Foundations of Entrepreneurship

Design, Innovation & Product Development

Lecture Note # 25

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CONCEPTS COVERED

- Creativity
- Mechanism of innovation
- TRIZ
- Design thinking
- Design-Driven Innovation
- Open innovation

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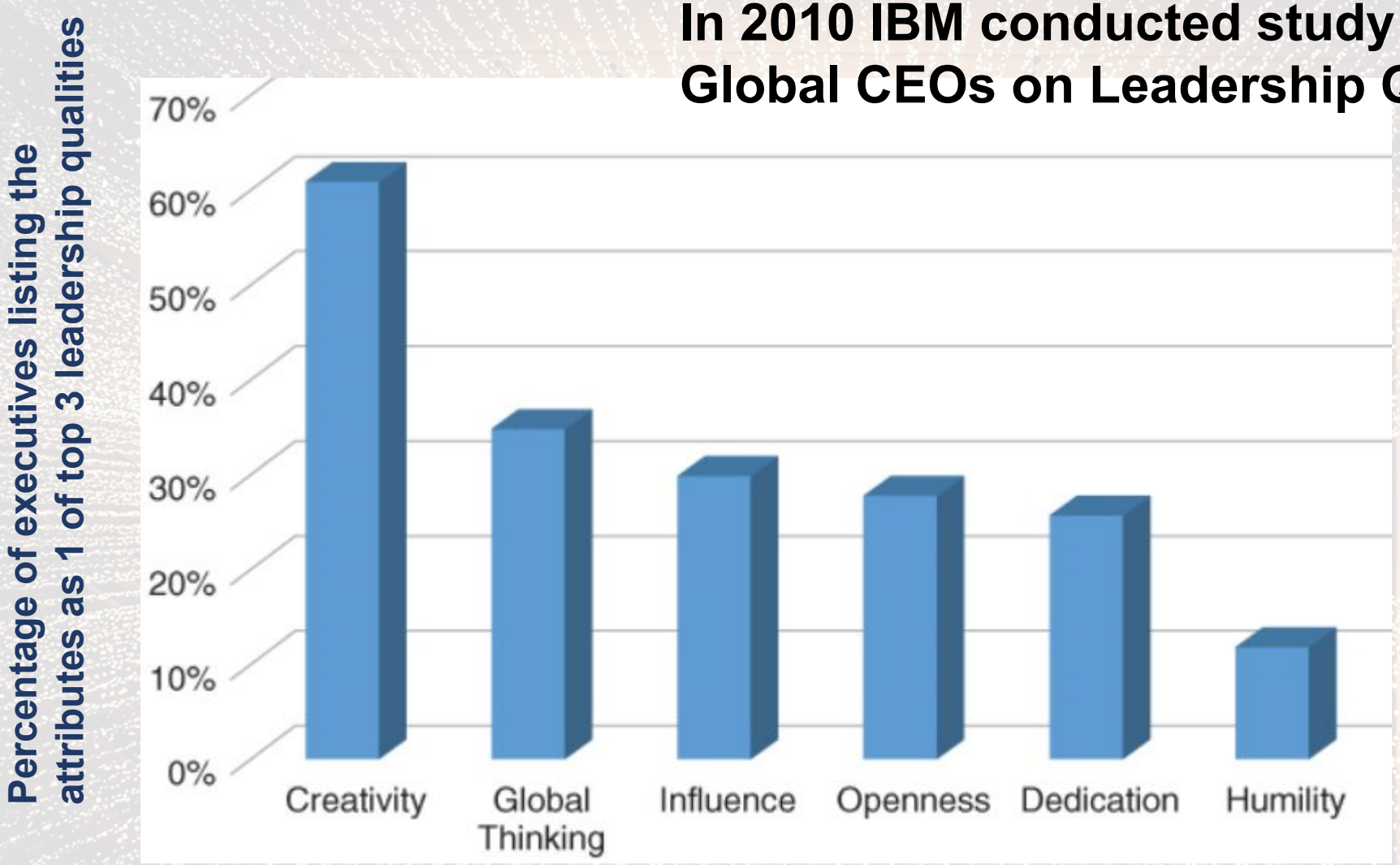
In 2010 IBM conducted study on 1541 Global CEOs on Leadership Quality



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Design and Designers' Sensibilities

Design is an art of creating beautiful, elegant, and innovative solutions those meet (or exceed) customers' aspirations.

Sensibility refers to complex feelings such as amenity, pleasantness, comfort, pleasure, and so forth, which are often experienced in the use of objects.

The senses of vision, hearing, smell, touch, and taste.

Sensation and perception that generate the capacity of emotional, rational, ethical, artistic, literal, social, and cultural understanding, called 'sensibility.'

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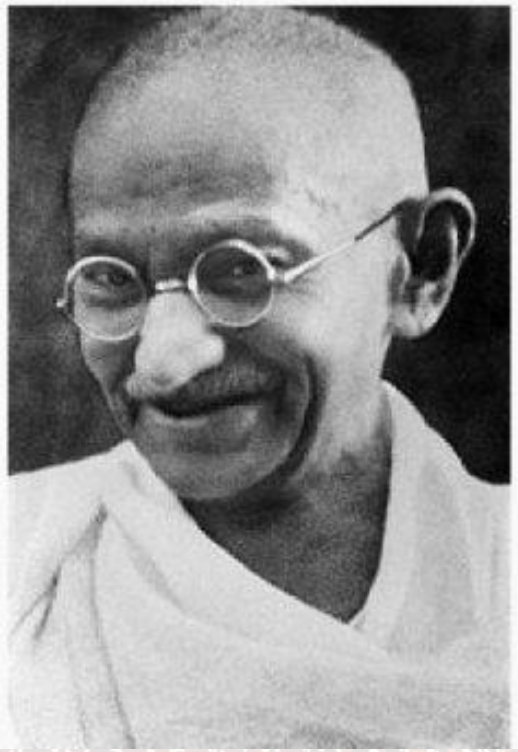
Gandhi: one of the few creative geniuses to walk the earth

Ahimsa is not for a coward.
One must be courageous
to practice it.



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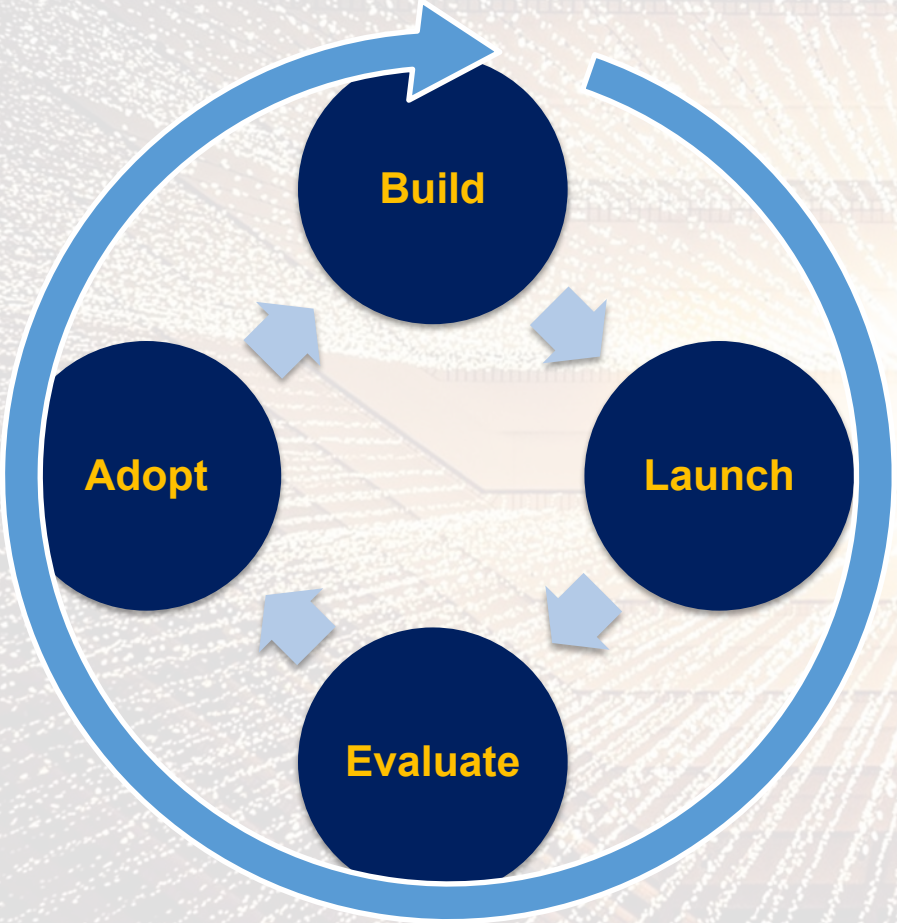
Linear Thinking



