ENIGMA OF INNOVATION

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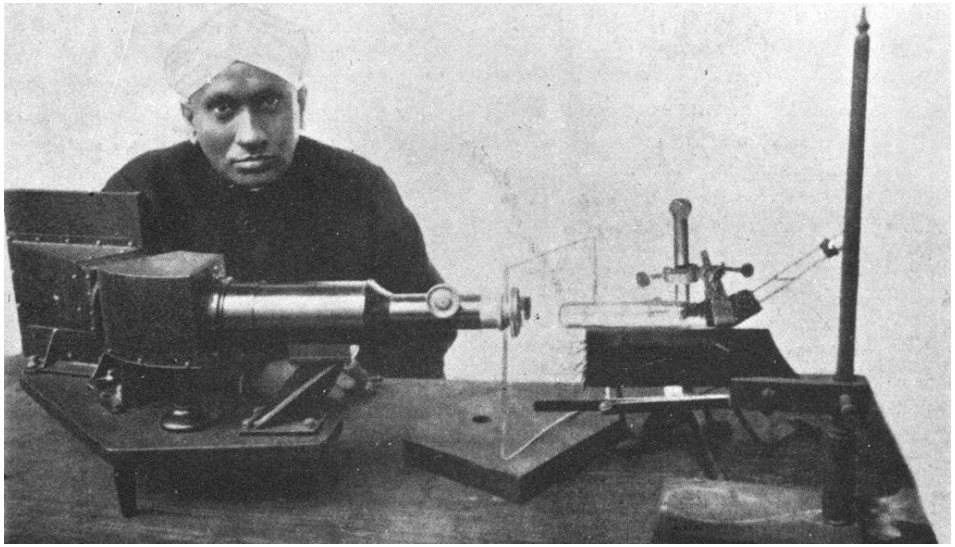
FEBRUARY 28, 2015

THE RAMAN EFFECT



On February 28, 1928, through his experiments on the scattering of light, Raman discovered a phenomena called Raman Effect

Raman was confident of winning the Nobel Prize in Physics and was disappointed when the Nobel Prize went to Richardson in 1928 and de Broglie in 1929. He was so confident of winning the prize in 1930 that he booked tickets in July, even though the awards were to be announced in November, and would scan each day's newspaper for the announcement, tossing it away if it did not carry the news.

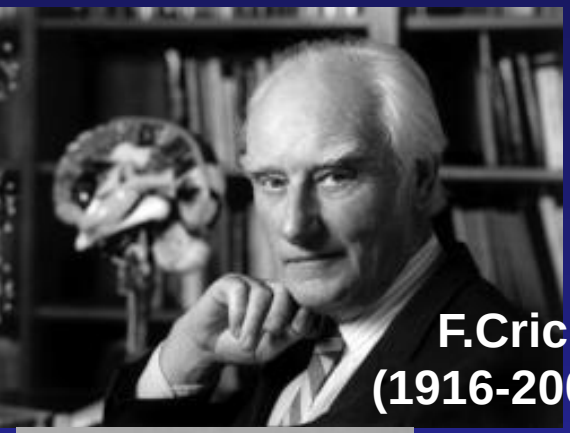
He did eventually win the 1930 Nobel Prize in Physics "for his work on the scattering of light and for the discovery of the effect named after him ". He was the first Asian and first non-white to get a Nobel Prize in the sciences.

C. V. Raman
1888-1970

1906 Stood 1st in M.Sc. (did not attend classes!!)
1907 Assistant Auditor General, AG`s Office, Calcutta
1907 Starts research at IACS, part time and publishes the first paper

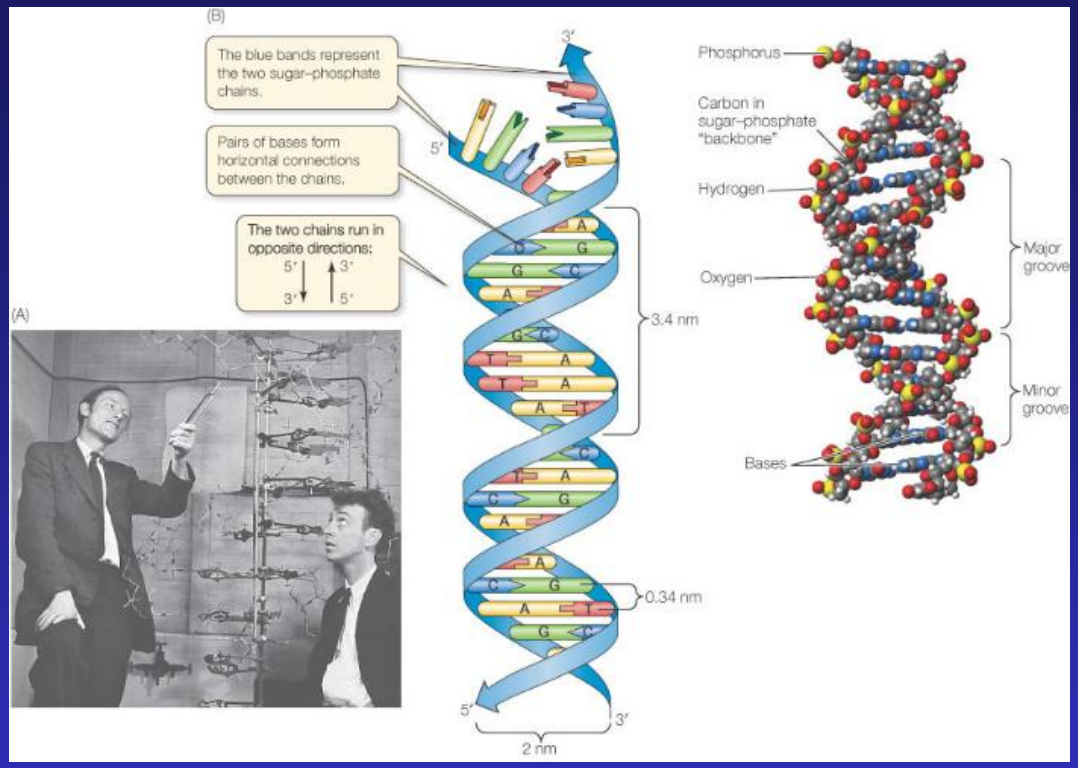
“Indian mind is not inferior ; what we lack is courage and a spirit of victory. If that indomitable spirit were to arise, nothing can hold us from achieving our rightful destiny”

