

CREATIVITY AND INNOVATION IN RESEARCH AND DEVELOPMENT OF SCIENTIFIC DISCOVERIES AND NEW PRODUCTS

**INTERNATIONAL JEAN MONNET SUMMER SCHOOL and ROUND TABLE DEBATE
EUROPEAN GREEN DEAL AND THE CIRCULAR ECONOMY:
CHALLENGES FOR UKRAINE**

Sukhvinder S. Sandhu, Ph.D.

**Department of Biochemistry, Biophysics,
Pharmacology & Material Sciences
Sumy State University, Sumy, Ukraine**

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➤ **CREATIVITY**

➤ **INNOVATION**

➤ CREATIVITY:

❖ Generation of Novel, Useful Ideas

- *A Personal Act (Discovery Phase)*

➤ INNOVATION:

❖ Taking The Ideas To The Market

- *Team Effort (Invention Phase)*

CREATIVITY

ABILITY OF THE HUMAN MIND
TO SEE THINGS DIFFERENTLY

**GET READY
FOR A MENTAL EXERCISE**





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CREATIVITY

**Ability Of The Human Mind
To See Things Differently**

Creativity

All Things are Created Twice

- **Mental Creation**
- **Actual Creation**



David
Marble Statue by
Michelangelo





CREATIVITY

Breaking Out of Normal Thinking Patterns

Core of New Competitiveness

Creativity: *Pattern Breaking Tools*

I Lateral Thinking

Solving problems by illogical means

II Metaphoric Thinking

Generation of new ideas by connecting the problem to something that occurs in a totally unrelated system

III Positive Thinking

Viewing negative from a different angle and turning it around

IV Fantasizing: *I wish I had.....?*

Lateral Thinking...

Solving problems by illogical means

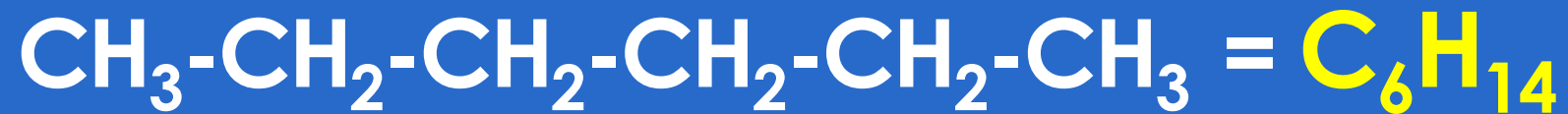
e.g. Determination of Benzene Structure

Benzene Discovered in 1826

Formula for Benzene: C_6H_6

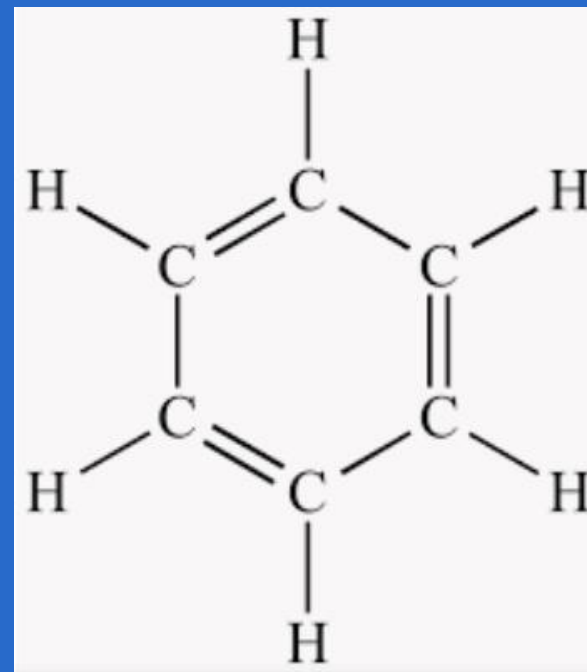
Benzene Structure : 1865 By Friedrich Kekule

