EEE 452: Engineering Economics and Management

…how ideas in leveraging EEC technology possibilities for getting jobs done better are being formed and shaped in a competitive market into eocnomic value or waste…

Lec 1: Purpose of Studing Electrical and Computer Engineering

Faculty: Dr. Rokonuzzaman

m.rokonuzzaman@northsouth.edu; https://www.the-waves.org/

Why do you study STEM?

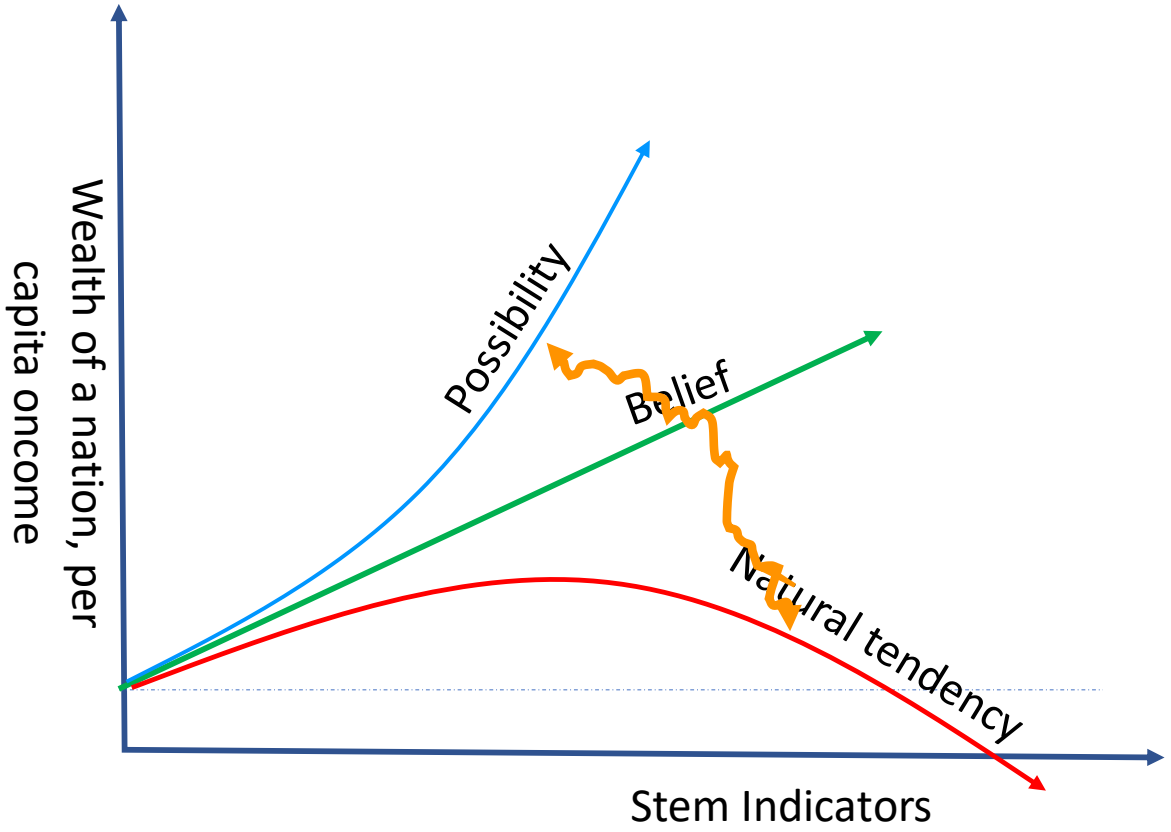
Science, Technology, Engineering and Mathematics

STEM

- Science
- Technology
- Engineering
- Mathematics

STEM Indicators

- Graduates
- Degrees
- Publications
- Patents
- R&D investment



Belief:

Higher the value of STEM indicators more the prosperity.

What is the reality?