Iterative Problem Solving Process: Learning by doing

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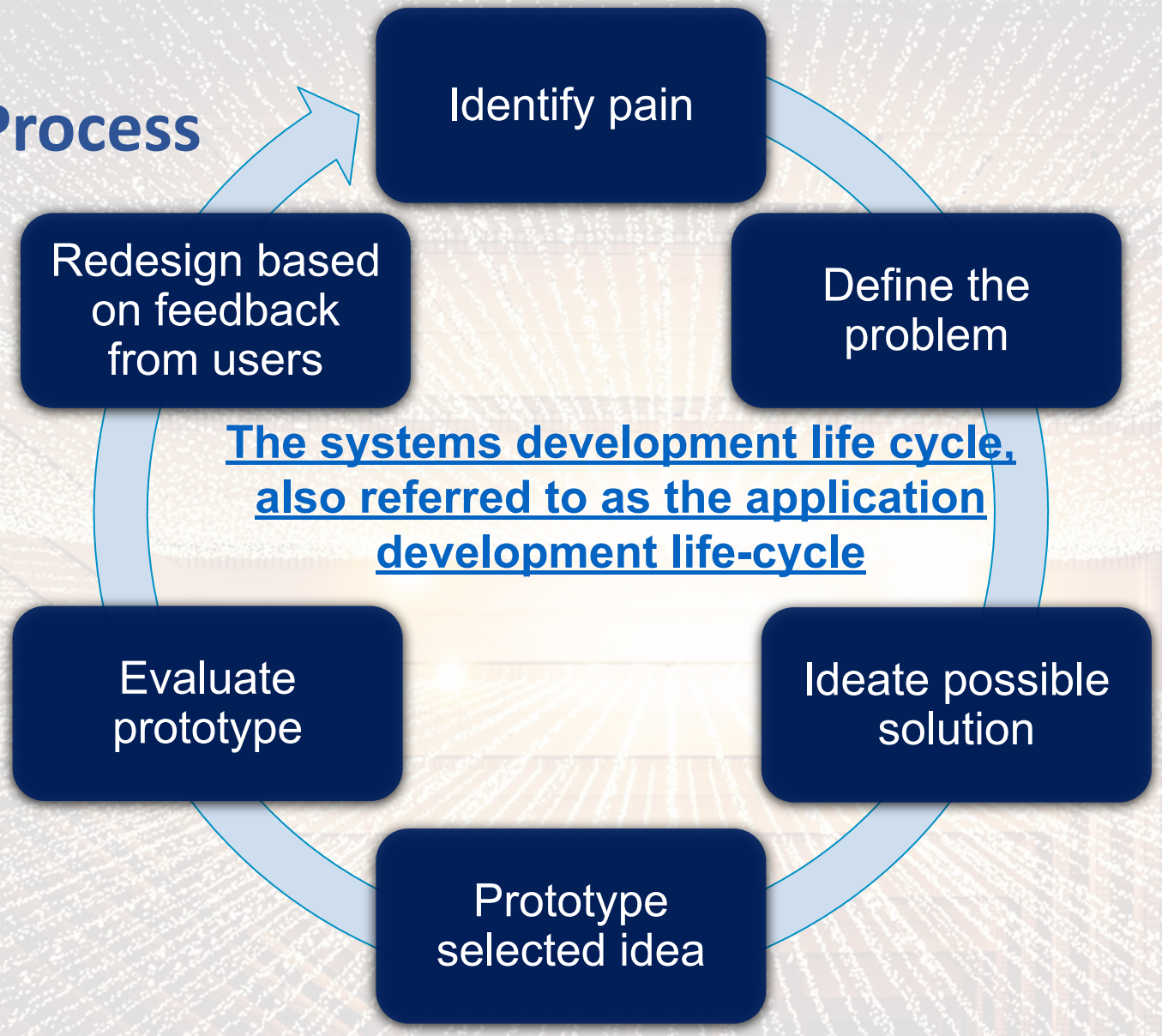
Design Process



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- Innovation is difficult to plan, if at all possible.
- You really do not plan like you plan a straightforward production process or execution plan.
- It is more like a meandering river leading you through unknown territory, and that should be OK.

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Some of the Constructs or Tools in Design and Innovation are

- Design Thinking
- Design-Driven Innovation
- TRIZ – Theory of Inventive Problem Solving
- Open Innovation
- Lean Product Development
- Agile Process
- Frugal Innovation
- Biomimetic

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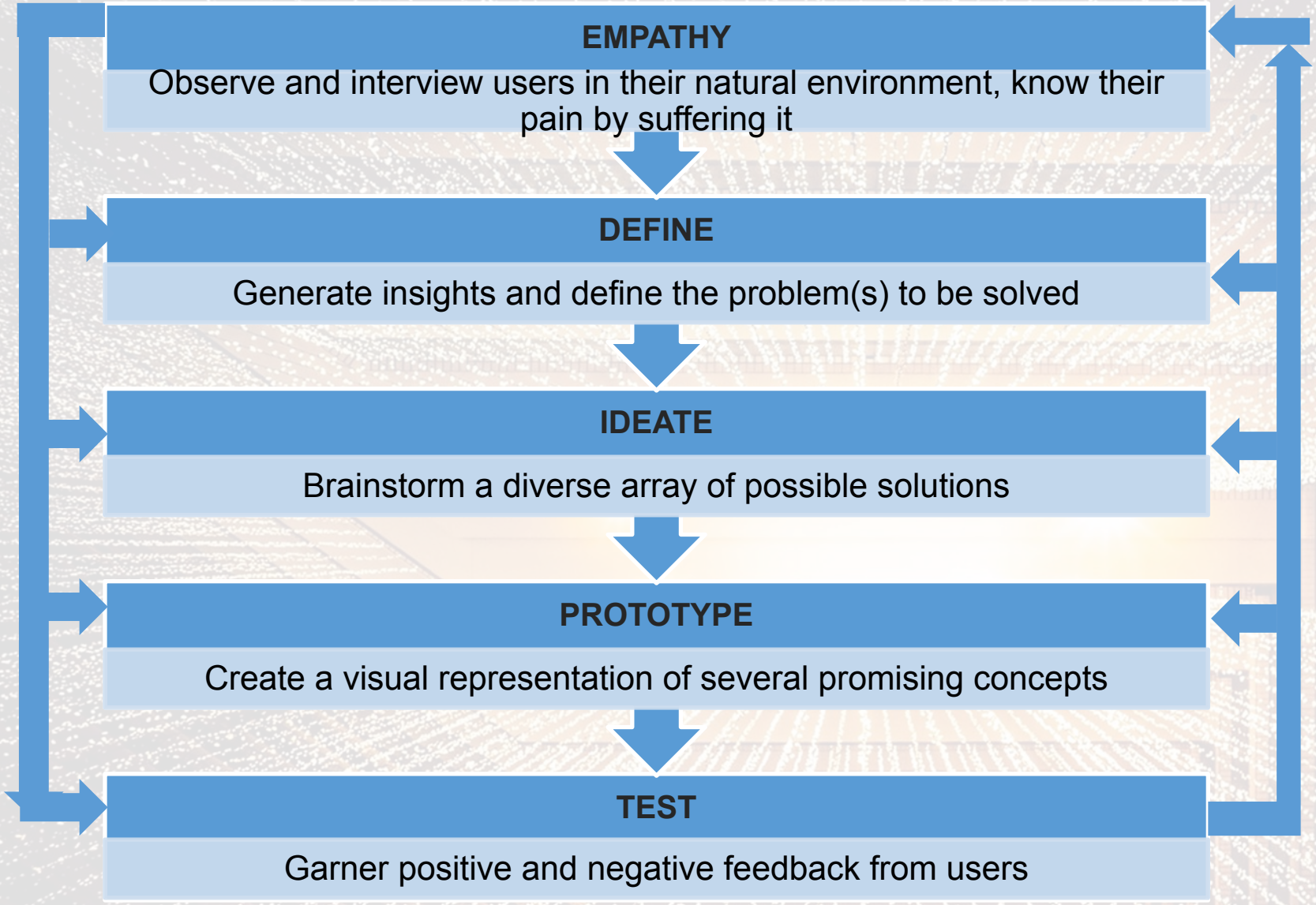
Design Thinking



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Many notice Design Thinkers among great creators

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How Innovation Usually Happen?

- Keep an open eye and demand better product or service.
- Ask yourselves: Can I come up with something better?
- Phanindra Sama faced a problem. He realized that others also would face the same problem. He asked himself: can I come up with a solution?
- The results was redBus. The ibibo group took over redBus for $138 million.
- Be active, go to places, look around, be mindful.

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Develop Deep Empathy for Customers

- *Empathy makes you a better innovator – Satya Nadella, CEO, Microsoft*
- **The greatest trait differentiating human beings from other creature is empathy.**
- **Empathy is a combination of three things – seeing with the eyes of another, listening with the ears of another and feeling with the heart of another.**
  By empathizing, one can define a problem well, conceive a creative solution resulting in breakthrough innovation.

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Question the Status Quo: Be a Contrarian

- Most of us compromise and manage or complain.
- A contrarian questions the status quo and takes up a contrary view.
- Starts building and testing hypothesis. They discover blue ocean markets.
- Phanindra Sama, Dhirubhai Ambani, Dr Venkatswamy of 'Arvind Netralaya', Steve Jobs, Elon Musk, Jeff Bezos, Jack Ma created success stories by questioning the status quo

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Invention and Innovation

- Invention is creation of something new and meaningful.
- Innovation is creation of something new that is meaningful and putting the required infrastructure and create value for the society.
- The filament used in light bulb was invented by several researchers, but their inventions were not useful as a product.
- Thomas Alva Edison invented material and the concept of the vacuum glass container to make it a useful product that lightened the society.
- It created new industries and changed lives.