28 FEBRUARY 1953 : ANOTHER HISTORIC DAY FOR SCIENCE



F.Crick (1916-2004)

J.D.Watson (1928-)



"This structure has novel features which are of considerable biological interest"……It has not escaped our notice that the specific pairing we have postulated immediately suggests a possible copying mechanism for the genetic material"

Watson and Crick in Nature, April 25, 1953

LESSONS FOR SUCCESS

- **Choose a problem ahead of its time, not because it is fashionable; Big challenges are truly ahead of their time**
- **You have to say either the first word or the last word in science to be noticed**
- **Never be the brightest person in a room; In science, it is better to be criticized than adored ! Getting out of intellectual rut requires jolts. If there are more smart people around you, smarter you will become**
- **Stay in close contact with your intellectual competitors competition is inevitable, if you are pursuing important objectives. To know who else is tackling similar problems as you are is an indication of how important the problem is**

JD Watson, 1970

LESSONS FOR SUCCESS

Contd….

- **Work with teams where intellectual partnership is equal**
- **Always have some one to save you. Build a network of well wishers, mentors, men of consequence and angels. In spite of all your accomplishments, you will always need a helping hand as you climb the ladder.**

JD Watson, 1970

Every great advance in science has been issued from a new audacity of imagination

John Dewey

INNOVATION

It is the means by which a person creates new wealth producing resources or endows existing resources with enhanced potential for creating wealth

Peter F. Drucker

HBR 1985

Innovation is the successful exploitation of new ideas and is a vital ingredient for competitiveness, productivity and social gain within businesses, organisations and nations

-London Innovation definition*

INNOVATION & INNOVATION MANAGEMENT

Innovation

- **Transformation or application of knowledge to a novel and useful end. It is the integration of the utilitarian element and the exploitation of both newly discovered and well established sources of knowledge**
- **Innovation that does not create wealth is merely an invention**

Innovation management

- **The business process that converts a bright idea or knowledge into an innovation**

INVENTION AND INNOVATION

- **An invention is an idea that can solve a practical problem in a new way, while innovation is the action needed to put it into practice**
- **The greater the scientific knowledge of the inventor, the greater is his or her range of potential inventions**
- **Innovation may take place centuries after the invention because the knowledge was not in the right place, the materials and processes were lacking or because there was not a big reward**
- **Predicting the future of invention/innovation is important, bit it is rarely correct**

FAILURES OF VISION

1920 - ‘The wireless music box (radio) has no imaginable commercial value. Who would pay for a message sent to nobody in particular?’ - *David Sarnoff’s associates, in response to his urgings for investment in the radio*

1943 - ‘I think there’s a world market for maybe five computers.’ - *Thomas Watson, chairman of IBM*

1949 - ‘Computers in the future may weigh no more than 1.5 tons.’ - *Popular Mechanics*

1977 - ‘There is no reason anyone would want a computer in their home.’ - *Ken Olson, president, chairman and founder of Digital Equipment*

1981 - ‘640K ought to be enough computer memory for anyone.’ - *Bill Gates, chairman of Microsoft*

FAILURES OF VISION

1876 - ‘This “telephone” has too many shortcomings to be seriously considered as a means of communication.’ - ***Western Union internal memo***

1895 - ‘Heavier-than-air flying machines are impossible.’ - ***Lord Kelvin, President, Royal Society***

1899- ‘Everything that can be invented has been invented.’ - ***Charles Duell, Commissioner of the US Office of Patents***

Contd…..