Natural tendency: a concave down curve

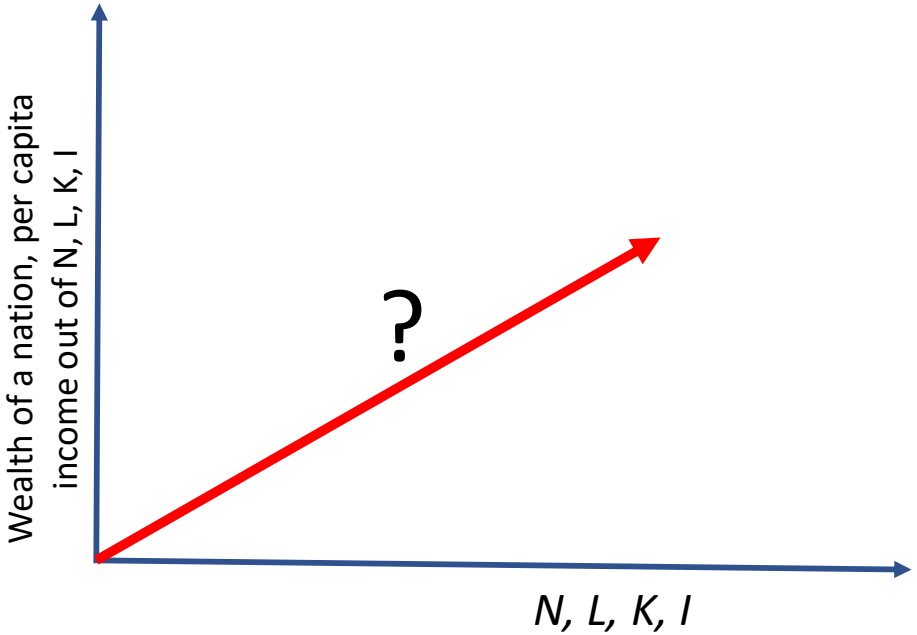
Possibility: Exponential growth

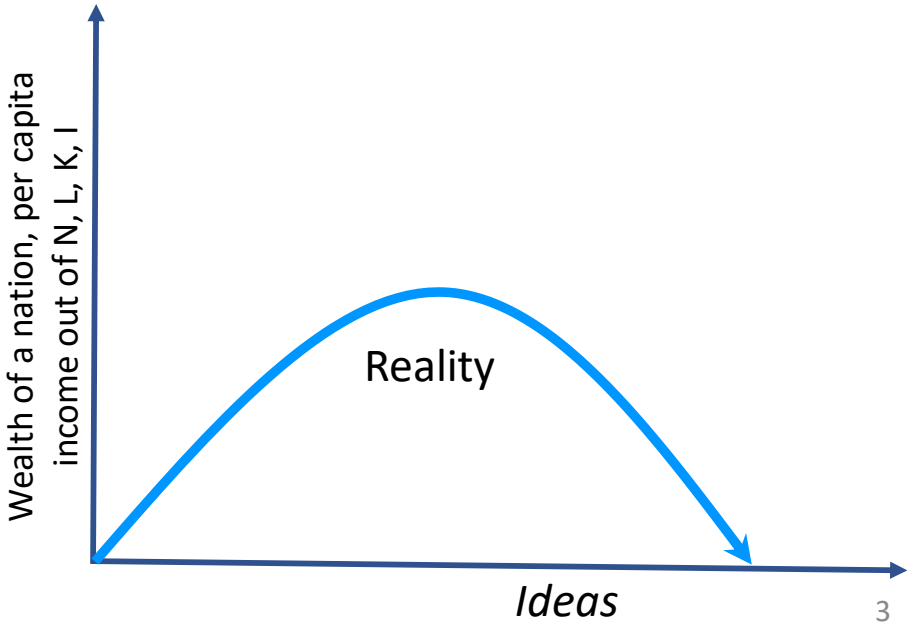
Sources of Wealth:

- Natural resources: N
- Labor: L
- Knowledge: K
- Ideas: I

Wealth==F(N, L, K, I)

Are they linearly correlated?





Why did it grow to it?

Why did it suceed to build automobile industry and Diamler-Benz

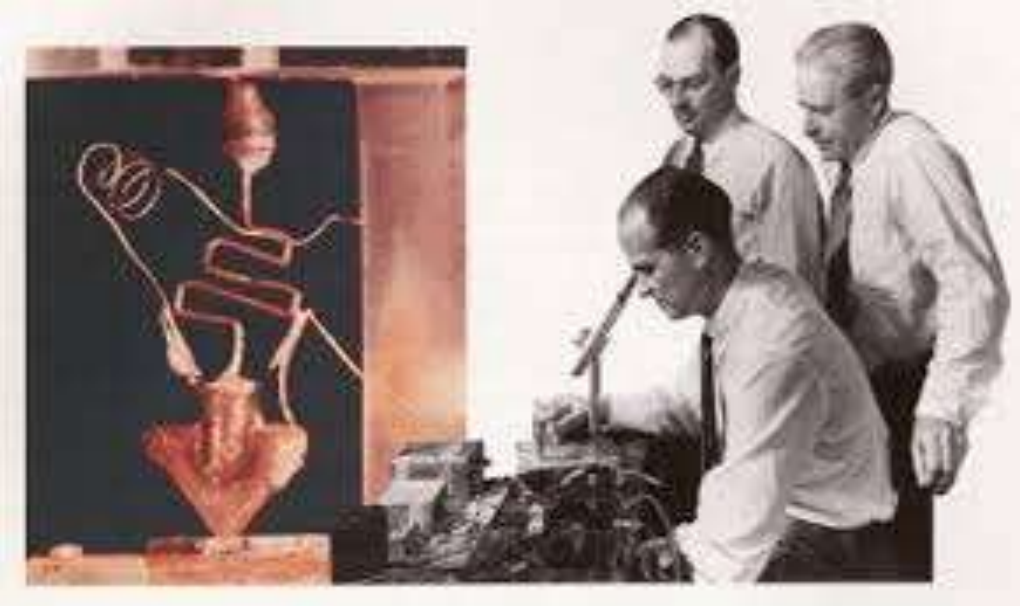
Why did it fail?

