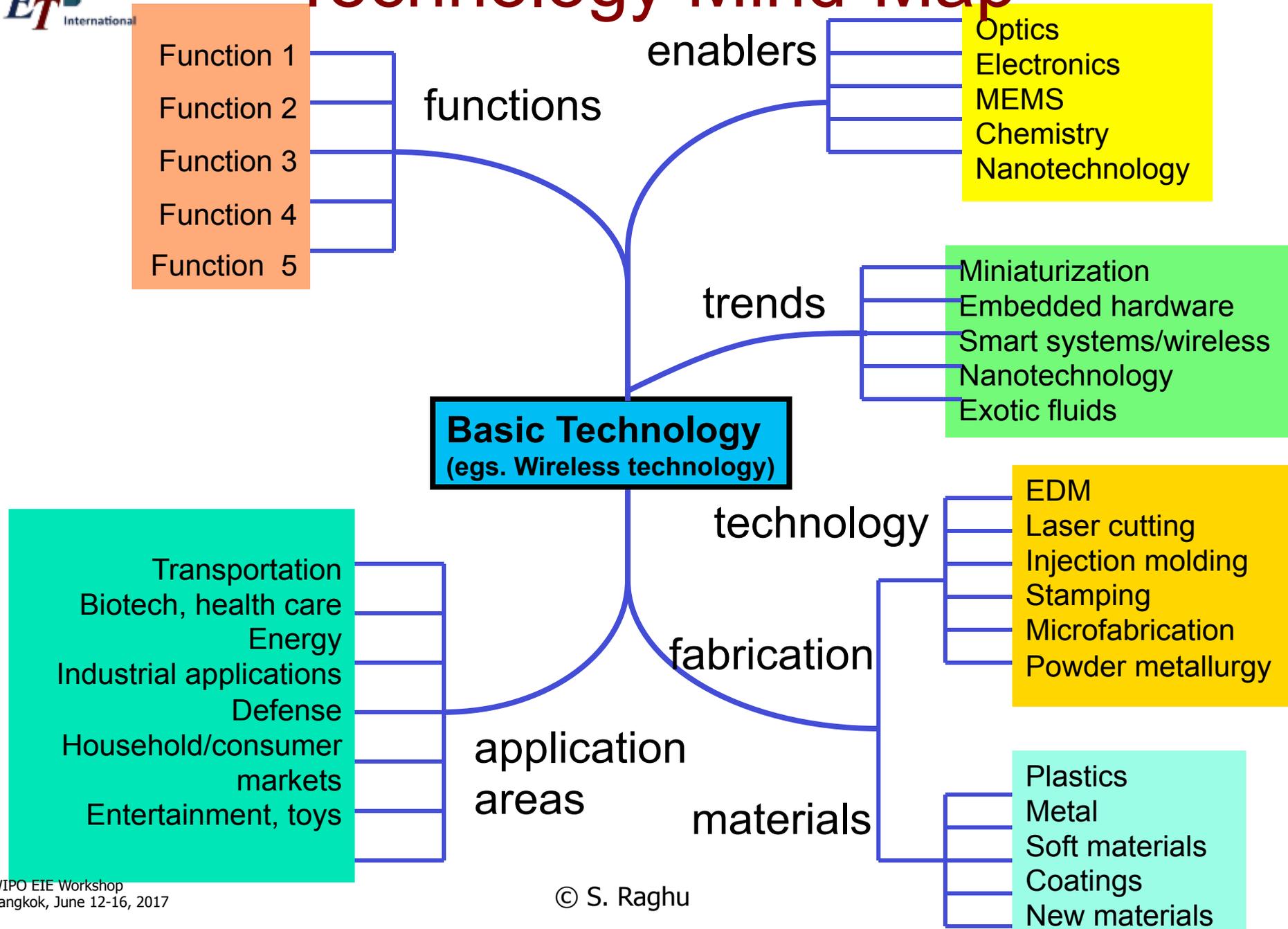
Technology Roadmaps in Thailand?