TYPES OF INNOVATION

- **Incremental innovation : Practice Intensive**
  - **Quality improvement**
  - **Efficiency improvement**
  - **Cost minimization**
  - **New applications**
- **Radical or breakthrough innovation : Knowledge intensive**
  - **“Game Changer” technology**
  - **Creation of new products that never existed before**
  - **Log term returns with high risk & reward**

To be successful in business, we must acquire technology at a lower cost than our competitors

RADICAL INNOVATION

- Balance between short term and long term
- Balance between efficiency and innovation
- Ability to reconfigure resources quickly
- Ability to collaborate

C.K. Prahalad

TYPES OF INNOVATION

- **Product or Service Innovation**
  - *New offerings that consumers willingly pay more for*
- **Process Innovation**
  - *New ways of producing and delivering these offerings to reduce costs*
- **Business Model Innovation**
  - *New ways of reconfiguring the entire businesses*

ESSENTIALS ELEMENTS OF INNOVATION

- **Deep broad continuously refreshed reservoir of knowledge**
- **Knowledge pool is a requisite but not necessarily a prerequisite for any particular innovation**
- **A linear picture of orderly succession of increasingly applied tasks strung together in a bridge from pure knowledge to the market is as mythical as it is appealing in its simplicity**
- **The reservoir of knowledge interacts with the users and providers in an apparently random and chaotic way , more diffusive than sequential, more turbulent than laminar**

No preordained casual relationship between the knowledge produced and ultimate innovation. Innovation process is not a relay race; It is a contact sport

DRIVERS OF INNOVATION

- **Religious belief (Sociology)**
- **National Culture (Psychology)**
- **Property Rights(Legal)**
- **Distance from the Equator(Geography)**
- **Labour and Capital (Economics)**

Investment in R&D, higher education, tax policies or improvement In intellectual property laws are some of the measures which can improve a country's competitiveness

THE CREATIVE PROCESS

- Preparation
- Incubation
- Illumination
- Verification

WHERE DO GOOD IDEAS COME FROM ?

- The adjacent possible
- Liquid networks
- The slow hunch
- Serendipity
- Error
- Exaptation
- Platforms

From “ Where Good ideas come from, S. Johnson

SOURCES OF INNOVATION

- Unexpected occurrences
- Exploitation of incongruities
- Process needs
- Industry and market changes
- Demographic changes
- Changes in perception
- New knowledge

INNOVATION PROCESS

- Competence : Creativity
- Process : Innovation
- Outcome : Invention
- Good ideas follow smart people
- Question the status quo
- Challenge the assumption
- Encourage contrarian thinking
- Ensure a free flow of ideas
- Engage with others to gain new perspectives

THREE STAGES OF INNOVATION

- Reconnaissance
  - Scouting for new (markets and technological) possibilities
- Evaluation
- Investment

Opportunities are often uncovered by people who were not looking for them

SEVEN PRINCIPLES OF INNOVATION

- **Curiosity**
  - **Finding the question**
  - **Continuous learning**
  - **Emotional intelligence**
- **Demonstration**
  - **A commitment to test knowledge through experience, persistence and willingness to learn from mistakes**
- **Sensation**
  - **Looking, seeing, visualization**
  - **Listening and hearing**
  - **Touching and feeling**
- **Sfumato**
  - **A willingness to embrace ambiguity, paradox and uncertainty**
  - **Confusion endurance**

Contd….

SEVEN PRINCIPLES OF INNOVATION

- – Incubation / intuition
- – Solitude
- Art and science
  - – Balance between science / art, logic imagination
  - – Whole brain thinking
- Corporalita
  - – The cultivation of grace, ambidexterity fitness and poise
- Connessime
  - – Systems thinking
  - – A recognition of and appreciation for the interconnectedness of all things and phenomena