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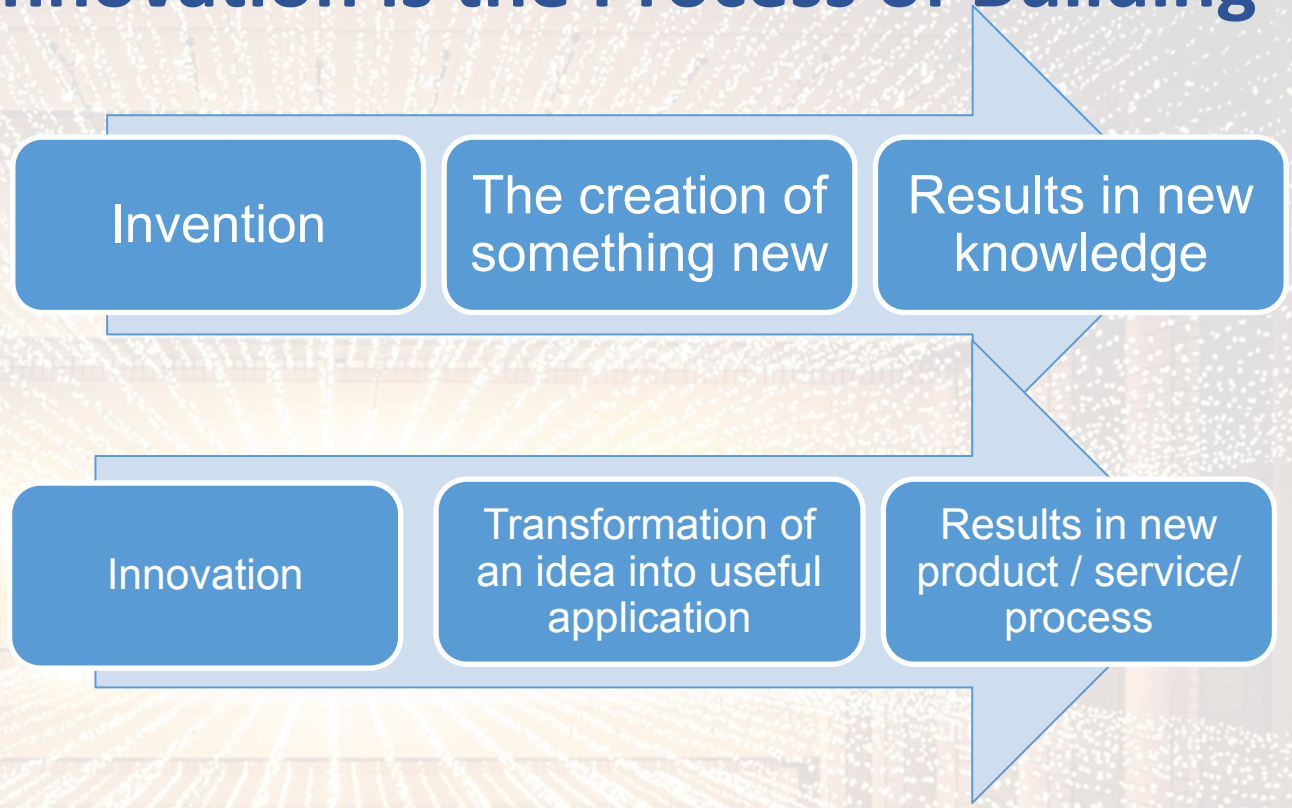
Idea to Invention to Innovation is the Process of Building Entrepreneurship

- **Drucker has stated that "…Innovation … is the means by which the entrepreneur either creates new wealth-producing resources or endows existing resources with enhanced potential for creating wealth."**



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Steps in Invention

- Problem
- Define
- Question
- Leap of faith
- Hypothesis
- Explore
- Look around
- Research

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Leap of Faith

- One must believe that it is possible to find a better solution than what exists to date.
- That it is possible to come up with new ideas that can potentially serve to alleviate a pain or serve unmet needs.
- Some call it confidence.
- But a solution will always elude us as long as we think “never heard of anything better” or “this is the best possible solution” or “have to somehow manage” and brand some as ‘crazy’ if one thinks differently.

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Being mindful of the travails you are going through, I am trying to arrange talks by experts instead of delivering lectures by myself. Schedule for the next part of the semester

25.03.2021	Preetam Prashun	Entrepreneur, presently stationed in Vienna, Austria
26.03.2021	Class test - 3	
31.03.2021	Dr. Ajai Chowdhry	Co-founder of HCL, Padma Bhushan, nothing short of a Bharat Ratna
01.04.2021	Class test - 4	
02.04.2021	Capital budgeting	
07.04.2021	Talk by Aneesh Reddy of Capillary Tech	2005 graduate and the Co-founder of Capillary Tech
8.04.2021	Sourav: Product development	Intel
09.04.2021	Final examination	
14.04.2021	Assignment to be submitted by 14.04.2021	

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For persistently Following and Succeeding in Creative Pursuit

- **Get rid of the tunnel vision, which is a great obstacle against thinking out of the box. Examples**
  - Lateral thinking - Lateral thinking is a manner of solving problems using an indirect and creative approach via reasoning that is not immediately obvious. It involves ideas that may not be obtainable using only traditional step-by-step logic.
- **Leap of faith**
- **Divergent thinking – use Sinectics**
  - Step 1 Name your problem , Step 2 Brainstorm analogies to your problem, Step 3 Let the team(s) pick up the analogy they like the most, Step 4: Brainstorm ideas how to solve the analogy problem, Step 5: Translate the brainstormed solutions back to the context of the original problem
  - The same process can be simulated in your brain, most of the times without any chronology.

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How to Identify Problem and How to Find Solutions?

- Need to engage to identify a problem.
- Rather than compromising on difficulties, we need to question how the difficulty can be overcome. Question the status quo.
- Every problem has solutions. But solution starts with questioning.
- James Dyson noticed that a traditional vacuum cleaner loses suction as the bag fills up.
- His leap of faith was that a solution is definitely possible.
- He chanced upon how sawdust was removed from the air by large industrial cyclones and comprehended to replicate it in domestic vacuum cleaner.

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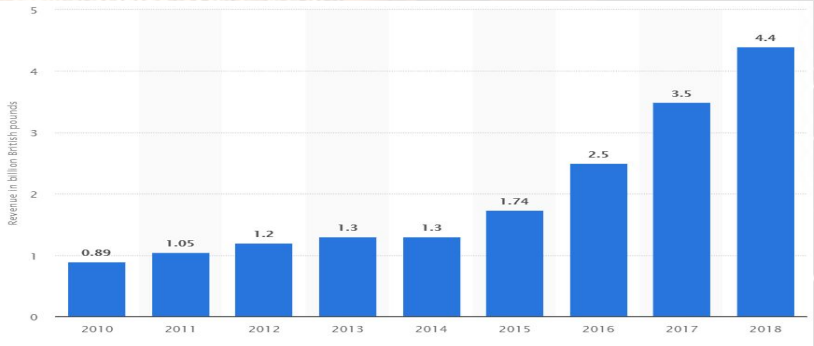
Dyson Vacuum Cleaner

- It took him years to develop a product and get it market validated. Built 5127 prototypes.
- But when launched, Dyson's machine became the biggest selling vacuum cleaner in the UK in just 18 months.
- This also evidences that applying a little creative thinking, a mass-used consumer product can be innovated.
- The company generated revenue of $7.3 billion in 2019 and $ 1.5 billion profit. 13,000 employees



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How the Invention Process Works in our brain?

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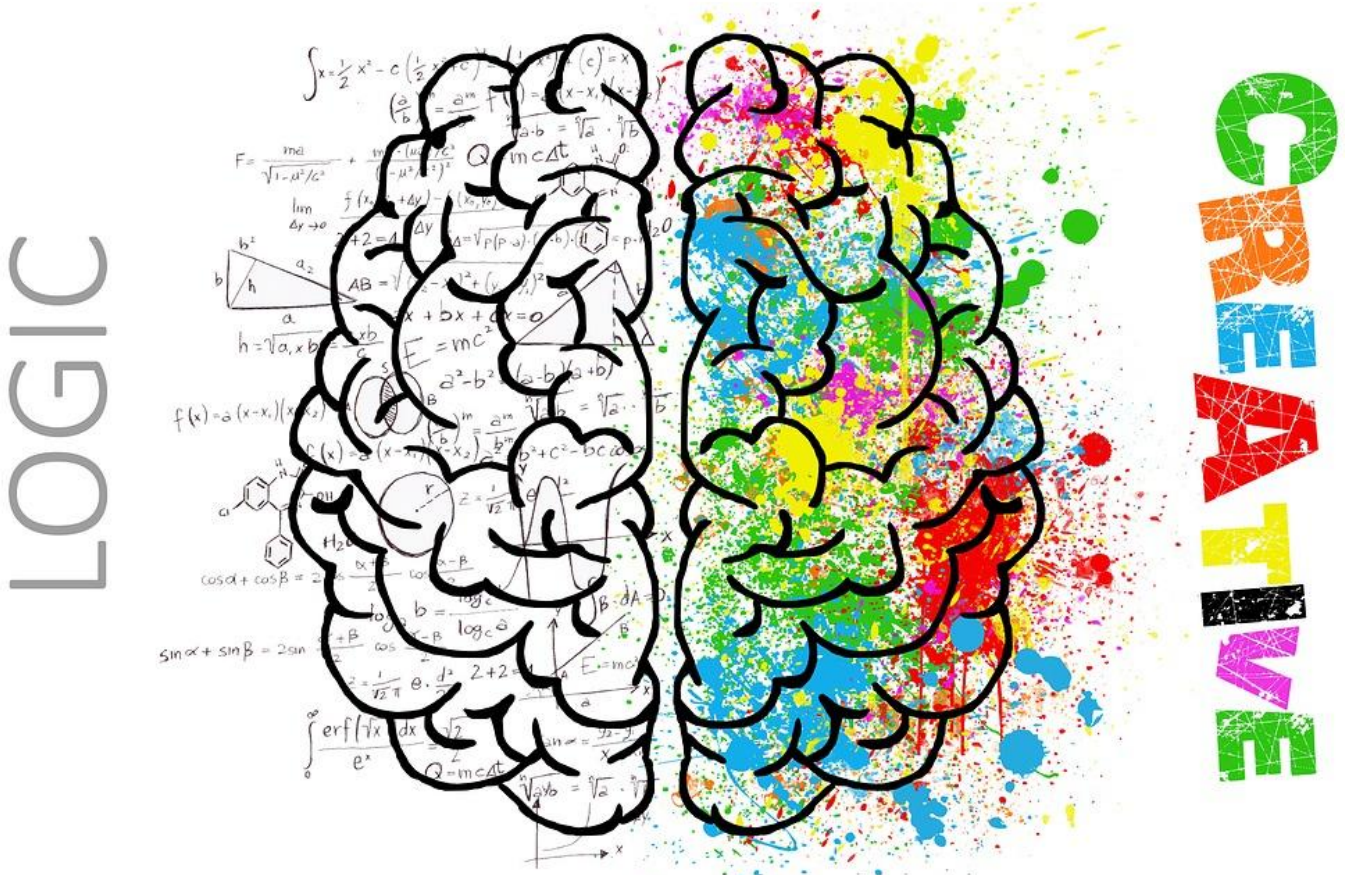
Two Compartments of the Brain