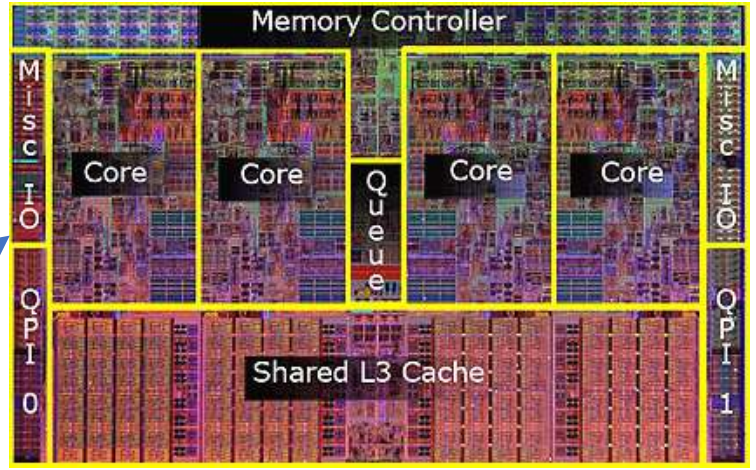
Why do some innovations keep growing, crearting prosperity?

How do the market of innovations keep growing?

Why did not Bangladesh's Rickshaw or Mishuk grow as mega success stories?

How did it get invented and grow?





What was the driving force of the invention of the Transistor?

What is the underlying science of creating Moore's law?

Why was there a growing demand for increasing chip density?

Why is not invention good enough for wealth creation?

How do inventions grow and support innovations?

Why has the centre of excellence of Transistor been migrating?

Electrical and Computer Enginering:

Is it just to know physics, maths, technology, and programming?

Do you like to be paid for the comptence you have been acquiring?

How are science, technology, innovation and weal creation correlated?

What is the role of market in growing ideas?

Why should people recuit STEM graduates?

Human beings are driven by economic incentives

We all are after money?

How to make money out of ECE?

Why should people pay for ECE competence?

Is there a natural correlation between wealth creation and ECE competence?

Understanding wealth creation dynamocs out of ECE comptence in a competitive market is the goal of EEE 452.

Why people buy products?

To get jobs done

Relentles Journey:

To get jobs done better at less cost, while creating more comfort. And the list of getting jobs done keeps growing.

Consumers are looking for better products at lower price—is it conflicting?

Perceived value should be more than the dollar to spend—and it varies; how to what customers are asking for?

Why should producers produce them?

How?
Higher quality products at lower cost

What does make the difference?

How?

Ideas?

Through ideas of products and processes to make them

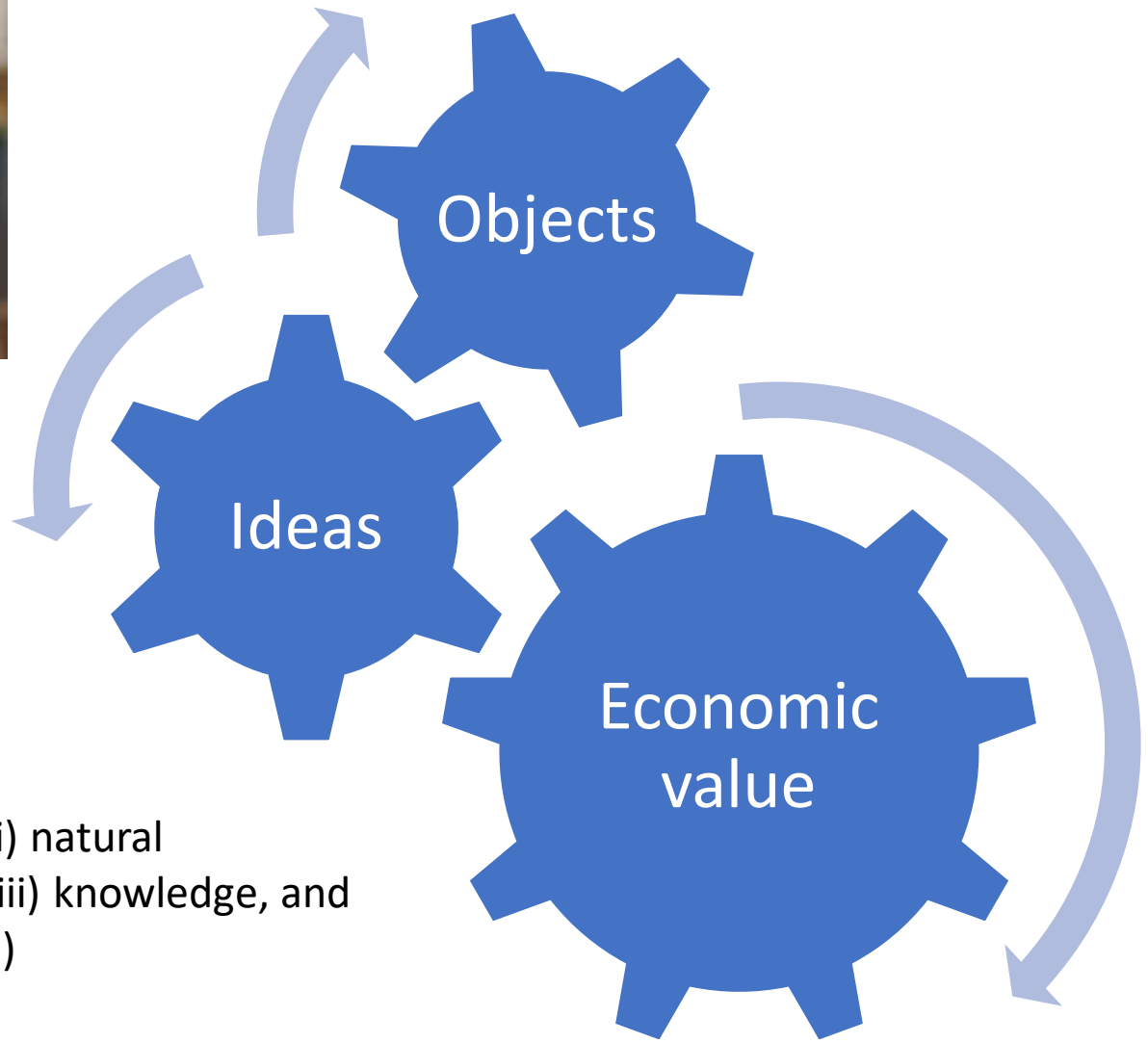
Where is knowledge for generating and implementing ideas?