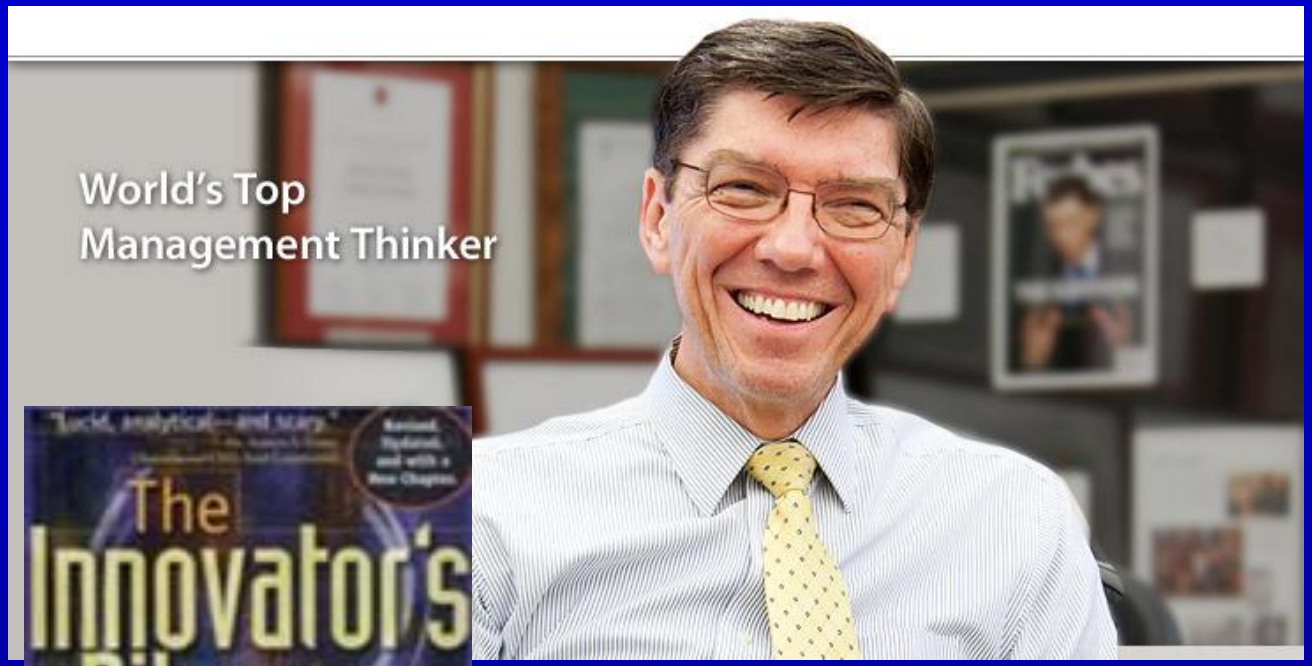
(from How to Think Like Leonardo de Vinci, M.J. Gelb, 2000)

SEVEN HABITS OF INNOVATION

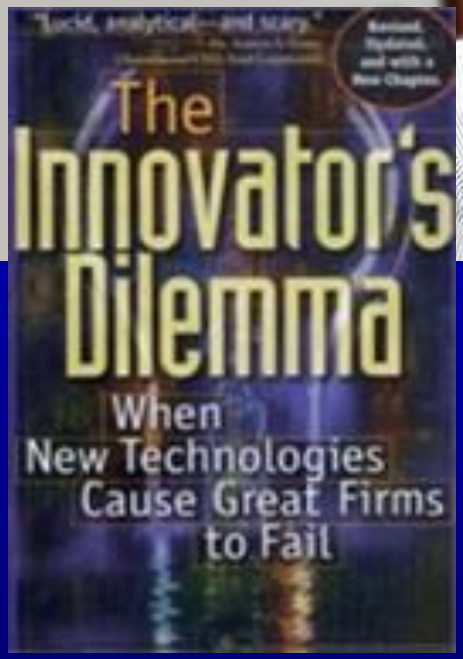
- Challenging assumptions, defining the problems correctly, “out of box” thinking
- Welcoming chance intrusions, practicing serendipity
- Listening to the depth of your mind
- Suspending judgment
- Using the stepping stones of analogy
- Tolerating ambiguity
- Ideas banking

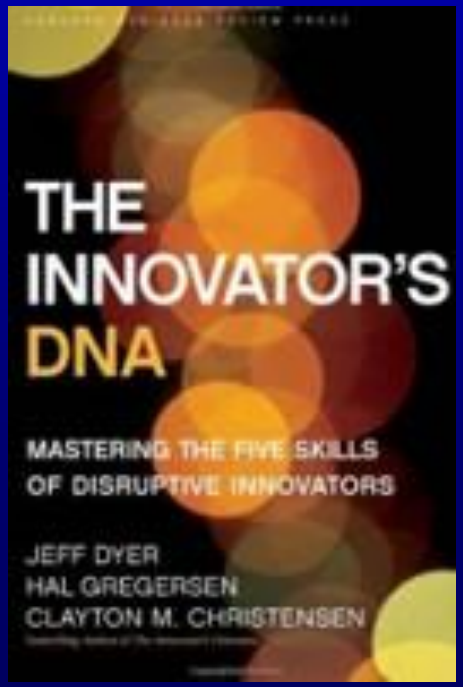
MINDSET FOR INNOVATION

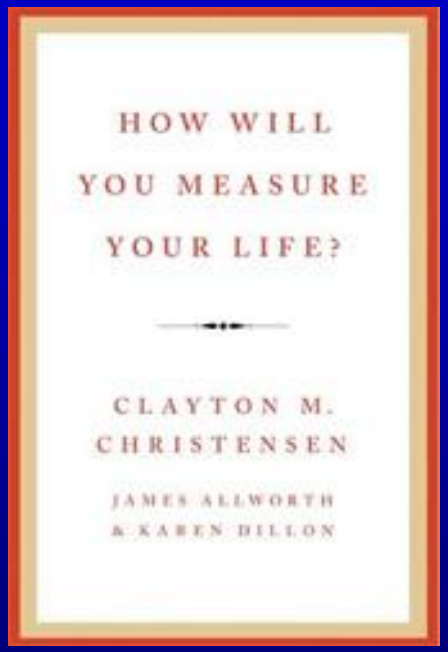
- Willingness to invest in risky projects
- Persistence to build capabilities
- Tenacity to stay in the midst of failures and obstacles
- Capability to manage all the above in a systematic way