Linear Compounds



Cyclic Compound

Benzene: C_6H_6

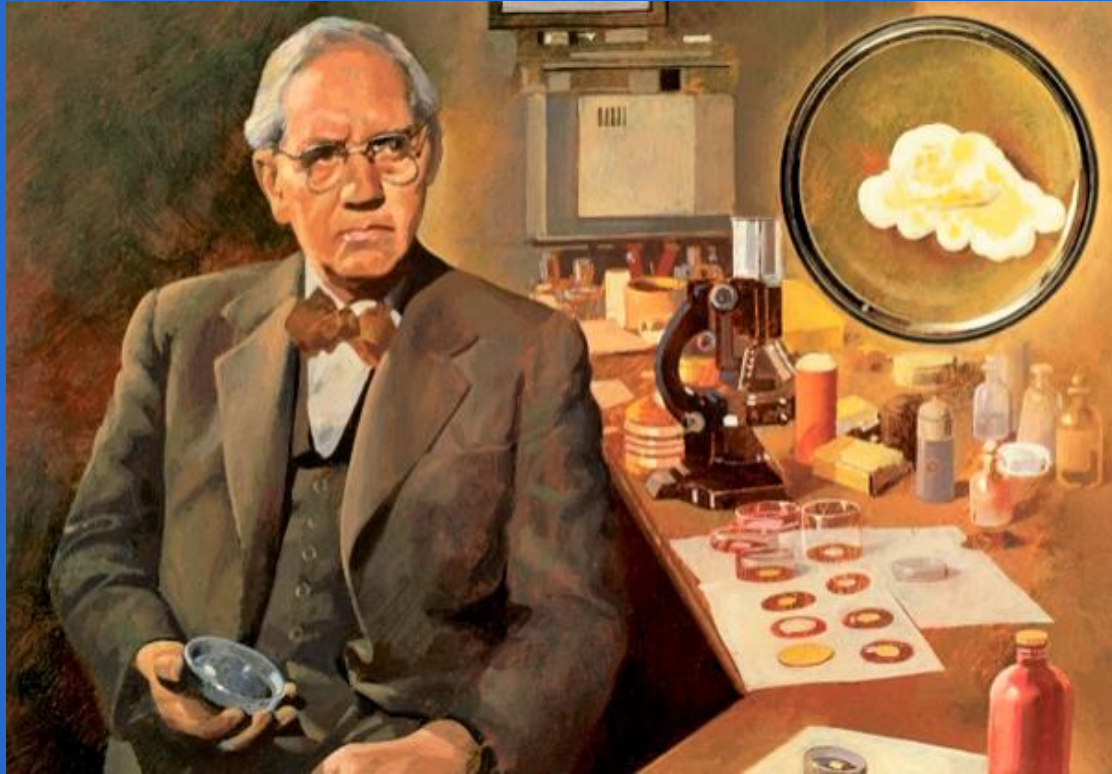


Metaphoric Thinking...

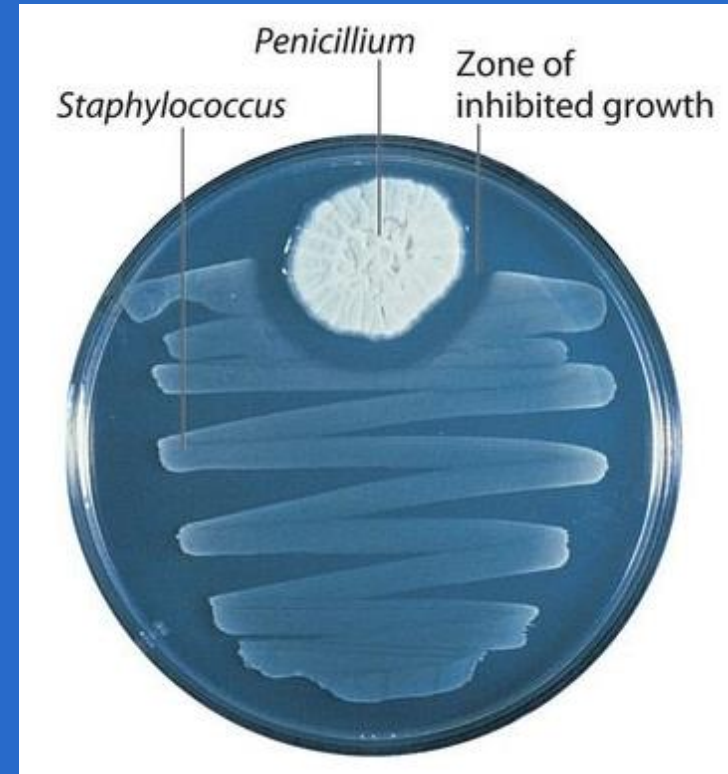
Generation Of New Ideas By Connecting
The Problem To Something That Occurs In
A Totally Unrelated System

- *Discovery of Penicillin*
- *Use Of Agar-agar To Grow Bacteria
On A Solid Surface*

Discovery of Penicillin



Alexander Fleming
1881-1955



Penicillin Discovered: 1928, Nobel Prize: 1945

Discovery of Agar-Agar

Culture Media For Microbiological Work

Jelly-Like Substance from Red Algae

- ❖ Linear Polysaccharide of Galactose disaccharide repeating units (70%)
- ❖ Heterogenous mix of Agaropectin (30%)

Gelling Agent: Desserts, Fruit Preservation

First Used by German Microbiologist Walther Hesse in 1882 as a solid culture medium

Solid: 32-40° C, Melts: 85° C

Positive Thinking...