Generate and add ideas from ECE knowledge for generating more value than cost

For making products better as well as cheaper

To generate more value from a dollar, for both consumers and producers

Paul M. Romer



Economic outputs depend on ideas and objects.

$$O=f(A,X)$$

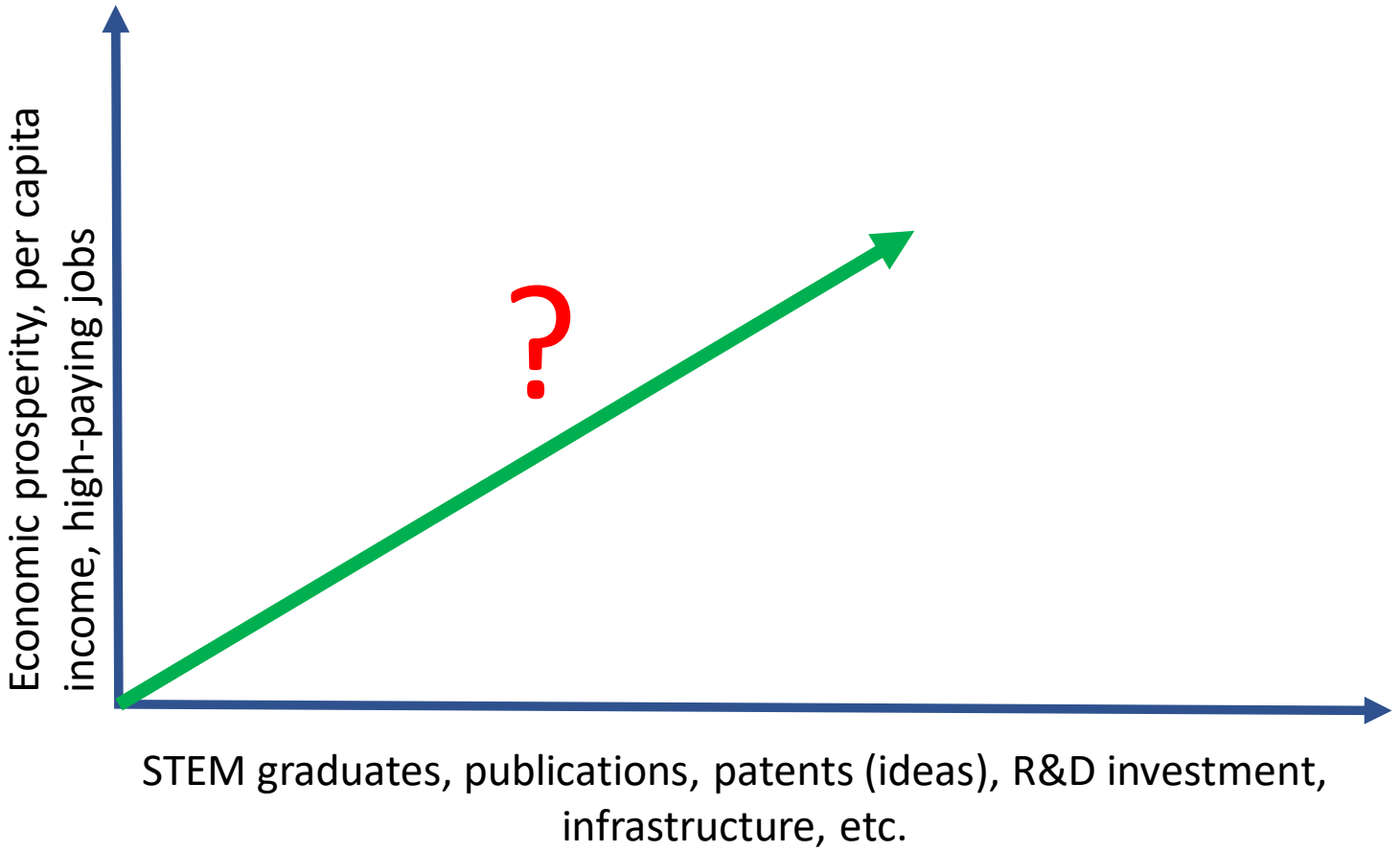
X=natural resource, labor,…
A: Ideas

ECE is a major source of ideas

Is there a natural correlation between ideas and economic output?