Healthcare?
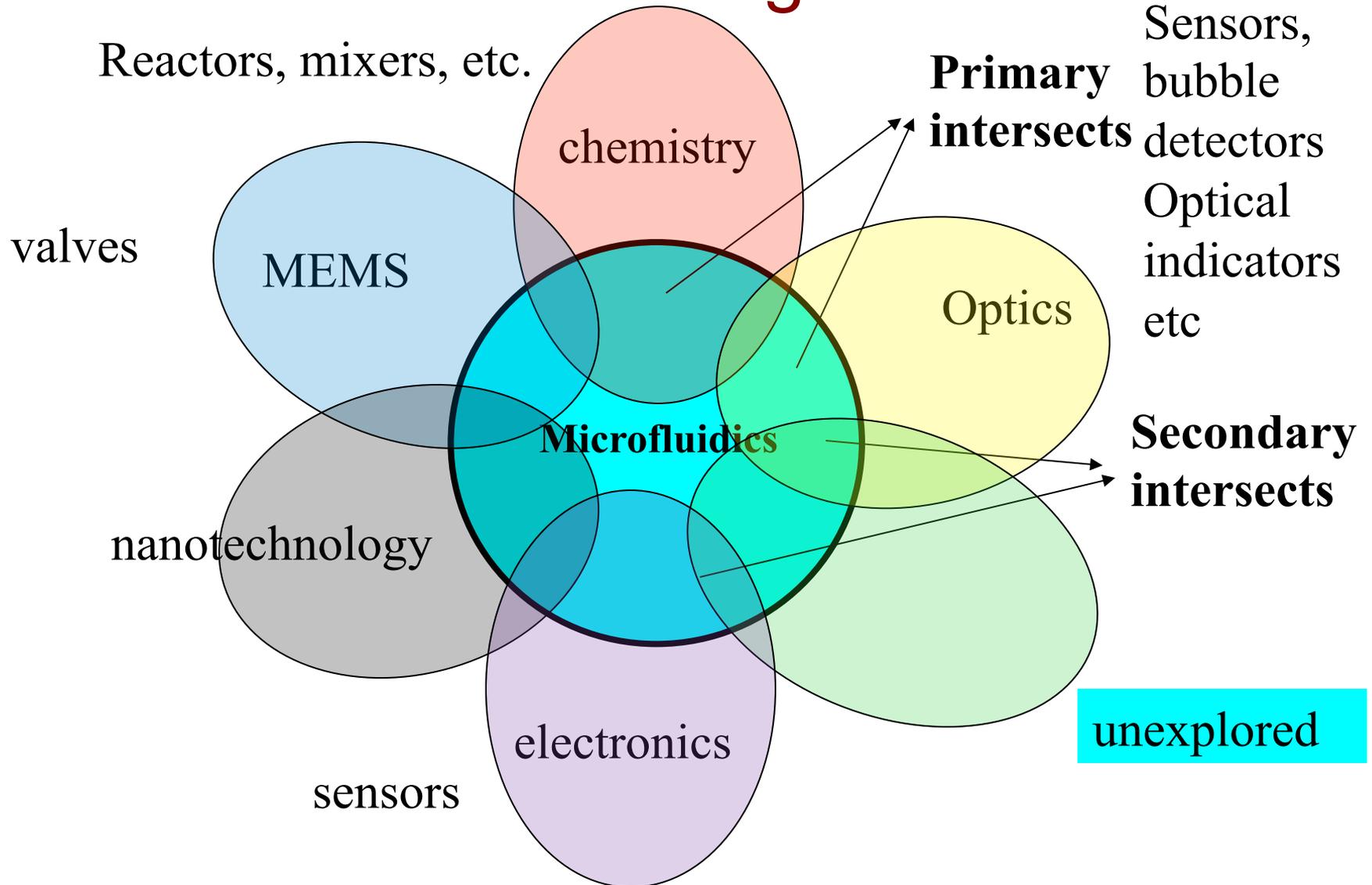Energy?
Water and Sanitation?
Agriculture?
Aquaculture
Food Security?

Technology Mind-Map

ET International

functions
- Function 1
- Function 2
- Function 3
- Function 4
- Function 5

enablers
- Optics
- Electronics
- MEMS
- Chemistry
- Nanotechnology

trends
- Miniaturization
- Embedded hardware
- Smart systems/wireless
- Nanotechnology
- Exotic fluids

Basic Technology
(egs. Wireless technology)

technology

fabrication
- EDM
- Laser cutting
- Injection molding
- Stamping
- Microfabrication
- Powder metallurgy

application areas
- Transportation
- Biotech, health care
- Energy
- Industrial applications
- Defense
- Household/consumer markets
- Entertainment, toys

materials
- Plastics
- Metal
- Soft materials
- Coatings
- New materials

© S. Raghu

Technology Intersects with Emerging Technologies

Reactors, mixers, etc.