Viewing Negative From A Different Angle And Turning It Around

- Discovery of Teflon
- Rogaine
- Viagra
- Microwave
- Dye Resistant Carpet
- “Post it” /Sticky Notes

Accidental Discovery of

**Teflon
Rogaine
Viagra**

**Negative Result / Positive thinking
New Discovery**

Teflon

Search To **Replace FREON**

Used in Air Conditioning

Gave Accidental **Birth to Teflon**

A Compound Commonly Used in

Non-Stick Household Utensils

Tetra-fluoroethylene (Gas)



Polymerization

Poly-tetrafluoroethylene

Solid, Teflon

- Insoluble In Any Known Solvent
- Not Attacked By Highly Corrosive Acids & Alkalis
- Did Not Melt Or Degrade At High Temp
- Stable At Extremely Low Temp.
- **UNUSUALLY SLIPPERY**

**Accidental Discovery of
A Hair Growth Product
Rogaine**

Rogaine: Hair Growth Product

1950's UpJohn Co.: Treat Ulcers

1979: FDA Approved to **Test**
for Hypertension

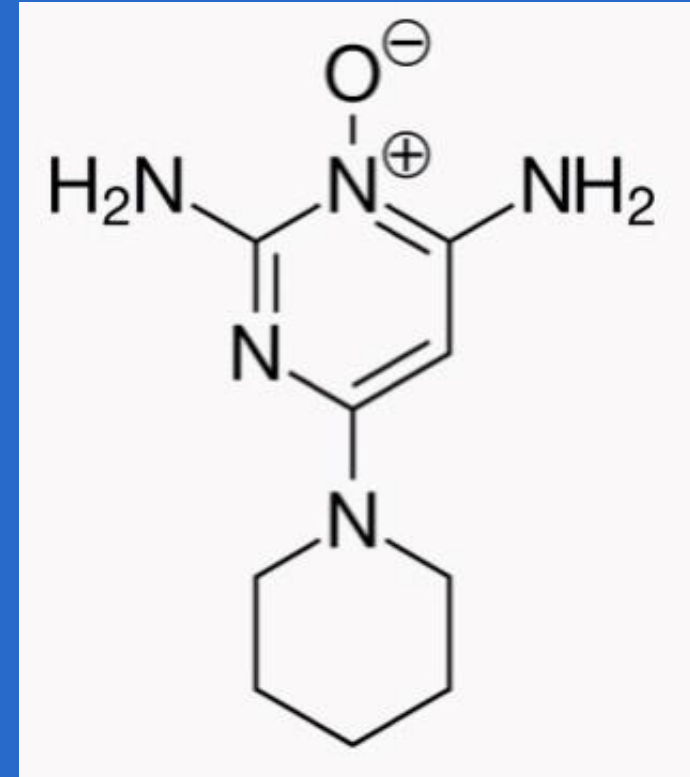
Side Effect: Hair Growth

1988: Approved for Hair Loss

Anti-hypertensive, **Vasodilator.**

K Channel blocker. Allows more

oxygen, blood & nutrients to Hair Follicles



MINOXIDIL

Accidental Discovery Of

VIAGRA

To Treat Erectile Disorder (ED)

Viagra:

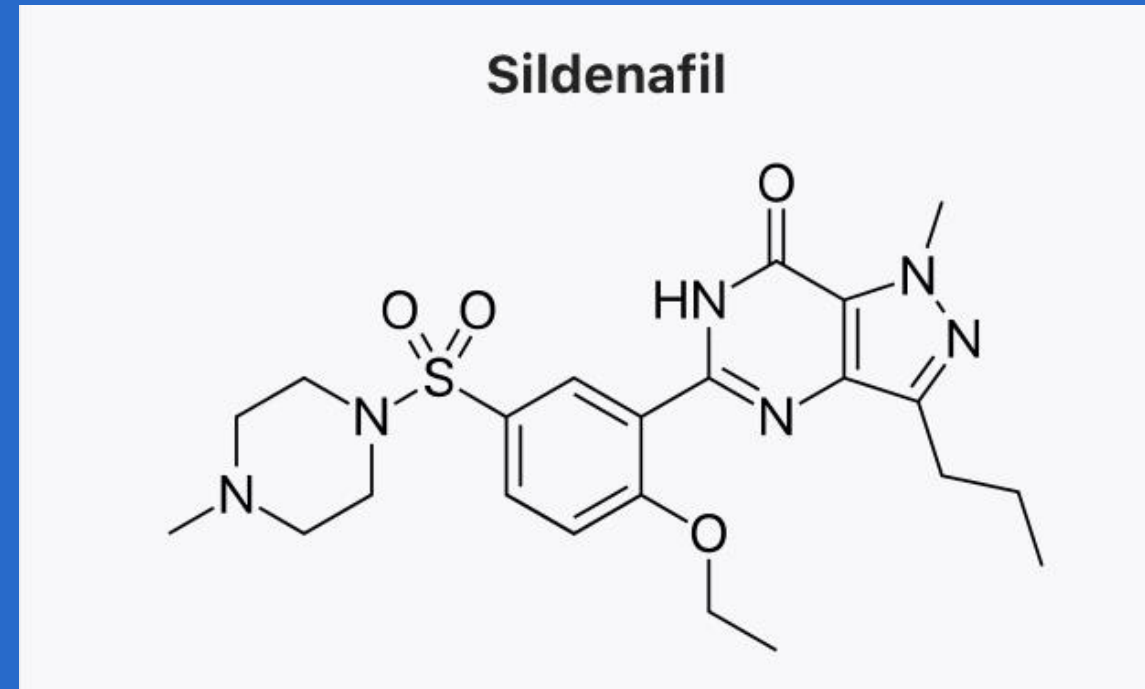
To Treat Erectile Disorder (ED)

Pfizer: 1989

Testing Sildenafil to
Control Pulmonary
Arterial Hypertension
Failed Miserably to
Control Blood Pressure

Side Effect: Caused Erections

FDA Approved Viagra in 1998 for ED



Fantasizing...