Wealth depends on (i) natural resources, (ii) labor, (iii) knowledge, and (iv) ideas. Y=F(K, L, H)
Y=MA

Does it mean like this?



Made In Bangladesh Vision
https://thefinancialexpress.com.bd/views/reviews/made-in-bangladesh-vision-1623250458

Ideas cause creative destruction

- Core strength of free market economy
- Profit making firms pursue ideas for offering better products at lower cost
- Ideas fuel economic innovation and the business cycle.
- known as **Schumpeter's gale**
- How to get ideas and transforma them into economic value ?

Schumpeter wrote that “creative destruction [is] [t]he process of industrial mutation that incessantly revolutionizes the economic structure from within, incessantly destroying the old one, incessantly creating a new one. This process of creative destruction is the essential fact about capitalism. It is what capitalism consists in and what every capitalist concern has got to live in.

Seeded Marxian economic theory

- The concept to refers more broadly to the linked processes of the accumulation and annihilation of wealth under capitalism.
- Marx uses the term "praxis" to refer to the free, universal, creative and self-creative activity through which man creates and changes his historical world and himself. changes
- Praxis is an activity unique to man, which distinguishes him from all other beings. The concept appears in two of Marx's early works: the Economic and Philosophical Manuscripts of 1844 and the Theses on Feuerbach (1845)
- Ideas power creative destruction to make it happen
- What happen to employees and shareholders of Kodak, Nokia or Digital Equipment Corporation?

Basic Principles:

1. Ownership of capital
2. Ownership of ideas
3. Freedom to profit from ideas, offering us increasingly better alternative means to get jobs done better
4. Promoting entrepreneurship
5. Ensuring fair competition
6. Patronizing science, technology and engineering

Suceesive versions are requireing less objects, but more ideas—better as well as cheaper

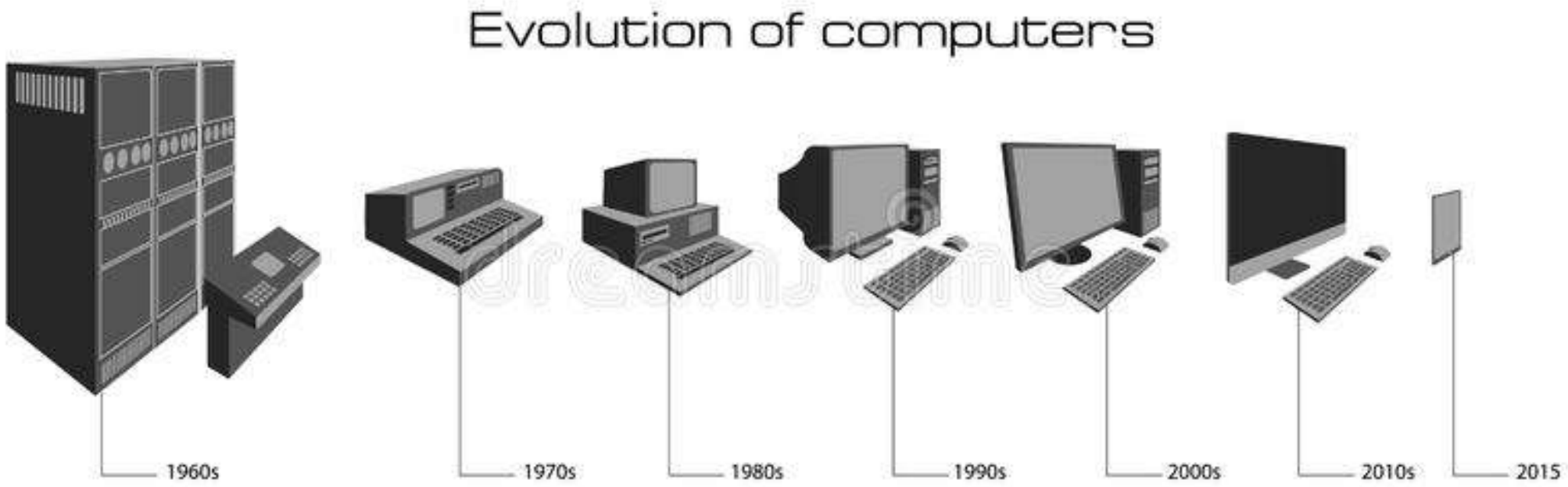
How has the telephone been evolving?

Are there roles of change of technology cores?

What is the role of incremental innovation?

Are inventors still at the helm of telephone innovations?

It it getting better and cheaper? How?



"I think **there is a world market for maybe five computers**." -- Thomas Watson, chairman of IBM, 1943.
"Where a calculator on the ENIAC is equipped with 18,000 vacuum tubes and weighs 30 tons, computers in the future may have only 1,000 vacuum tubes and weigh only 1.5 tons." -- Popular Mechanics, 1949.

Why was he wrong?

"No one will need more than 637KB of memory for a personal computer. 640KB ought to be enough for anybody," Bill Gates is alleged to have said in 1981.

Why was he wrong?

Creative spark emerged as 750lb machine (triggered by accidental observation), at a price tag of $5000!

How does it help in getting jobs done better?

Who were the buyers?

Why didn’t the Eureka produce profitable revenue?

How did it become smaller, better and less costly?

What is its implications on diffusion?