Sensors, bubble detectors

Primary intersects

chemistry

valves

MEMS

Optics

Optical indicators etc

Microfluidics

nanotechnology

Secondary intersects

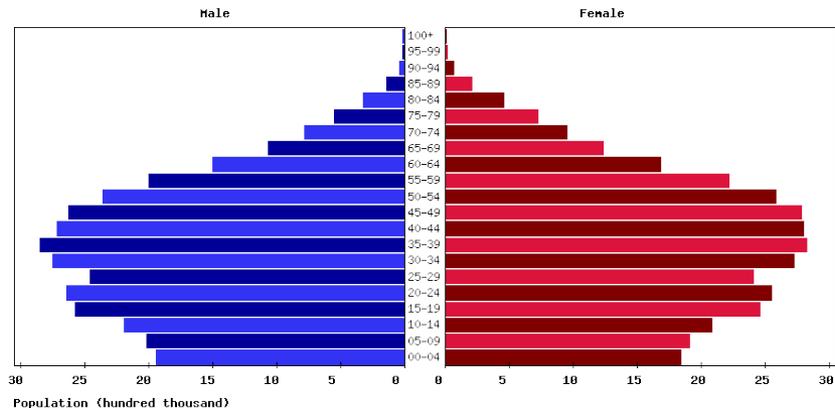electronics

sensors

unexplored

© S. Raghu

Technology Forecasting

Points to consider for forecasting

- Observing/Studying Trends (weak signals in high noise)
- Economic factors
- Societal factors
- Technological Advances
- Political Action/Regulatory statutes
- Disruptive Market Models

Technology Forecasting

Male   Female

Population (hundred thousand)

68.47M

Micro-sensors

Health Monitoring

Generation-3 Internet

24-hour medical care

HEALTH CARE CAN'T WAIT!

http://www.i-micronews.com/

Infrastructure Health Monitoring

Drones

Wireless
Sensors

Continuous
Monitoring

Generation-3
Internet
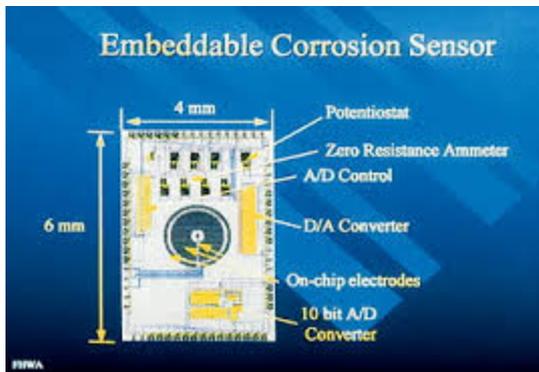
4 Different Methods of Finding Opportunities

Next……

Assessing the Idea

Assessing the idea

Technology feasible?
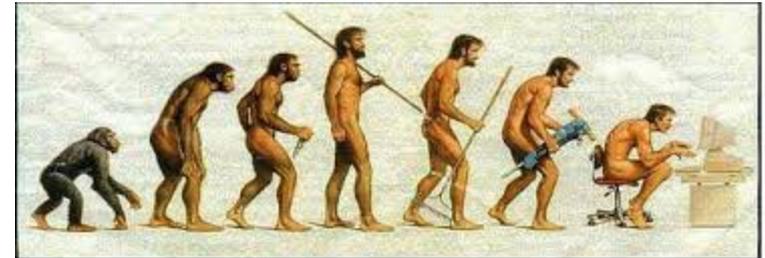(Unique vs. Advantageous)

Is there a market?

Is there a business opportunity?