Conscious and subconscious

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The Creative Process

- Researches have shown that the creative process can be perceived to be a five step process. The process starts from problem identification and definition:
- Idea germination – the seeding stage of a new idea: Recognition
- Preparation – conscious search for knowledge: Rationalization
- Incubation – subconscious assimilation of information: Fantasizing
- Illumination – recognition of idea of being feasible: Realization
- Verification – test to prove idea has value: Validation
- The speed varies based on context and urgency.

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1. Idea Germination

- Exact mechanism is yet to be known.
- Experts believe that once a problem is identified, our brain starts exploring solutions from its own reservoir of information, starts making permutation and combination of the diverse pieces of information.
- It appears as if suddenly some combination emerges in the brain as a plausible solution.
- Gradually, pieces start falling into place.

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2. Preparation: Rationalization

- Once an idea is seeded, the brain embarks on conscious search for increasingly better fit of the solution to the problem.
- A continuous back & forth, between conscious and subconscious, information transfer on new solution vis-à-vis validations happen.

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3. Incubation: Fantasizing

- **Our subconscious takes charge as if we tell our subconscious to churn the idea and find a solution.**
- **The subconscious assumes control of the creative process, tirelessly works to find a solution without our conscious knowledge. This art of joining different pieces of information to create new knowledge by subconscious is known as *'synectics'*.**
- **Immediately on finding a solution, the subconscious relays the information to the conscious and we have the 'eureka' moment as if it came from nowhere, so all of a sudden.**

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It is not all so sudden though it appears so.

- We tend to think the idea appeared suddenly in a flash.
- The fact is that the subconscious did a lot of research to come to this stage.
- Some external stimuli may have aided the subconscious. Newton who have researched for decades to discover the gravity or Archimedes to discover buoyancy or Graham Bell the telephone.
- It is believed that we use the left-brain skills to harvest the right-brain ideas, as if the right brain is the wood and the left brain is the tool to do the curving.

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Our Subconscious is Much More Powerful than the Conscious Brain. The moot question is can we exploit it more than we usually tend to do.

Though there are not many empirical evidences, you may perhaps tell your subconscious to perform tasks.

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4. Illumination: Realization

- The conscious brain starts adding value to the idea from its cognitive reserve of knowledge.
- Iterates and validates repeatedly.
- A moment comes when it appears that the perfect solution has been received. You say ‘Aha, I see’.
- Illumination may trigger by an external event. Like Alexander Graham Bell and Marie Curie.

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5. Verification: Validation

- At this stage the cognitive brain takes over, helps to make prototypes, and helps to validate.
- Eventually, the idea is converted into a commercially relevant technology.

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Innovation and Entrepreneurship

- Entrepreneurial effort is essential to translate an illuminated idea into a validated, realistic, meaningful, and useful technology/product/ process/service.
- This process is often tedious and requires perseverance and commitment.
- Many ideas fall by the wayside.
- Very often aspiring entrepreneurs come to realize that someone somewhere has already filed a patent on the technology that has been assiduously developed with much of efforts, time, and resources.

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- The right brain skills are crucial for creative vision.
- But innovation does not occur until left-brain rationalization takes place.

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Design-Driven Innovation

Design-driven innovation aims to produce products that are useful and meaningful to customers.

It is about introducing new meaning in a product or service that gives customers unique experience and unique sense of wellbeing

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Meaning (Experience) in a Product

The meanings that a product or service might have for its users include the memories it invokes, the extent and quality of interaction and enjoyment.

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Add Meaning to Product through Design

Gain sustainable competitive advantage by giving customers unique experience

- **Technological innovations are important for business success. But capability to innovate meaning can add unique value that is difficult to emulate.**
- **Recent evidence is testimony that companies who are successful in packaging meaning in their offerings could create and maintain competitive advantage and brand value over a long period of time.**

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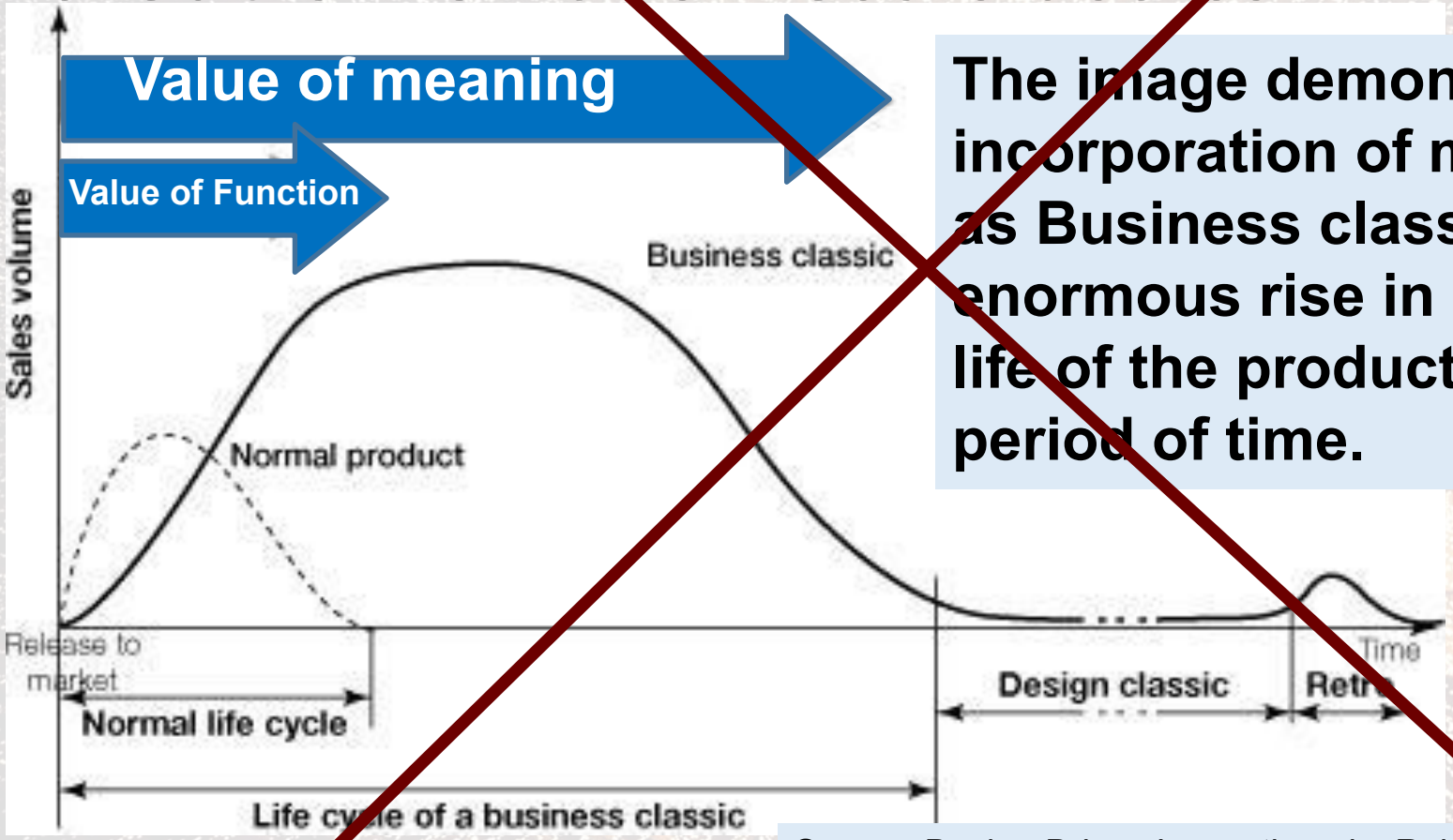
Meaning in a product or service

- The alternate path to innovation (alternative to the linear path) aims to discover not how things work, but why we need things. It gives customers something more meaningful—something they can love.
- Roberto Verganti describes the work of companies, including Nest Labs, Apple, Yankee Candle, and Philips Healthcare, that have created successful businesses by doing just this.
- Radically innovate the meaning of products and propose new reasons to buy them so that customers buy them repeatedly.

Reference: Design-driven Innovation: Changing the Rules of Competition by Radically Innovating what Things Mean
Book by Roberto Verganti

Radical innovation of meanings and the creation of business classics



The image demonstrate how incorporation of meaning (shown as Business classic) leads to enormous rise in sales volume and life of the product over a long period of time.