Is there a role of flow of ideas?

In the absence of it, what could have been implication of microwave oven innovation on economic value creation?

Where is the Challenge?

1. Knowing existing body of knowledge of ECE
2. Acuqiring the capability of advncing ECE knowledge
3. Developing **ideas** based on ECE knowledge for redesigning existing products and processes for imporving the quality and redcuing the cost, and innovating new ones
4. More importantly, we need to **trade those ideas** in a globally competitive Market for generating **profitable** revenue

Evolution progresses in episodic manner—creating uncertainties

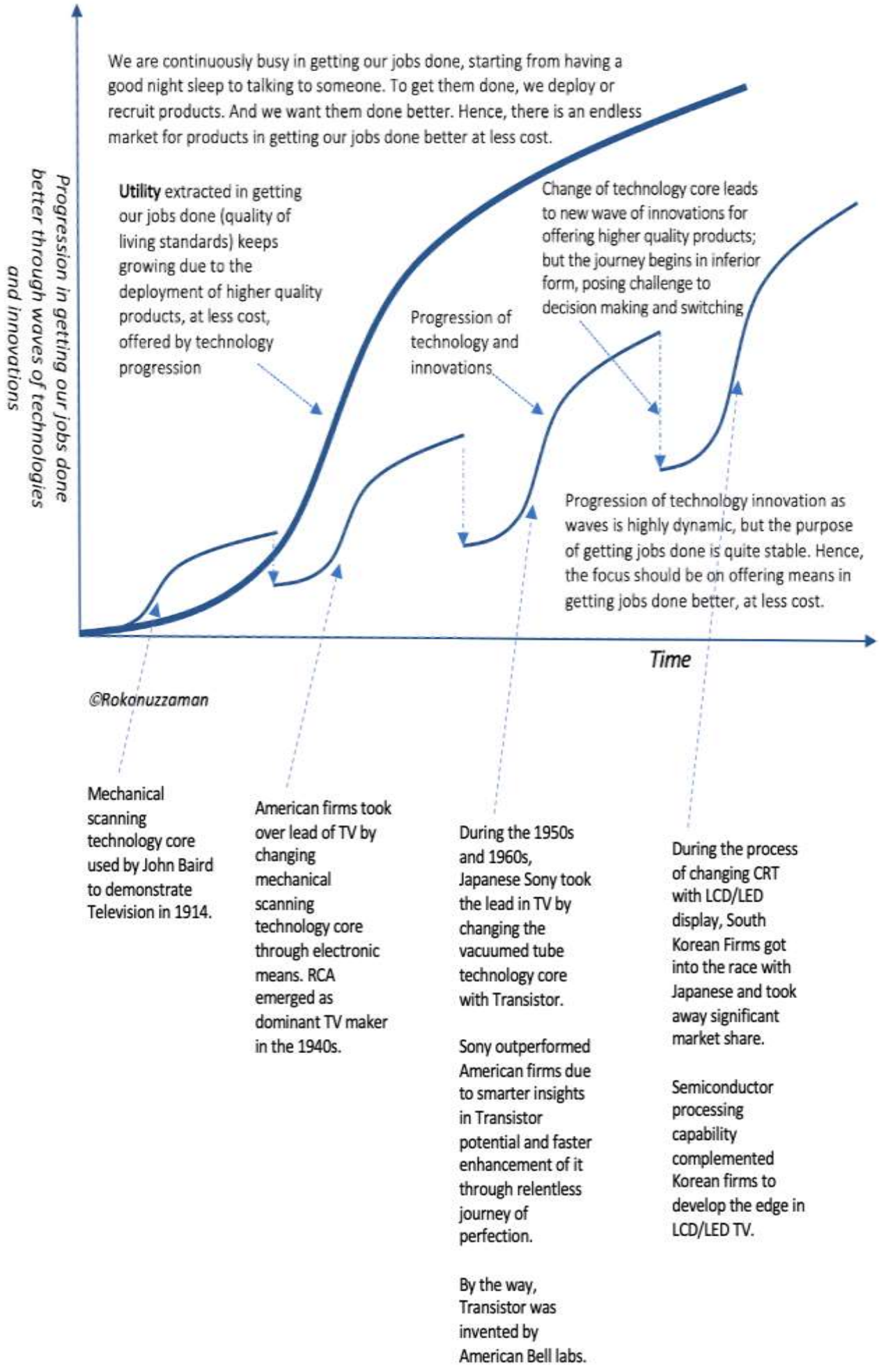
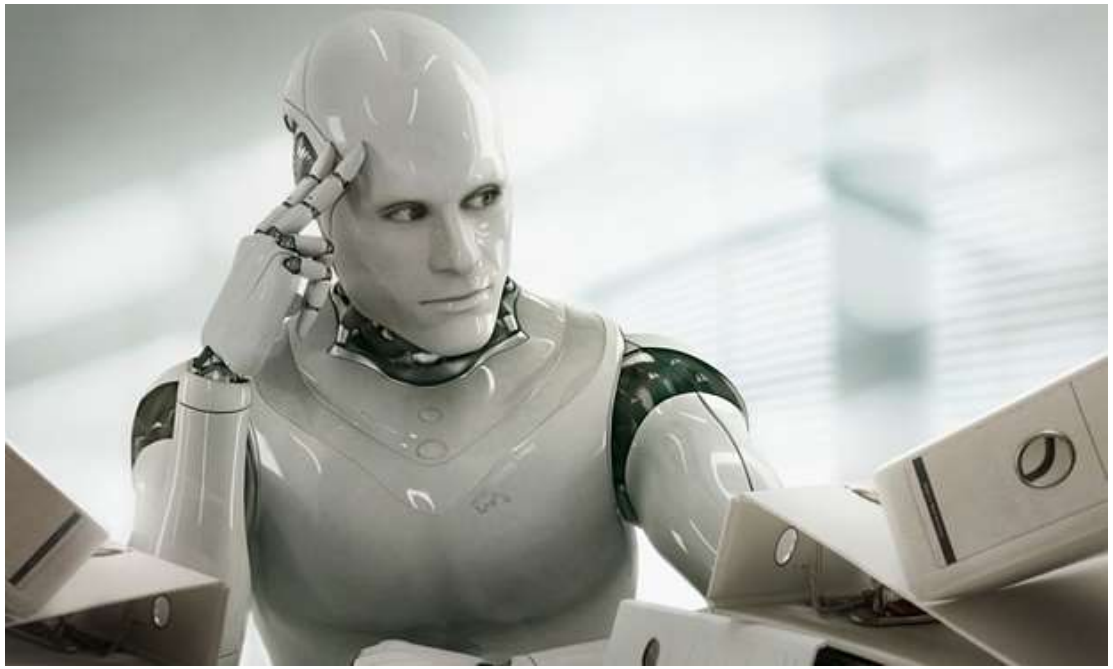