Technology Impact Evaluation

1. **Effects on Society**
   Intended, unintended, direct, indirect, delayed consequences

2. **Detect, control and direct technological changes**
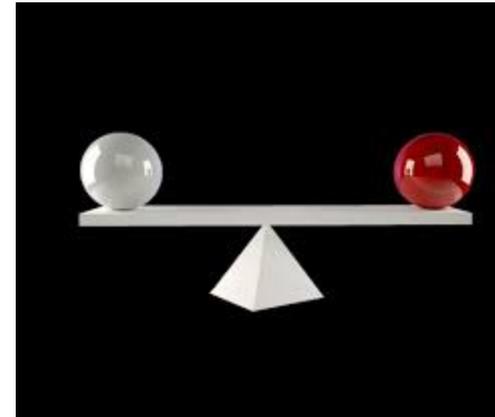   so as to maximize public good and minimize public risks

3. **Evaluate alternative technologies?**
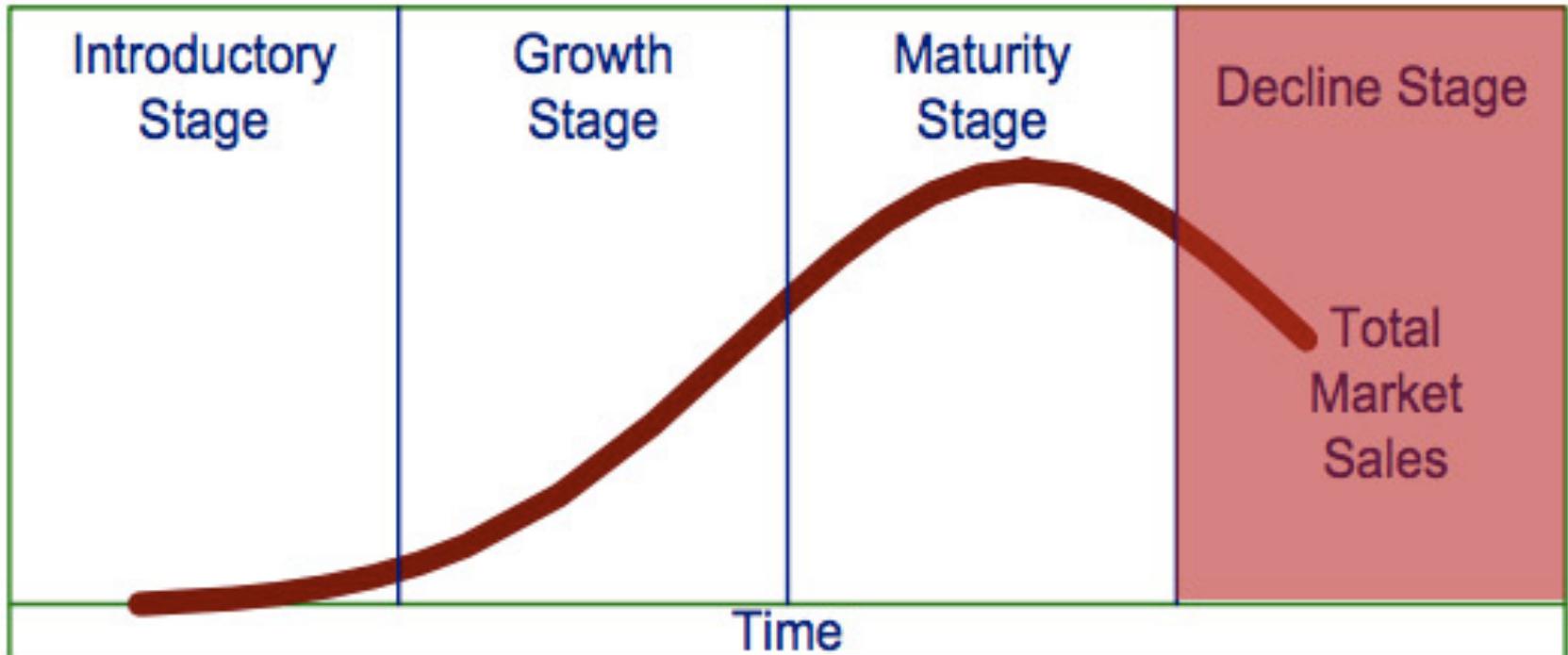
Technology Benchmarking

Compare to "Gold Standard"?

Compare to competition?