Source: Design-Driven Innovation - by Roberto Verganti

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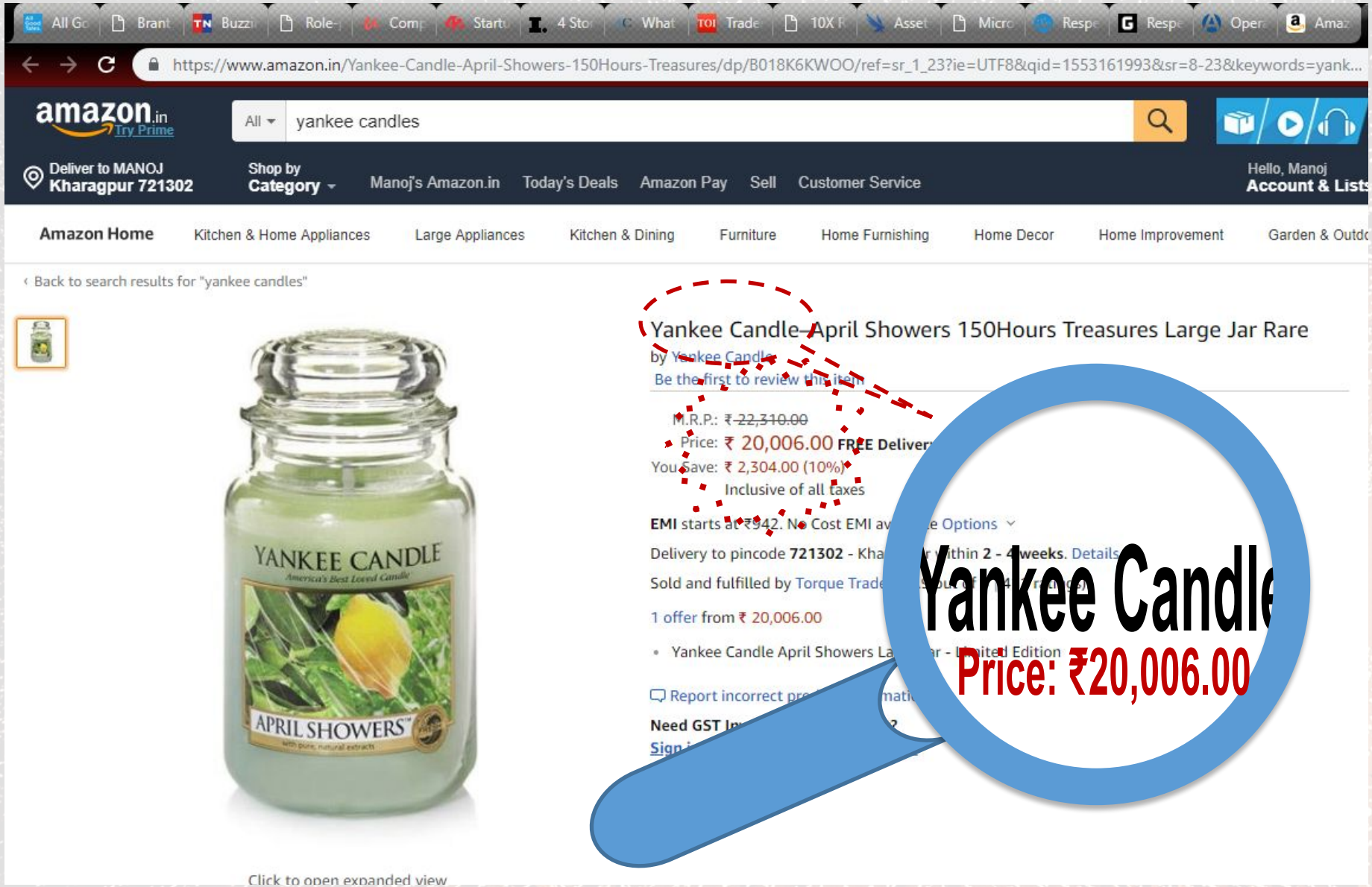

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The Alessi Bird Kettle

- Featuring the bird that sings when the water is boiling.
- It has transformed the breakfast experience in many households by infusing an aura of originality, uniqueness and prestige.
- Having sold millions of units, the Alessi 9093 kettle remains one of the Milan-based company's most successful products to date. New meaning giving new experience.

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Example: Nintendo introduced the Wii in 2006.

- The gaming industry's convention was that success of new consoles depended on more "power."
- Nintendo, instead of following this model to compete with Sony and Microsoft, focused their intent on how many more people they can get to play games.
- Nintendo innovators developed the wireless Wii remote that anyone could use with gestures and spatial movement.
- Games were converted from being sedentary to being ultra-active.
- Urban condo-dwellers, country ranchers, parents with children, and even grandparents started enjoying the Wii.

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Nintendo Wii

- Game console makers strive to add more power.
- Nintendo changed the game not by boosting power, but by introducing new meaning.
- Game is no longer a sedentary and inactive process, but a community based work-out with all the entertainment elements.

Picture courtesy: http://www.dashhacks.com/wii-u/wii-u-news/

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Design-Driven Innovation

- Design & Meaning – Innovating meaning that makes sense of things
- Design-Driven Innovation creates unique values - Brand equity, competitive position, and customer loyalty.
- Radical Push (radical innovation of meaning) – Rarely pulled by users but is proposed by firms.
- Technological innovation and innovation of meaning – Simultaneously excelling in both is the key.

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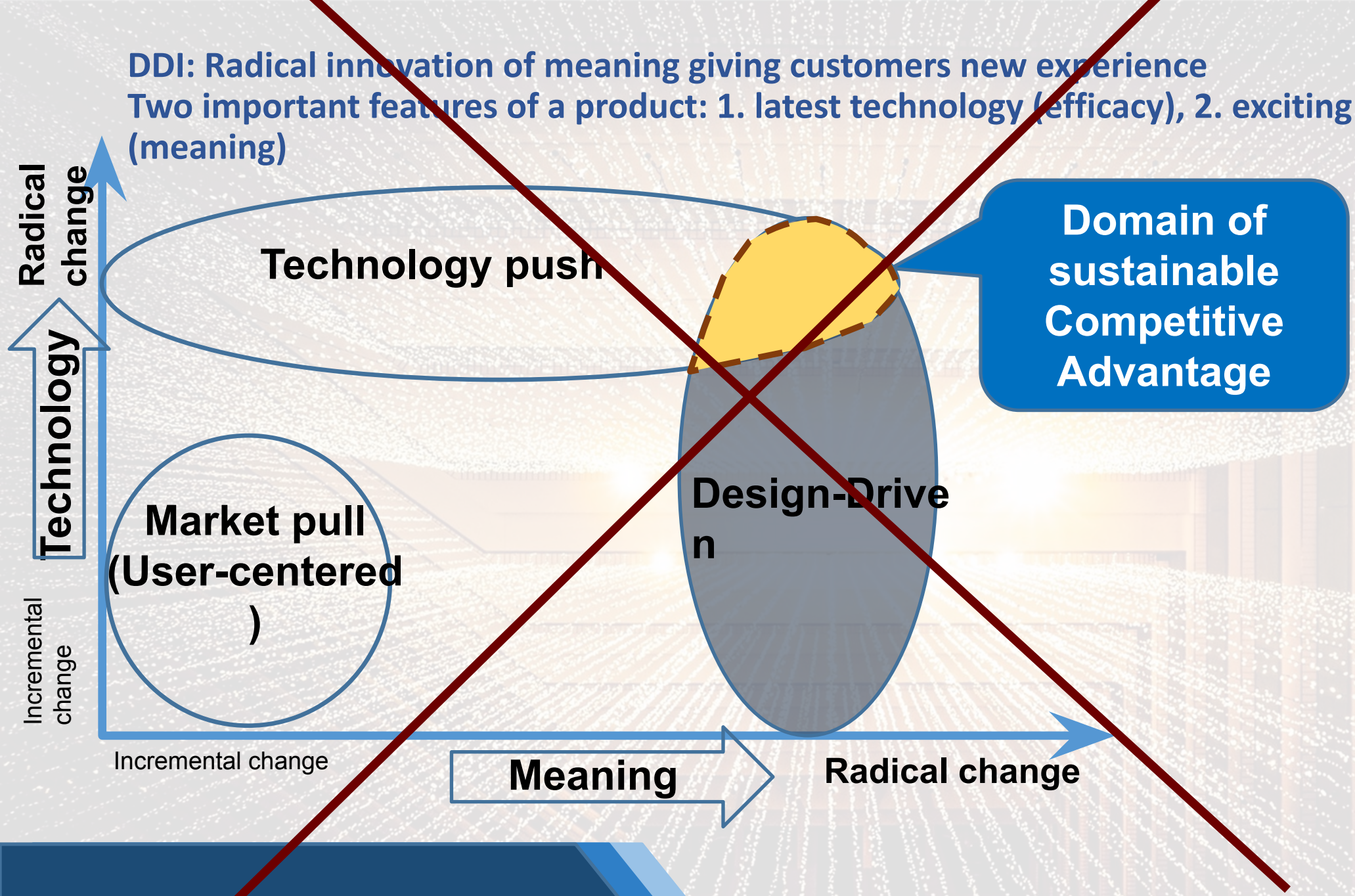
DDI: Radical innovation of meaning giving customers new experience
Two important features of a product: 1. latest technology (efficacy), 2. exciting experience (meaning)



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Process of Design-Driven Innovation (DDI)

- Listening – gaining access to new knowledge
- Interpreting (The interpreter) - combining the gathered knowledge with your own insights into a unique proposal
- Addressing - addressing the proposal via the interpreters, who prepare the people and context.