Figure 2: Episodic model of growth of inventions through a series of technology changes—explained further with the example of the evolution of television.



- If ECE ideas are so valuable in crearting wealth in market eocnomy, why are ECE graduates in Bangladesh failing to get quality jobs?
- Should we slow down the supply?
- How to create the demand for ECE graduates?
- Well, why do we care about it?

Sources of wealth: (i) Natural resource, (ii) labor, (iii) knowledge, (iv) ideas.

Idea Economy--Lesson from Philips and Ericsson

- Philips and Ericsson generating approximately $25 billion per year each are European economic powerhouses.
- Each of them has created 100,000 jobs; 5% of them are in R&D for generating ideas
- How are they fuelling this revenue generation?

1. The most powerful production input is patent--ideas for redesign and innovation.
2. These patents are combining all other inputs to produce the revenue.
3. For example, Philips has over 79,000 patents to fuel its MedTech and Electronics business.
4. With 54,000 patents, Ericsson is a dominant telecom equipment maker.

- In absence of these patents, and the ability of continuously adding additional ones every month, neither infrastructure, factories, logistics, nor other inputs are going to keep these two companies afloat in producing economic outputs, paying salaries to over 100,000 employees of each of them, dividend to their shareholders, and taxes to the Governments .

Although idea generation, consequentially claiming patent, is an inherent capability of humans, making them superior to all other living creatures, not every country equally benefits from it. As a matter of fact, growing gap in this capability is increasing inequality among firms and countries.

It's time for developing countries to focus on the economic output creation capability out of ideas--consequentially building **idea economy.**

- How important to create the idea economy?
- What is the fuel of idea economy?
- ECE is a major source of ideas for creating idea economy