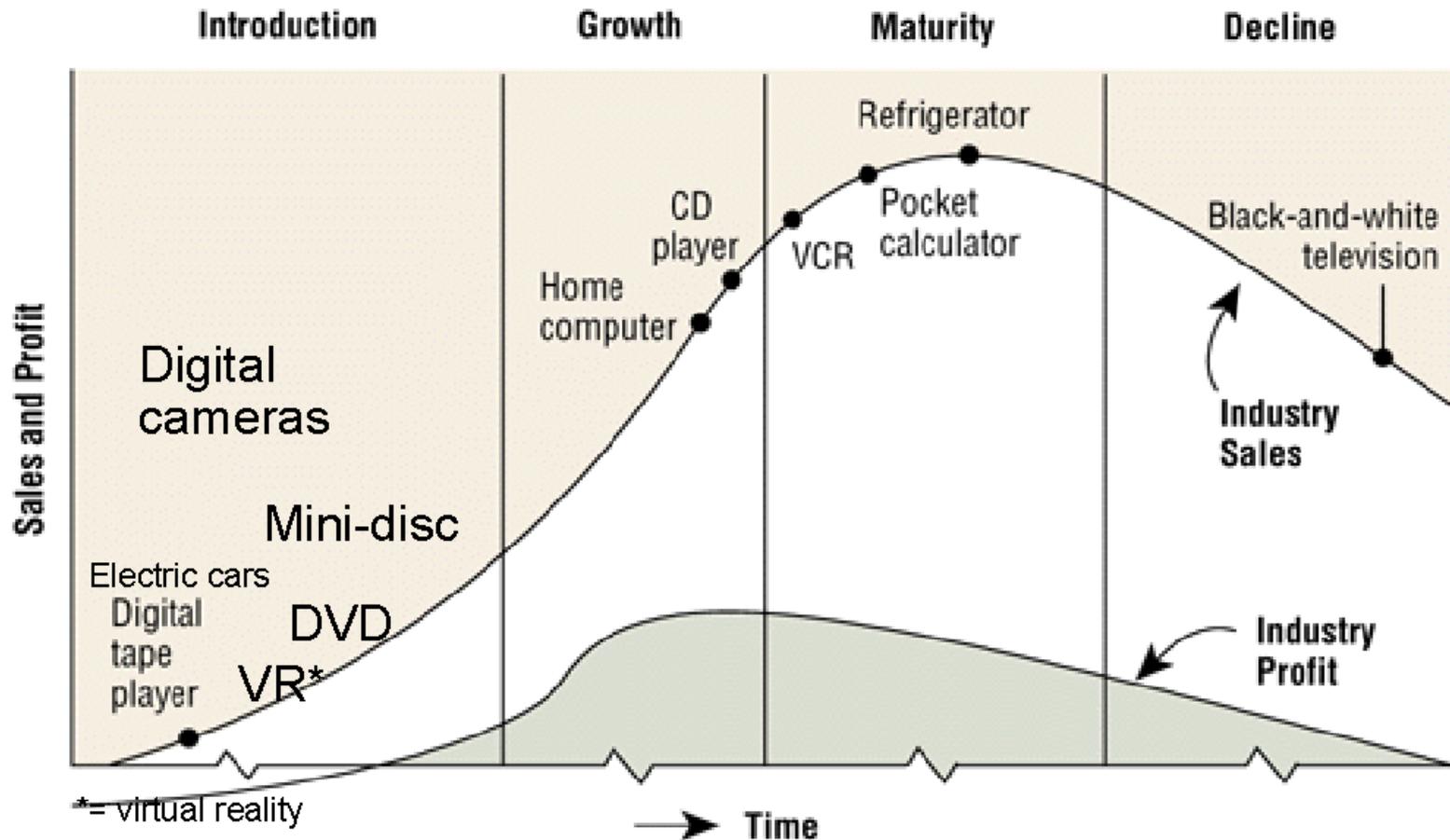Measure, compare, diagnose, improve and optimize
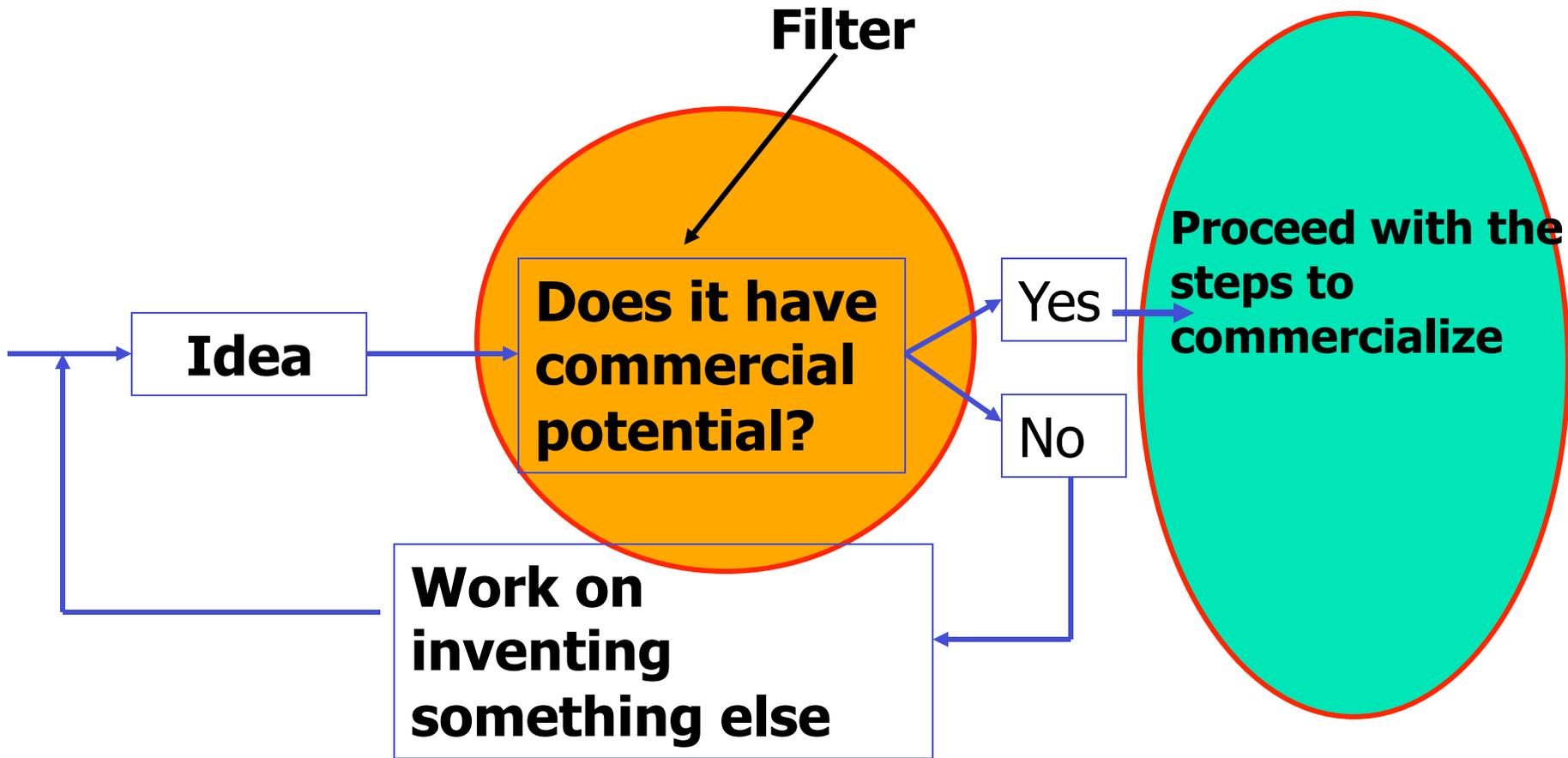
Technology Life Cycle Analysis