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Design-Driven Innovation

- Design-Driven Innovation is the strategy about the R&D process for innovating products or services that have new meanings that customers do not expect but they eventually love: those that convey new reason for customers to buy them.
- Products and services resulting out of design-driven innovation process provide unique sustainable competitive advantages.

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TRIZ

Theory of Inventive Problem Solving

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TRIZ – *"theory of inventive problem solving"* invented by the Russian engineer **Genrich Altshuller**

- **Altshuller noticed patterns in invention disclosures.**
- **Altshuller discovered that 98% of patented innovations originated from an already known principle.**
- **He found hat only 2% of all patents were based on ground breaking principles.**

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Image copyrighted by Oxford Creativity 2007
Oxford TRIZ illustrated by Clive Goddard

https://www.toolshero.com/problem-solving/triz-method/

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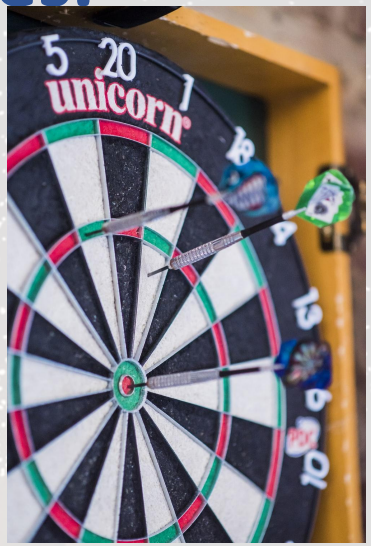
TRIZ espouses 5 basic principles for innovation initiatives.

TRIZ uses 40 inventive principles to facilitate innovations.



- The ideal end result
- It is important not to be complacent with some solution.
- There is always a better solution.
- Strive to find improvement and aim at an ideal solution.

However, we should remain mindful of the 80:20 rule

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The 5 basic principles of TRIZ for innovation initiatives.

02| Less is more

- This is related to lean manufacturing ethos.
- You must try to cut everything that can be eliminated without compromise on the fundamental functionalities.
- Spend the least possible amount of money.
- Chances are the objective can be realized with available materials and sometimes the solution is close at hand.

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The 5 basic principles of TRIZ for innovation initiatives.

03| Solutions already exist

- Almost all problems can be solved using some existing principles.
- One has to search within and outside the specific knowledge domains in search for solutions.
- This can reduce time, money, and man-hours and accelerate the innovation process.

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The 5 basic principles of TRIZ for innovation initiatives.

04|

- Search for fundamental contradictions
- Problems can be thought of as contradiction to solutions.
- Most problem-solution has conflicting requirements.
- If the contradictions can be accurately identified, solution will emerge. Don't compromise.

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The 5 basic principles of TRIZ for innovation initiatives.

05| Lines of evolution

- All systems are part of nature.
- Nothing evolves in nature randomly that drastically disrupts nature.
- Changes follow some patterns and by studying the patterns, it is possible to predict how technology has to evolve.

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TRIZ IS

A way of accessing the **collective creativity** of humanity built over centuries

An **attitude** to problem solving that can accelerate the process of finding solution

A set of systematic thinking tools to help you think **systematically** in innovation process

Invention

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Some wonderful reference material by Oxford Creativity

- https://www.slideshare.net/assocpm/structured-innovation-for-pm-triz-problem-solving-method
- https://www.toolshero.com/problem-solving/triz-method/

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Book reference

- **Simplified TRIZ: New Problem Solving Applications for Technical and Business Professionals - by -** Kalevi Rantanen, David W. Conley, Ellen R. Domb, Publisher: Productivity Press;Taylor & Francis, Year: 2018
- Web resources:

http://www.triz40.com/

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TRIZ

- TRIZ is considered an Algorithm.
- It is a step by step process and can be termed an empirical method.
- It's primary premise is that innovation can be taught.
- Also that problems may be coded, classified and solved methodically.
- Applying TRIZ helps to reduce the number of trials & make some kind of quick short-cut to solution.

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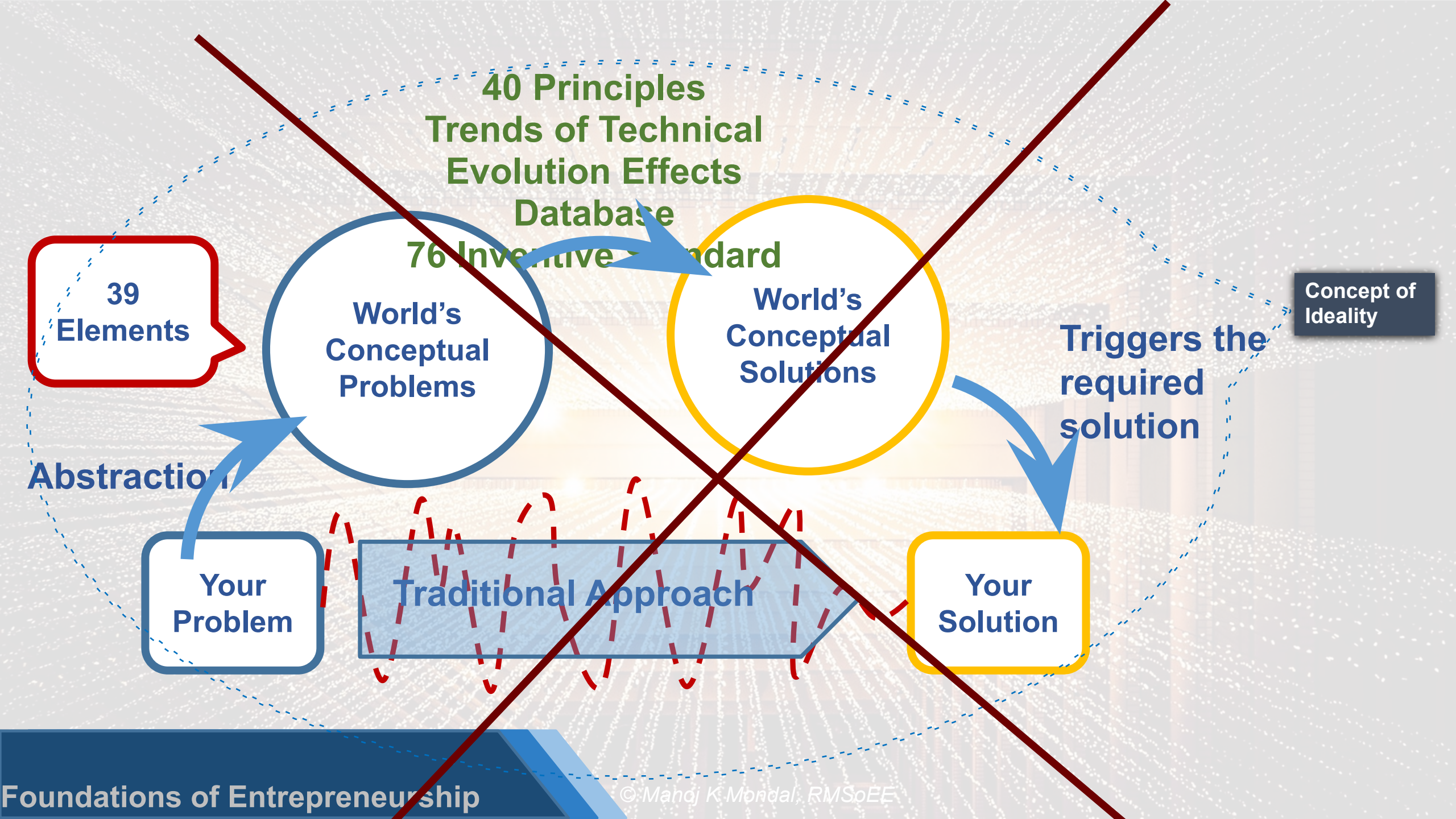

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TRIZ may reduce Product Development Time, Cost, and other Resources and Ensure Greater Success.

- Manufacturing industry averages about one product success for every 3,000 ideas generated.
- This proportion has remained virtually unchanged over the past many decades.
- So companies waste approximately half of their development budgets on products that never reach the consumer or that fail after commercialization.
- One problem is that new products lack design sensibilities.
- The dilemma is that companies have to innovate to remain competitive.
- TRIZ attempts to circumvent the many mediocre solutions and get directly to the best solution faster.

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39 Parameters or contradictions and 40 Inventive Principles

- Altshuller identified 39 contradictions or parameters and 40 inventive principles.
- In TRIZ process, each innovative initiative can be related to one or more of these principles that would help a solution.
- To arrive at the appropriate inventive principle, one has to be able to identify the right contradiction in a matrix.
- Once the inventive principles are located, the problem solving process can begin.