Hardly people understand its importance…

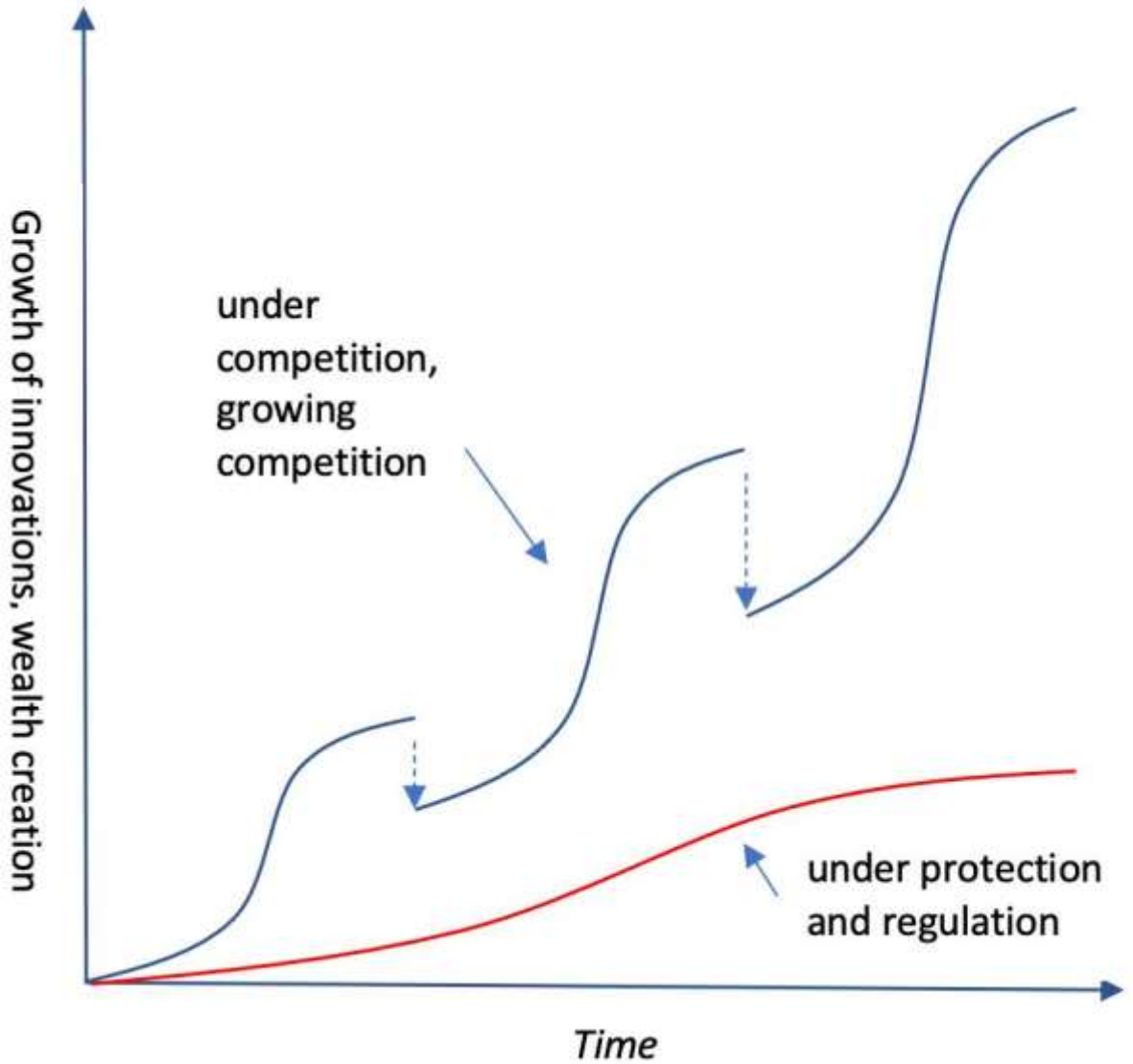
Even ECE stduents do not pay attention to it, let alone be serious


WELCOME TO
THE IDEA
ECONOMY.
What will you think of next?

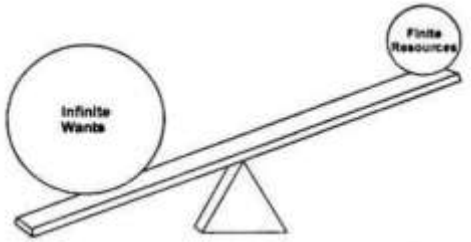
Creating Economic Value Out of ECE:

- ECE graduates can apply their ECE competence through three primary means: i. providing ECE technology selection, procurement, installation, integration, testing, operating and maintenance services, ii. conceiving, designing, constructing, testing, and commissioning customized ECE solutions, and iii. innovating ECE idea based products and processes.
- However, first two options have been eroding. But the third one has been growing, as it keeps expanding the door of offering higher quality alternatives at a decreasing cost—primarily due to the increasing role of ECE ideas.
- One of the major challenges in creating economic value out of ECE is to succeed in trading ECE ideas in the globally connected competitive market at profit.
- EEE 452 focuses on the nature of purposes, products, ideas, and market, and how to deal with them in taking ECE ideas to market at profit.

Why market?


Growth of innovations, wealth creation
under competition, growing competition
under protection and regulation
Time

What is Engineering Economics and Management (EEM)?



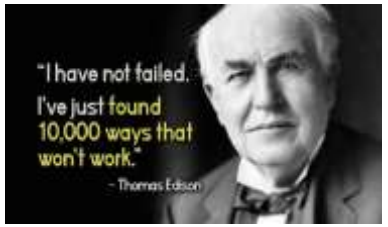
Economics deals with the science of optimum allocation of scarce resources—for maximizing welfare.

And **innovation** is the heroic art of Genius—a magical act. It is about getting jobs don better out of ideas.

Inventions—creative sparks in the mind of genius.

Innovation success —heroic act of a magical personality in making enormous amount of money (wealth) out of ideas.

Engineering is the use of scientific principles to design and build machines through optimum allocation of resources; cost-effective technology solution of an economic problem (how to make the best use of limited, or scarce resources).



Science is about identifying variables and establishing quantitative (or at least, logically very strong) relations among them to interpret and scale up art. **Technology** is about intentional manipulation of those variables to invent or advance means for getting jobs done better.

Economics is the branch of knowledge concerned with the production, consumption, and transfer of wealth.

Scarcity as an economic concept "... refers to the basic fact of life that there exists only a finite amount of human and nonhuman resources which the best technical knowledge is capable of using to produce only limited maximum amounts of each economic good. ”

Urgence: *replace the allocation of scarce goods among competing demands and heroic art of innovation by the science of infinite wealth creation out of scarce resources—so that we keep producing more with less*

Engineering Economics and Management focuses on interpreting technology led wealth creation dynamics as reoccurring patterns for scaling up invention & innovation art of economic value creation out of ideas with science, engineering and management practices—for endlessly expanding reservoir of wealth from scarce resources.

The WAVES: https://www.the-waves.org/2020/07/06/engineering-economics-for-innovation-economy/