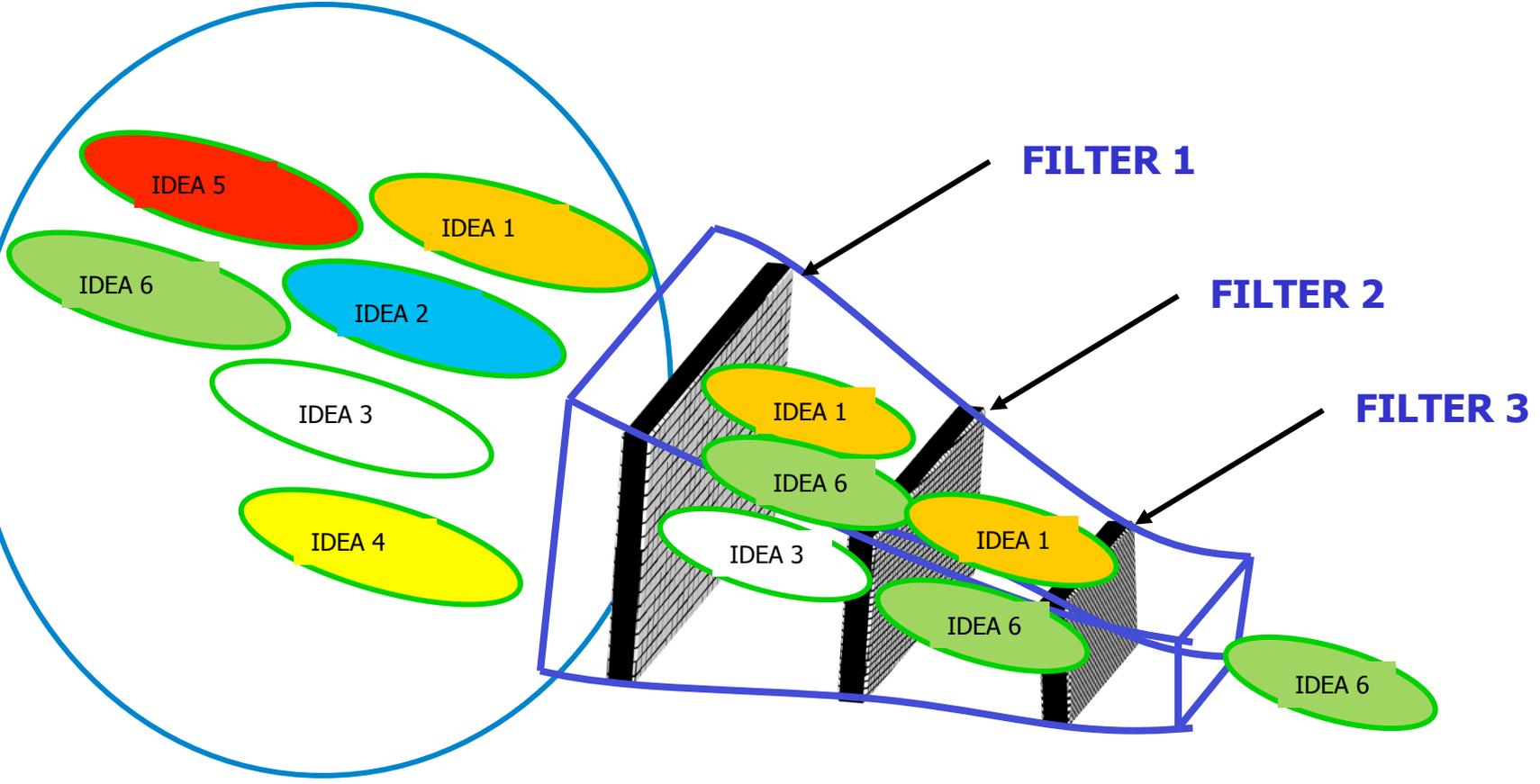https://figures.boundless.com/12987/large/-11-03-20at-209.43.18-20am.jpe