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Ideality: A Metric to Measure Progress Towards the Ideal Final Result (IFR)

- The ideal final solution:
  - Eliminates the deficiencies of the original system
  - Preserves the advantages of the original system
  - Does not make the system more complicated
  - Does not introduce new disadvantages

$$Ideality = \frac{\sum Benefit}{\sum Cost + \sum Harm}$$

- **Improvement is to increase benefit**
- **Reduce cost**
- **Reduce harm**

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The 39 TRIZ Features for technical contradictions or Technical parameters or Problem parameters

1: Weight of moving object	14: Strength	27: Reliability
2: Weight of stationary object	15: Durability of moving object	28: Measurement accuracy
3: Length of moving object	16: Durability of non moving object	29: Manufacturing precision
4: Length of stationary object	17: Temperature	30: Object-affected harmful
5: Area of moving object	18: Illumination intensity	31: Object-generated harmful
6: Area of stationary object	19: Use of energy by moving object	32: Ease of manufacture
7: Volume of moving object	20: Use of energy by stationary object	33: Ease of operation
8: Volume of stationary object	21: Power	34: Ease of repair
9: Speed of object	22: Loss of Energy	35: Adaptability or versatility
10: Force (Intensity)	23: Loss of substance	36: Device complexity
11: Stress or pressure	24: Loss of Information	37: Difficulty of detecting
12: Shape	25: Loss of Time	38: Extent of automation
13: Stability of the object	26: Quantity of substance	39: Productivity

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Altshuller's 40 Principles of invention of TRIZ

1. Segmentation
2. Taking out
3. Local Quality
4. Asymmetry
5. Merging
6. Universality
7. "Nested doll"
8. Anti-weight
9. Preliminary anti-action
10. Preliminary action
11. Beforehand cushioning
12. Equipotentiality
13. The other way around
14. Spheroidality
15. Dynamics
16. Partial or excessive actions
17. Another dimension
18. Mechanical vibration
19. Periodic action
20. Continuity of useful action
21. Skipping
22. "Blessing in disguise"
23. Feedback
24. 'Intermediary'
25. Self-service
26. Copying
27. Cheap short-living
28. Mechanics substitution
29. Pneumatics and hydraulics
30. Flexible shells and thin films
31. Porous materials
32. Color changes
33. Homogeneity
34. Discarding and recovering
35. Parameter changes
36. Phase transitions
37. Thermal expansion
38. Strong oxidants
39. Inert atmosphere
40. Composite material films

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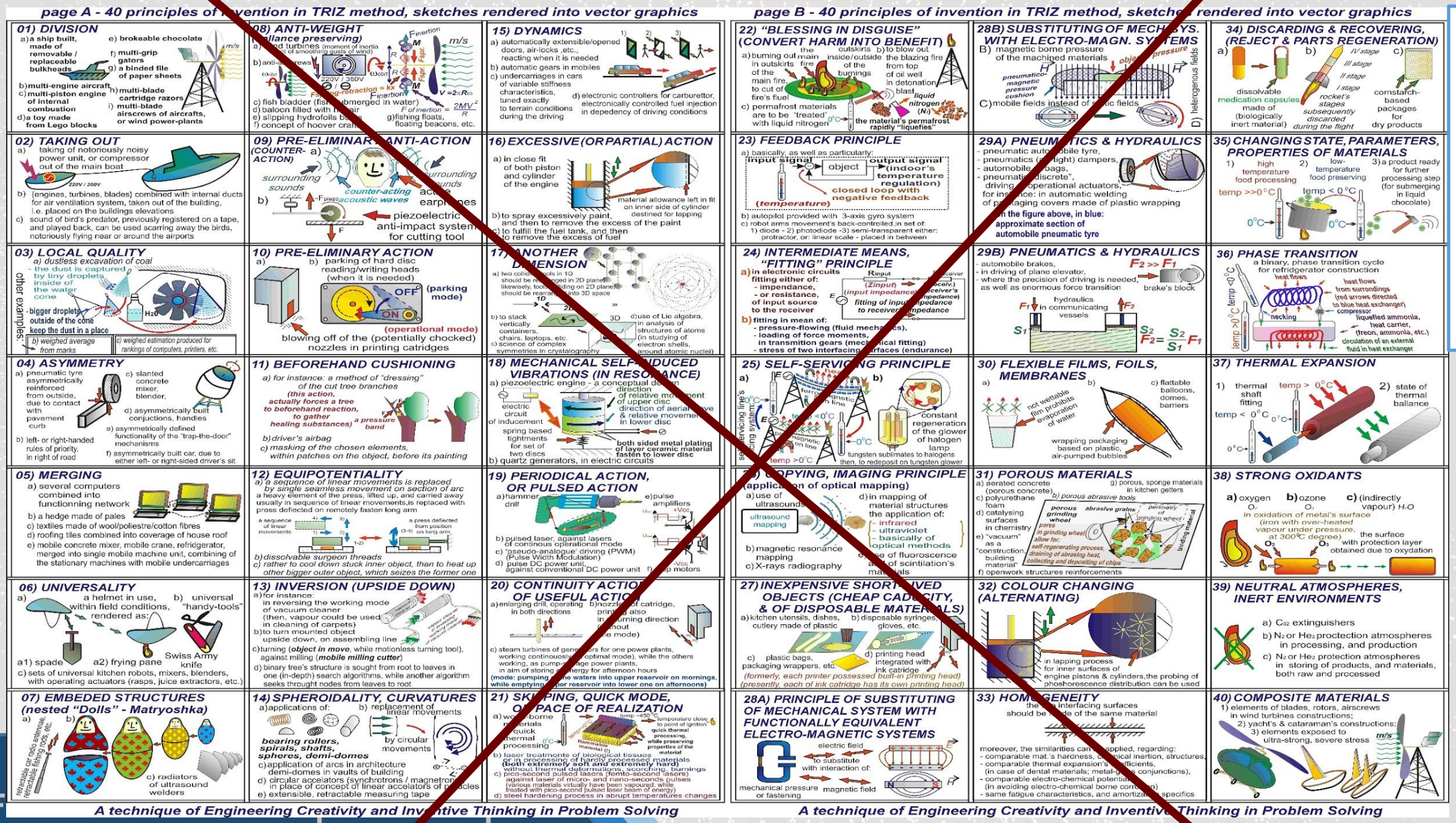
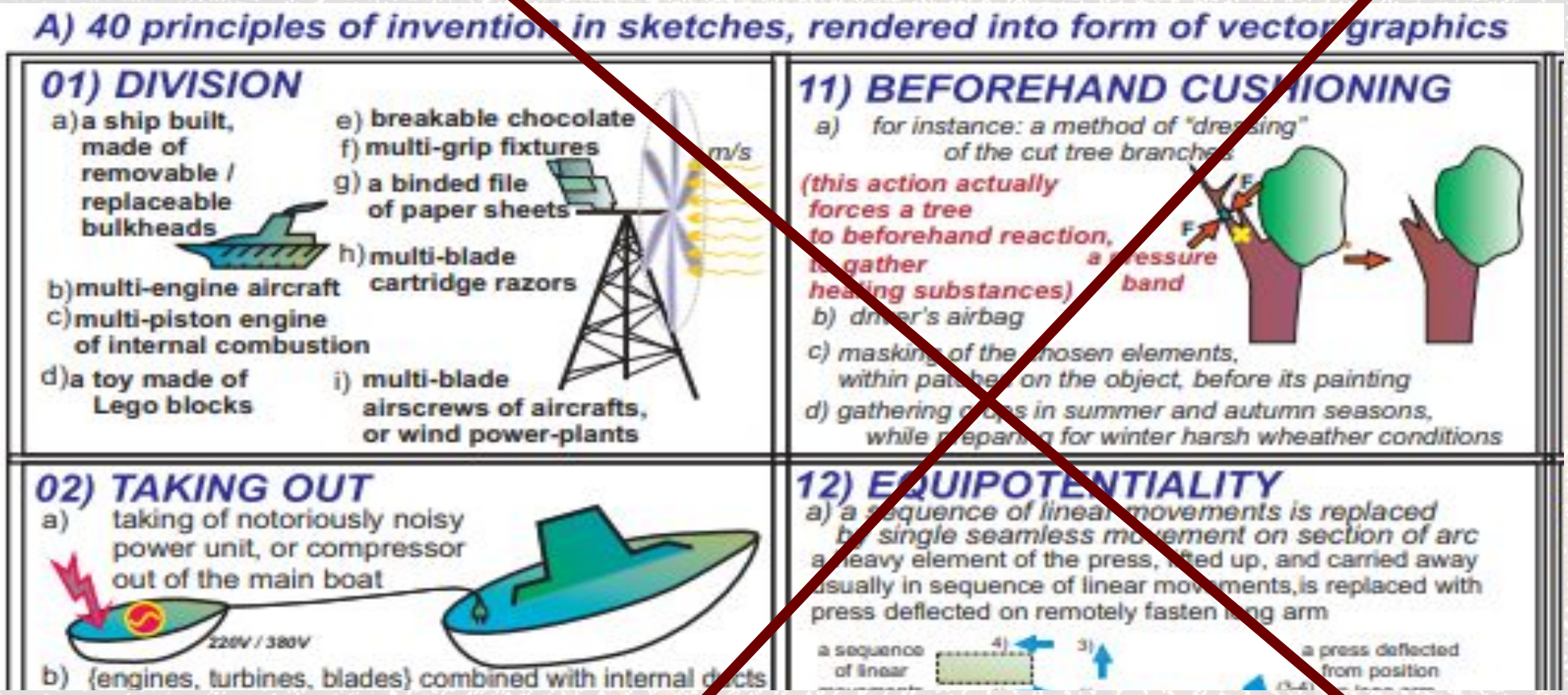


Source: wikipedia

TRIZ – developed by Genrich Altshuller

Image from https://en.wikipedia.org/wiki/TRIZ

39 Parameters and 40 Inventive Principles



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Steps

1. Identify contradictions of your problem solving context.
2. Locate one-set of the contradictions in the matrix leading to a particular cell in the matrix.
3. You find four (or less) numbers in the cell.
4. Find the invention principles corresponding to these numbers in the cell from the list of 40.
5. Interpret the possible and relevant inventive actions out of the many that the inventive principles may indicate.