I wish I had.....?

- *Light Bulbs*
- *Telephones*
- *Aero planes*
- *YouTube*
- *(Agar Agar Story)*

“Wish We Had A Voice/Face Activated Lock”

CREATIVITY.....

- **Science & Technology**
- **Business World**
- **Challenges In Our Daily Life**

Positive Thinker



Metaphoric Thinking



???



Positive Thinker





Fantasizing: I Wish.....



Metaphoric ...

Fantasizing:

I wish I had an Apple Computer

IT'S NOT CALLED BEING POOR.



IT'S CALLED CREATIVITY!

MemeCenter.com

INNOVATION

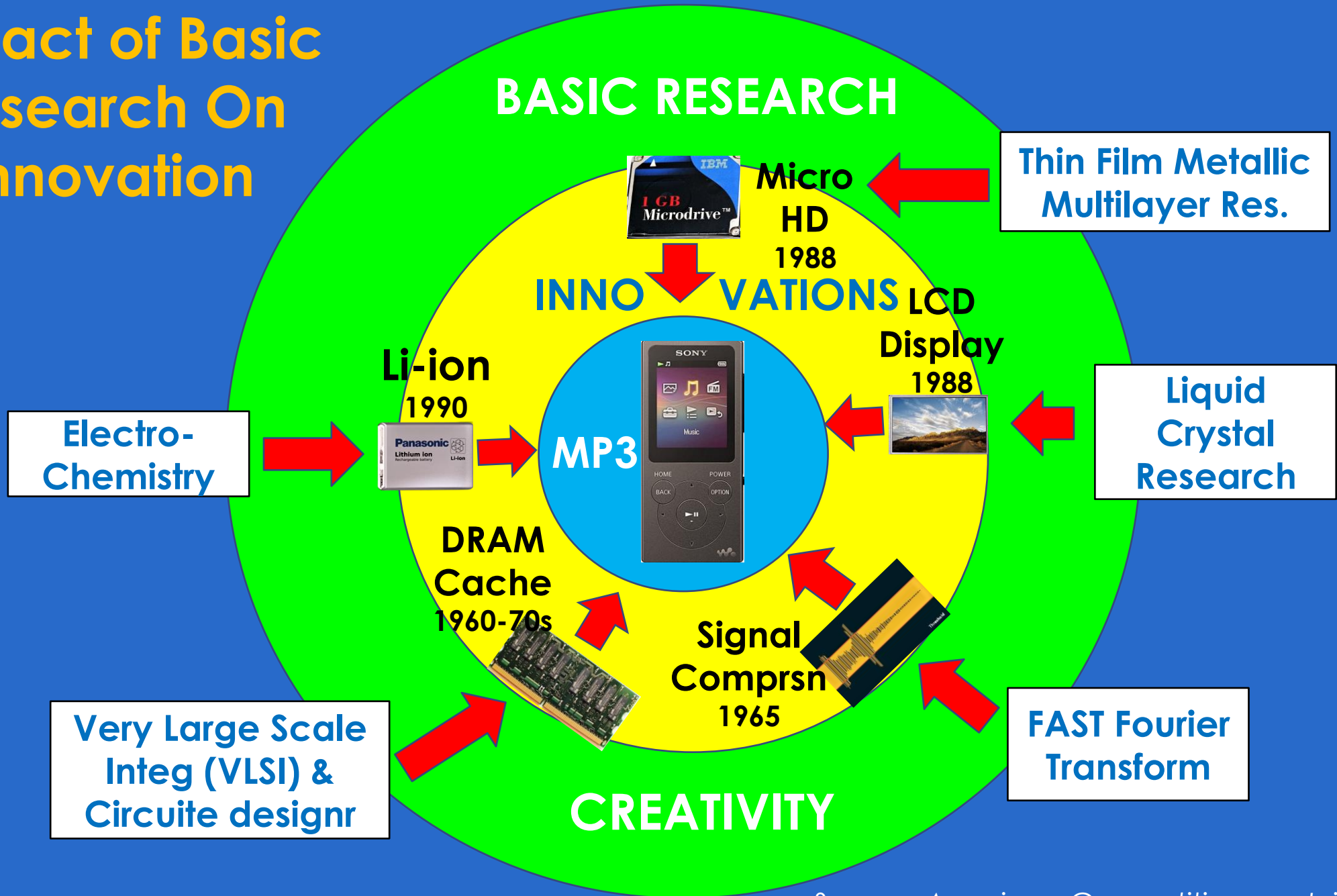
CREATIVITY:

- ❖ Generation of Novel Ideas:
 - Personal Act

INNOVATION:

- ❖ Taking The Ideas To The Market Place:
 - Team Effort

Impact of Basic Research On Innovation



INNOVATION

Invention of New Products

- Brand New Product
- Improving Existing Products

INNOVATION

Directly Impacts the Economic Prosperity

➤ Standard of Living

➤ Quality of Life

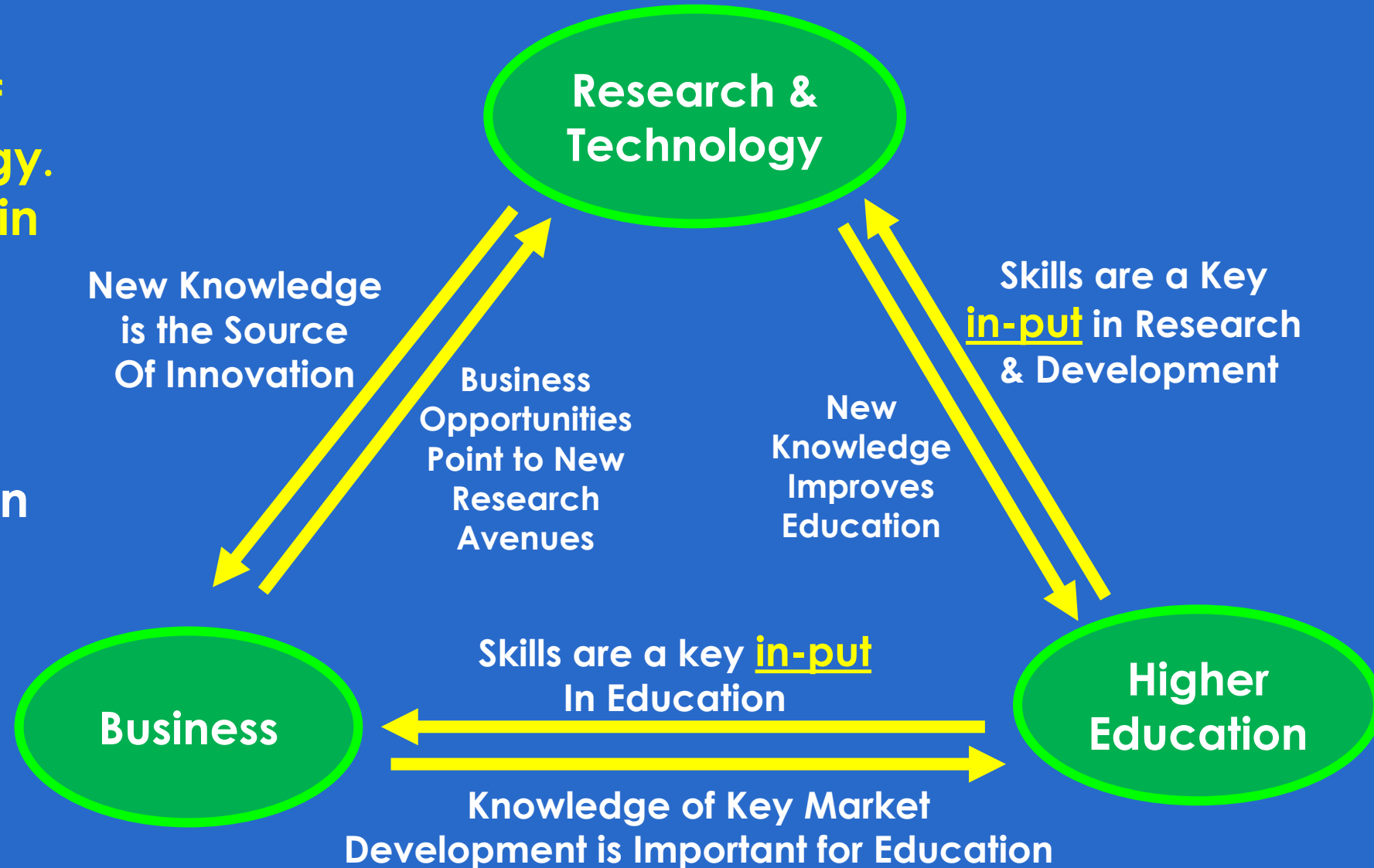
❖ Personal Happiness

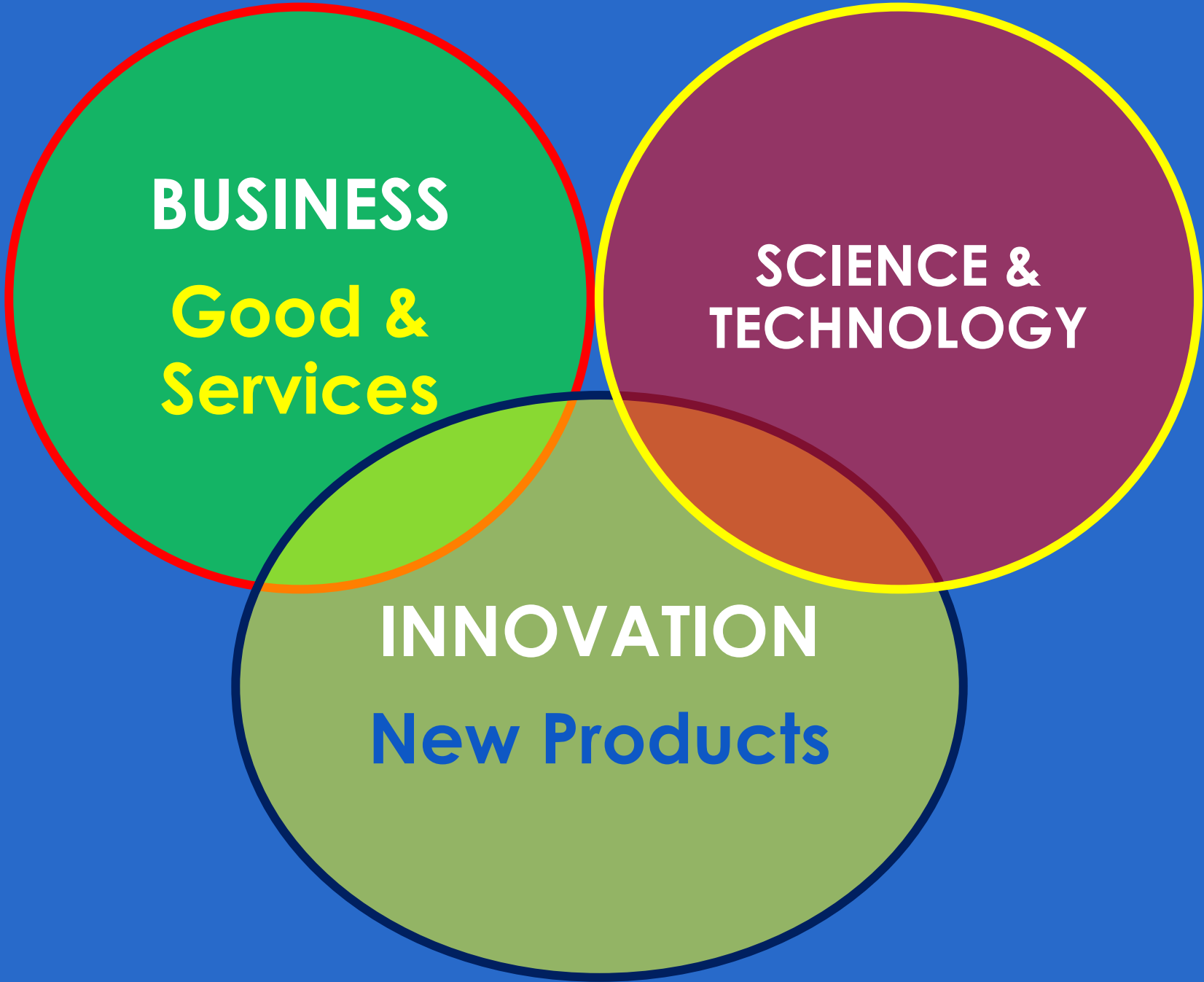
KNOWLEDGE TRIANGLE*

Integration of Research, Education and Innovation

*European Institute of
Innovation & Technology.
Catalyzing innovation in
Knowledge Triangle
(EIT 2012)

EU's Organization for
Economic Cooperation
& Development
(OECD 1996)