Professor Clayton Christenson
Harvard University







THE INNOVATOR'S DNA : CLAY CHRISTENSON (2011)

- **Five habits of disruptive innovators:**
  - **-Associating**
    - **-Questioning**
    - **-Observing**
    - **- Networking**
    - **- Experimenting**
- **Innovators excel in connecting seemingly unconnected things**
- **Creative associations come when you broaden your experience**
- **Best innovators are "T" shaped individuals**
- **Innovators constantly ask why can't things be done differently**
- **Define an innovation premium for companies, that is look at the proportion of their market value that cannot be accounted for by their current products.(e.g Apple's Innovation Premium is 52%)**

Most innovative companies are run by mega-minds who set hubristic goals

SUCCESS IN INNOVATION

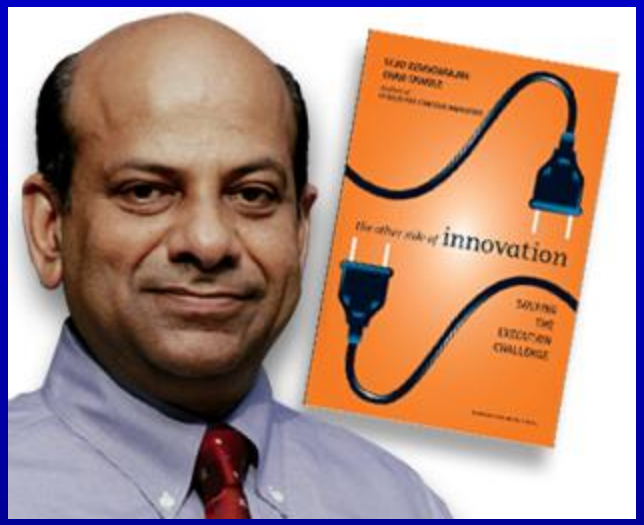
- **Long years of preparation**
- **A timely read book or paper**
- **Repeated failures**
- **Conversation with a colleague**
- **Periods of indolence**
- **Ambition and courage**
- **Longevity**

Concept of "divine" revelations in science is a myth. Archimedes (Buoyancy), Newton (Gravity) and Kekule (structure of benzene) discoveries were products of deep thoughts, not casual occurrences

SUCCESS IN INNOVATION REQUIRES…..

- **A belief that "innovation is not a prerogative of a talented few, but the everyday task of making non-obvious connections**
- **Getting people to view perspectives from other's eyes**
- **Setting 'stretch' goals**
- **Creating a culture of taking risks; Innovation is a gamble. One must learn to play for high stakes**
- **Ensure that there is no fear of failure. Failure is an integral part of innovation. One cannot learn without making mistakes**
- **An open and transparent organizational culture**

THE OTHER SIDE OF INNOVATION : SOLVING THE EXECUTION CHALLENGE (HBS) : VIJAY GOVINDARAJAN, CHRIS TIMBLE



- **I for ideation, I for invigoration and I for Incubation**
- **We miss the I for implementation**
- **Genius is 1 % inspiration and 99% perspiration**
- **Innovation is not equal to ideas**
- **Innovation is Ideas + Execution or Implementation**
- **Innovation is not just creativity; you can have lots of ideas but do not know what to do**
- **Organizations are not designed for innovation, but for efficiency**
- **Efficiency and scalability depend on predictability and repeatability**
- **Learn to effectively balance the performance engine with the innovation engine**
- **Innovation often requires short term sacrifice in order to gain long term advantage**

FACTORS INHIBITING INNOVATION

- Negative attitude
- Fear of failure
- Stress
- Following rules
- Making assumptions
- Over reliance on logic

WHAT DIFFERENTIATES THOSE WHO DO AND THOSE WHO MIGHT HAVE DONE

- Prepared mind
- Independent thinking
- Courage
- Perseverance
- Drive and intelligent application
- Tolerate ambiguity ; connecting the seemingly unconnected dots
- Intense passion
- Ability to look at “outliers’

DRIVERS OF INNOVATION

- Committed champions
- Personality of champions
  - “Out of box” thinkers
  - Intimate knowledge of organizations
- Accessibility to top management
- Significant or serendipitous events
- Idea generation through networks

KEY PLAYERS IN INNOVATION

- **Creative thinker**
- **Innovation**
- **Inventor**
- **Entrepreneur**
- **Intrapreneur**
- **Champion**
- **Sponsor**

INNOVATION AND CROSSFUNCTIONAL TEAMS

- **Cross functional diversity provides multiplicity of ideas essential to creative thinking**
- **However, merely including a large number of functional areas in a team does not improve performance. While more ideas may be generated problem solving becomes difficult**
- **For a team to succeed, one must have a strong "superordinate identity" to the team. Often team members retain deep rooted functional allegiance**
- **Strength of interpersonal ties among team members influences innovativeness. High social cohesiveness a deterrent to innovation**
- **Close monitoring of activity is a powerful motivator for enhancing innovation**