Stages in the Product Life Cycle

Stages in the Product Life Cycle diagram showing Introduction, Growth, Maturity, and Decline phases plotted on axes of Sales and Profit versus Time. Products labeled include: Digital cameras, Mini-disc, Electric cars, Digital tape player, DVD, VR, Home computer, CD player, VCR, Pocket calculator, Refrigerator, and Black-and-white television. Curves for Industry Sales and Industry Profit are shown. *= virtual reality*

Filtering the Ideas

Filtering of Technical Ideas

FILTER 1

FILTER 2

FILTER 3

IDEA 5

IDEA 1

IDEA 6

IDEA 2

IDEA 3

IDEA 4

IDEA 1

IDEA 6

IDEA 3

IDEA 1

IDEA 6

IDEA 6

Filters

Filters: Can be used to sort out feasible ideas right at the very beginning.

Examples of filters:

1. Market Opportunity and Market Attractiveness
2. Who has the right background to take this invention to a product
3. Sustainability of market (seasonal or year-round), time scales of sustainability of market interest and technology. Give examples
4. Regional and international competition

What are the other factors that can be used as filters?

Value Proposition

What is the pain?

What is your solution?

       Pain Killer?

       Cure?

What is the cost?

Summary

- Inventions can be matched with markets based on:

    Technology Forecasting

    Technology mapping (Roadmaps,

     Mind-map, Intersects)

- Assessment and Feasibility analysis

     Filtering your ideas

Group Work

1. Get back to your groups

2. Sketch a road map for any of the technologies in which you have received invention disclosures for 5, 10 and 20 years time scale
OR
A mindmap for any of the inventions you have received

3. Random/volunteer groups to present it to the class

20 minutes time

THANK YOU

Questions?