BUSINESS

**Good &
Services**

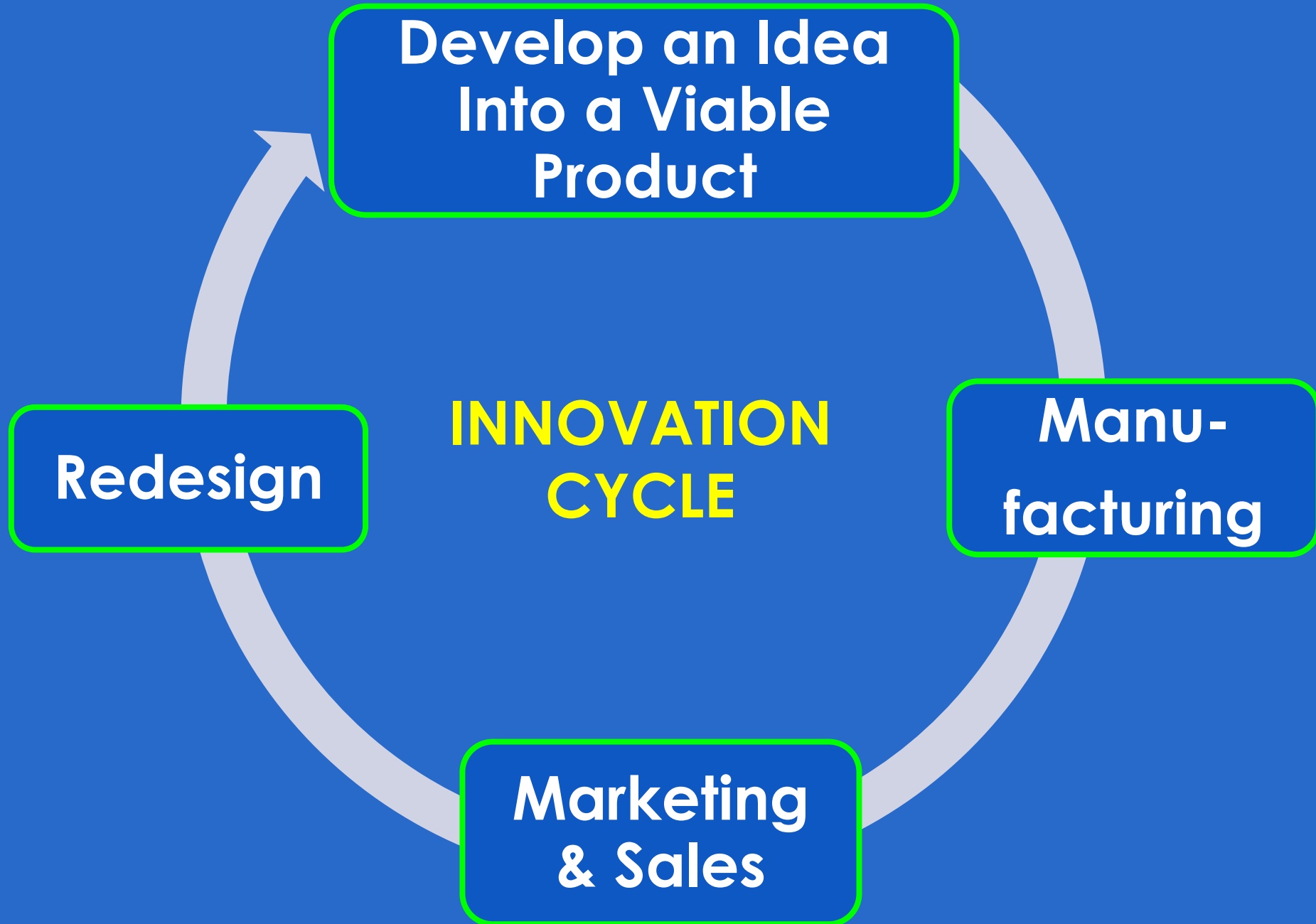
**SCIENCE &
TECHNOLOGY**

INNOVATION

New Products

Three Stages of New Product Development Process

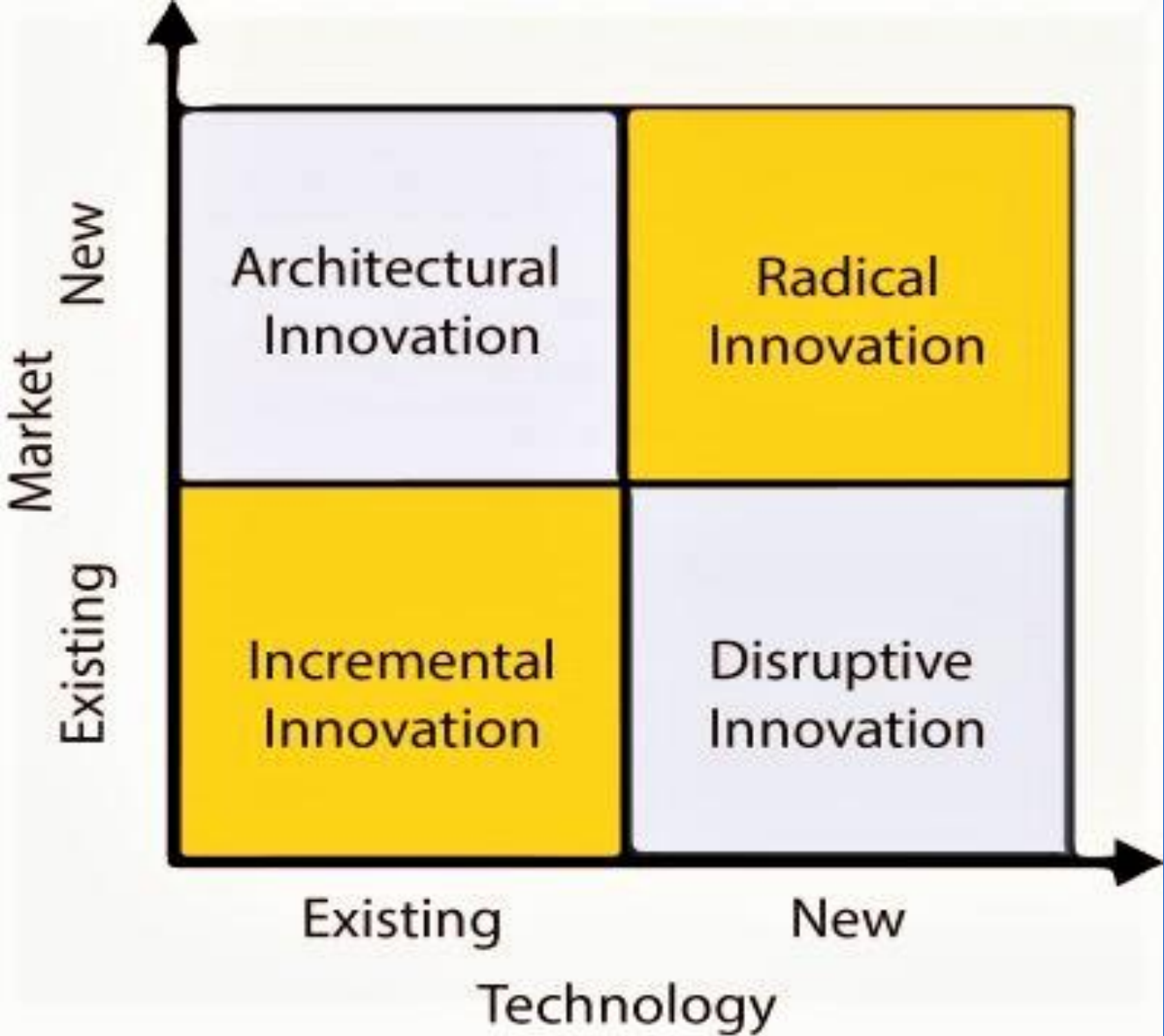
- **Development**
- **Manufacturing**
- **Marketing**