ATTRIBUTES OF AN INNOVATION TEAM

Unpredictable	• **Problem Solvers**	• **Integrator**
Predictable	• **Implementors**	•**Problem Finders**
	Simple	**Complex**

EMERGING MODELS OF INNOVATIVE ORGANIZATIONS

- **From hierarchal or linear to distributed networks**
- **Fluid network of many interacting parts, with many nodes, but no singular leader**

Leadership will need skills to create partnership, govern loose networks and lead by influence rather than control and command

THE STARFISH ORGANIZATION
(The Starfish and the Spider : The Unstoppable Power of Leaderless Organizations by O. Brafman and R.A.Bckstrom

- **Being small gives competitive advantage**
- **Communities of networks creates better value of human resources**
- **Creativity thrives in chaos; order and structure squelch creativity**
- **Knowledge is spread throughout the organization; the best knowledge is at the fringe of the organization**
- **The spirit of sharing thrives; everyone wants to be a contributor**
- **In a starfish organization, people will do what they will do; the role of management is to connect people and ideas**

If you cut off a spider's head, it dies; but if you cut off a starfish's leg, it grows a new one .Traditional top down organizations are like spiders

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LEADERSHIP ROLE IN INNOVATION PROCESS

- **Leadership that is failure tolerant; views failure as complement to success, not opposite**
- **Leadership that is fully engaged in the innovation process; Focused on increasing organization intellectual capital**
- **Leadership that is collaborative, not controlling**
- **Leadership that is less evaluative, more interpretative**
- **Encourage communication; Create avenues for ideas to “bubble up”**

INNOVATION ECO-SYSTEMS

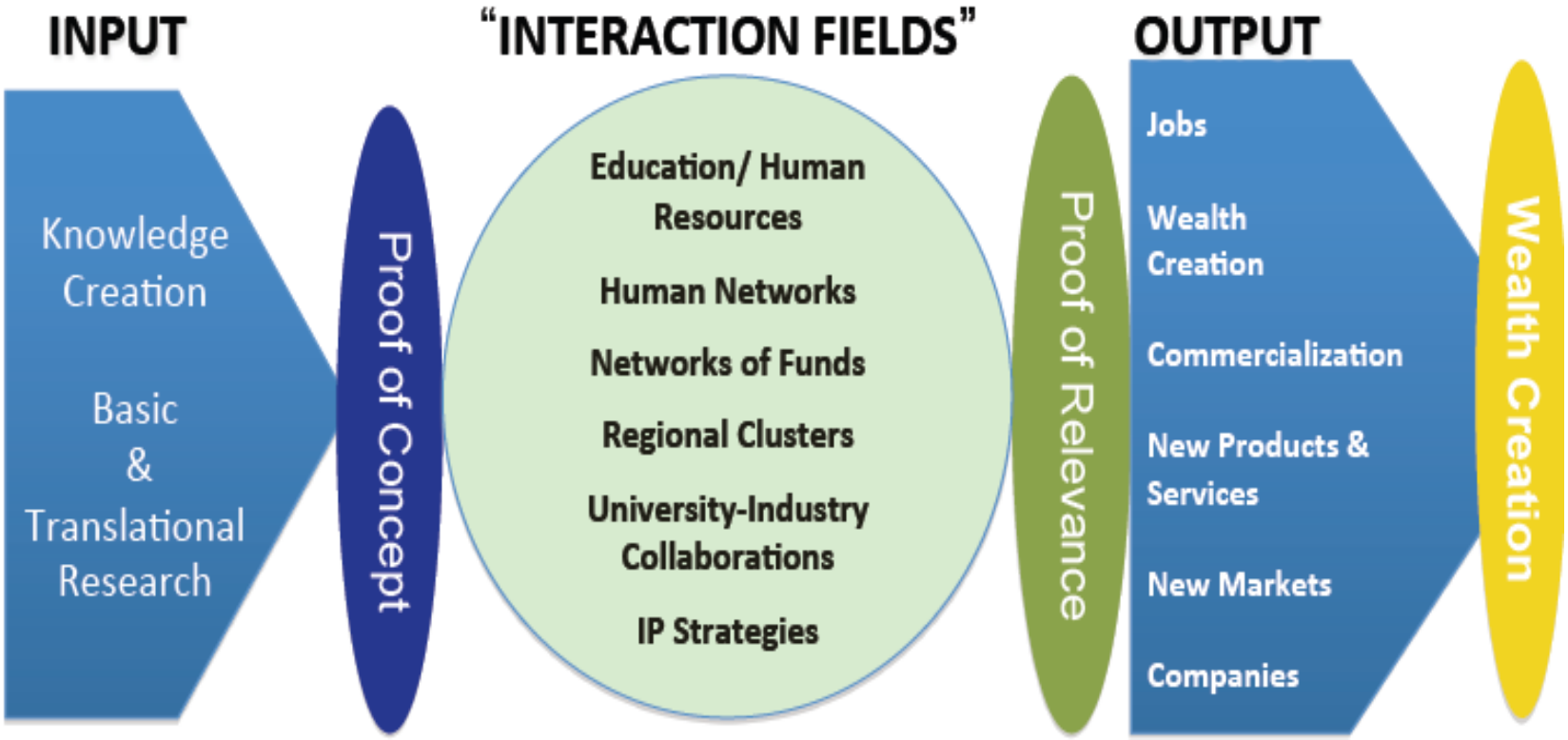
- **The collaborative processes by which multiple elements of innovation are combined to offer a coherent solution to a problem**
- **In the absence of such ecosystems value creation out of innovation is well impossible**
- **Innovation ecosystems are characterized by three types of risks-**

  Initiative risks, interdependence risks and integration risks
- **Many technology failures occur because of our inability to manage these risks**

Innovation is not just creative endeavor; it is a discipline. It is about creating a perspective within which ordinary people can create something extraordinary

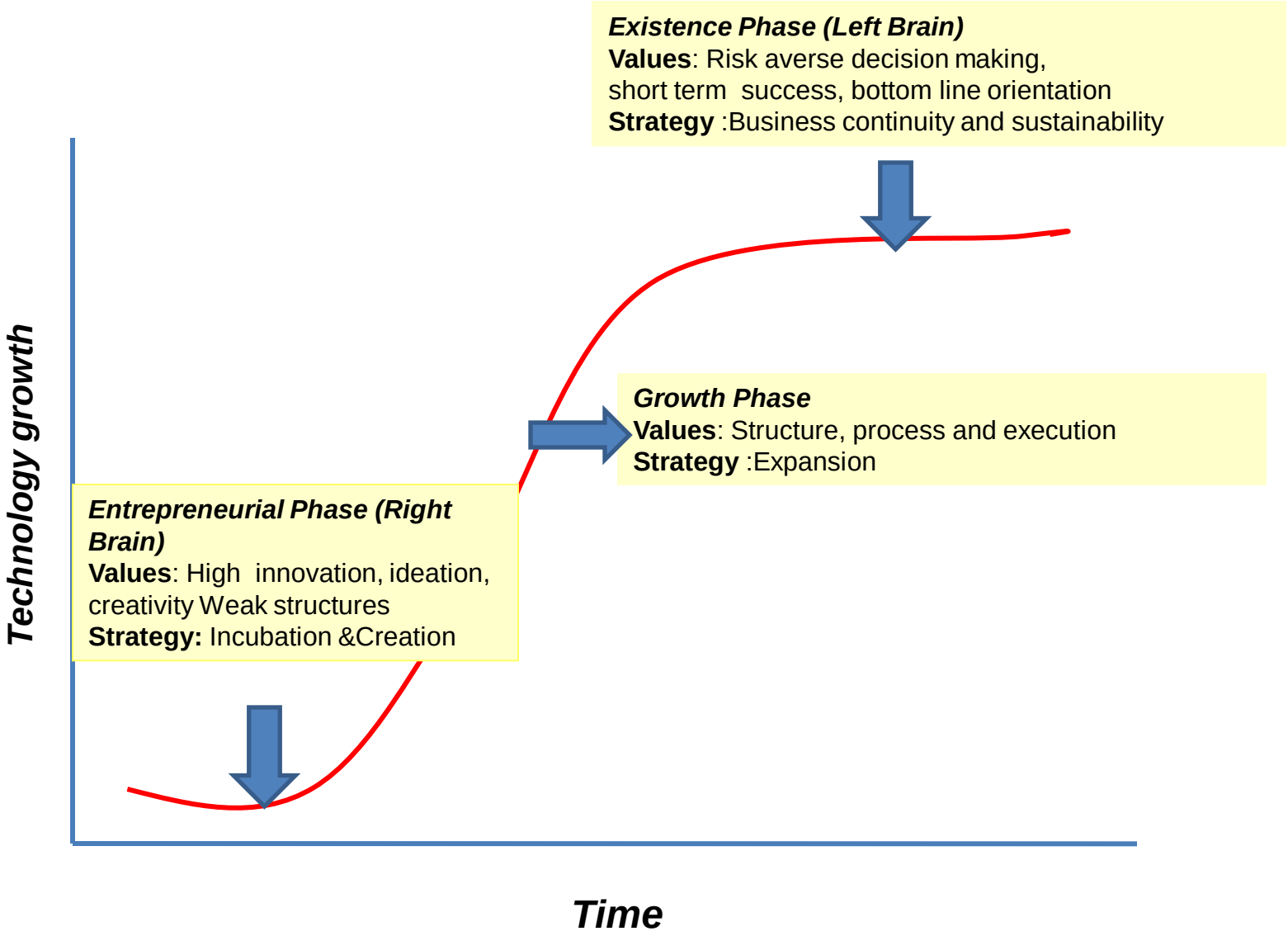
INNOVATION ECOSYSTEM

The journey from "Proof of Concept" to " Proof of Relevance" has to progress through the "Valley of Death". This journey is nurtured by the ecosystem