INNOVATION MATRIX*

Taking Technology From One field to Another (40% Patents)

Series of Small Insignificant Improvements (Majority)



Birth of New Revolutionary Technologies

Creating a New Network New Product or Entering Existing Mkt

Confucius
Chinese Philosopher
551-479 BC

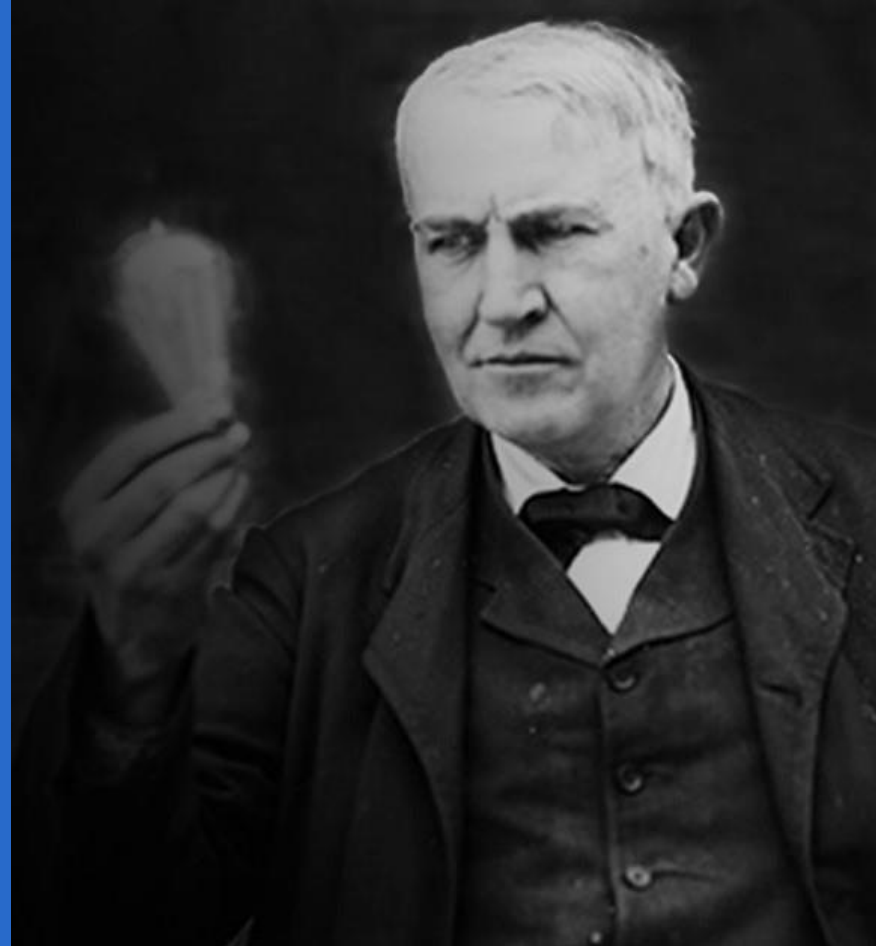


***“ When It Is Obvious The Goals Cannot Be Reached,
Don’t Adjust The Goals, Adjust the Action Steps.”***

**“Our Greatest Weakness Lies
In Giving Up.**

**The Most Certain Way To Succeed
Is Always To Try Just One More Time.”**

Thomas Edison



“Chance Favors Only The Prepared Mind”

Louis Pasteur



Thank You For Your Time