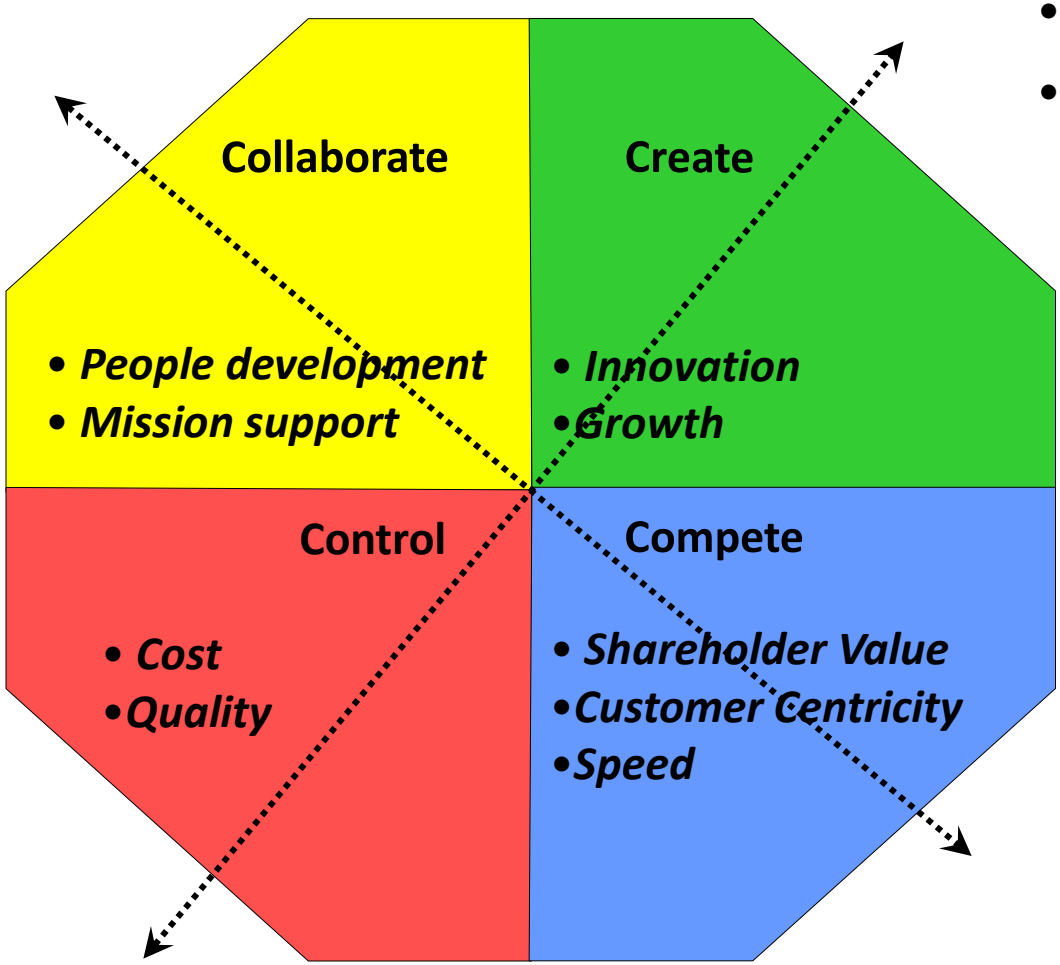


The concept of the Innovation Ecosystem stresses that the flow of technology and information among people, enterprises and institutions is key to a vibrant innovation process.

THE INNOVATION S CURVE AND VALUES



INNOVATION REQUIRES BALANCING COMPETING VALUES



- **Competencies**
- ***Values***

ASSESSING INNOVATION MATURITY

Creative confidence

Success rate of implemented ideas>50%
% of rev from Innov in last 5 yrs>30%

Level-5: High business Impact (Excellence)

Idea/person/yr >1
Big idea pipeline>
10% of revenue
# of sandboxes>1

Level-4: Balanced Portfolio

Prototypes>10%(ideas)
Response time<1month
Participation 30%+
Incubation pipeline
Review: Track Quarterly Business impact

Level-3: Engaged (In Experiments/Reviews)

Idea Mgmt
Buzz creation
Learning & Development
Innovation dashboard
Participation 10%+

Level-2: Foundation (of 3 key processes)

Don't track ideas

Level-1: Ad Hoc

Incubation effectiveness

Indian Companies are still here

Courtesy: Professor Rishi Krishnan

Innovation is the responsibility of every individual, and it begins with a conscious search for opportunities. Those opportunities can be categorized but not predicted. Finding those opportunities and exploiting them with focussed practical solutions - requires disciplined work

PETER F. DRUCKER
HBR May-June 1985

INNOVATION

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1950 - 2010
Celebrating Sixty
Years of Science
I shall be telling this with a sigh somewhere ages and ages hence;
two roads diverged in a wood
and , I took the one less traveled by,
and that has made all the difference
Robert Frost


1950 - 2010
Celebrating Sixty
Years of Science
CSIR - INDIA
THANK YOU