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Contradiction matrix

Making a table that is strong but lightweight

	Worsening Factor->	Weight of Moving Object	Weight of Stationary Object	Length of Moving Object
	Improving Factor	1	2	3
1	Weight of Moving Object			15,8,29,34
2	Weight of Stationary Object			
3	Length of Moving Object	8,15,29,34		
4	Length of Stationary Object		35,28,40,29	
5	Area of Moving Object	2,17,29,4		14,15,18,4
6	Area of Stationary Object		30,2,14,18	
7	Volume of Moving Object	2,26,29,40		1,7,4,35
8	Volume of Stationary Object		35,10,19,14	19,14
9	Speed	2,28,13,38		13,14,8
10	Force	8,1,37,18	18,13,1,28	17,19,9,36
11	Stress or Pressure	10,36,37,40	13,29,10,18	35,10,36
12	Shape	8,10,29,40	15,10,26,3	29,34,5,4
13	Stability of object's composition	21,35,2,39	26,39,1,40	13,15,1,28
14	Strength	1,8,40,15	40,26,27,1	1,15,8,35
15	Duration of Action of Moving Object	19,5,34,31		2,19,9
16	Duration of Action of Stationary Object		6,27,19,16	
17	Temperature	36,22,6,38	22,35,32	15,19,9
18	Illumination Intensity	19,1,32	2,35,32	19,32,16
19	Use of Energy by Moving Object	12,18,28,31		12,28
20	Use of Energy by Stationary Object		19,9,6,27	
21	Power	8,36,38,31	19,26,17,27	1,10,35,37
22	Loss of Energy	15,6,19,28	19,6,18,9	7,2,6,13
23	Loss of Substance	35,6,23,40	35,6,22,32	14,29,10,39

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Contradiction Matrix of the Airbag problem
Row 15 & Column 31

	Worsening Feature → / Improving Feature ↓	Volume of moving object	Speed	Force (Intensity)	Stress or pressure	Shape	Reliability	Object-generated harmful factors	Ease of operation	Ease of repair	Device complexity	Difficulty of detecting and measuring
		7	9	10	11	12	27	31	33	34	36	37
9	Speed	7, 29, 34	+	13, 28, 15, 19	6, 18, 38, 40	35, 15, 18, 34	12, 35, 27, 28	2, 24, 35, 21	32, 28, 13, 12	34, 2, 28, 27	10, 28, 4, 34	3, 34, 27, 16
10	Force (Intensity)	15, 9, 12, 37	13, 28, 15, 12	+	18, 21, 11	10, 35, 40, 34	3, 35, 13, 21	13, 3, 36, 24	1, 28, 3, 25	15, 1, 11	26, 35, 10, 18	36, 37, 10, 19
11	Stress or pressure	6, 35, 10	6, 35, 36	36, 35, 21	+	35, 4, 15, 10	10, 13, 19, 35	2, 35, 27, 18	11	2	19, 1, 35	2, 36, 37
12	Shape	14, 4, 15, 22	35, 15, 34, 18	35, 10, 37, 40	34, 15, 10, 14	+	10, 40, 16	35, 1	32, 15, 26	2, 13, 1	16, 29, 1, 28	15, 13, 39
15	Duration of action of moving object	10, 2, 19, 30	3, 35, 5	19, 2, 16	19, 3, 27	14, 26, 28, 25	11, 2, 13	21, 39, 16, 22	12, 27	29, 10, 27	10, 4, 29, 15	19, 29, 39, 35
33	Ease of operation	1, 16, 35, 15	18, 13, 34	28, 13, 35	2, 32, 12	15, 34, 29, 28	17, 27, 8, 40		+	12, 26, 1, 32	32, 26, 12, 17	

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- Principle 21. Skipping

  A. Conduct a process , or certain stages (e.g. destructible, harmful or hazardous operations) at high speed.

- Principle 39. Inert atmosphere

  A. Replace a normal environment with an inert one.

  B. Add neutral parts, or inert additives to an object.

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- Principle 16. Partial or excessive actions

  A. If 100 percent of an object is hard to achieve using a given solution method then, by using ‘slightly less’ or ‘slightly more’ of the same method, the problem may be considerably easier to solve.

- Principle 22. “Blessing in disguise” or “Turn Lemons into Lemonade”

  A. Use harmful factors (particularly, harmful effects of the environment or surroundings) to achieve a positive effect.

  B. B. Eliminate the primary harmful action by adding it to another harmful action to resolve the problem.

  C. C. Amplify a harmful factor to such a degree that it is no longer harmful.

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TRIZ Is an Empirical Method

- TRIZ reduces number of iterations [so 99% perspiration may be reduced].
- There are several methods for increasing innovation.
  - Brainstorming
  - Synectics
  - Lateral Thinking
  - Neuro-linguistic Programming
  - Mind Mapping

TRIZ is designed to overcome Psychological Inertia, which is due to habits, education, paradigms, internal processes, past successes, past failures.

TRIZ directs the solution path using a problem-solution matrix.

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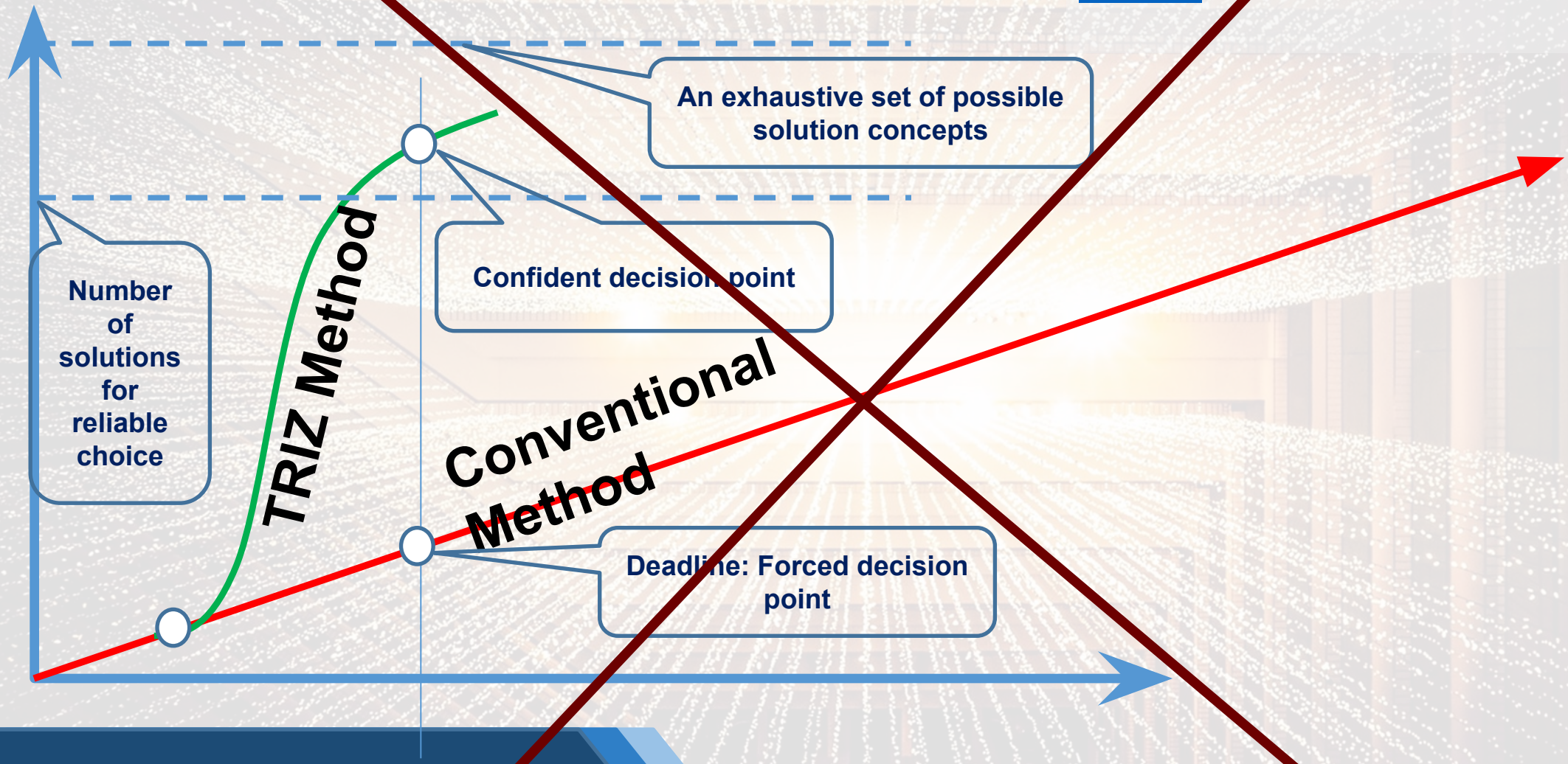
The graphical presentation has been prepared based on the presentation by NASA at https://www.slideshare.net/PersianGuru/triz2-12304568450882912



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Six Concepts

The problem-solving model uses six concepts:

- Contradiction
- Resources
- The ideal final result
- Functional analysis
- The patterns of evolution (called "the increase of interactions.") and
- Innovative principles.

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Six Concepts

1. Contradiction: Solving a problem means removing a contradiction.
2. Resources: Resources are available, but idle and often invisible substances, energy, properties, and other things in or near the system can be used to resolve the contradiction.
3. Ideal Final Result: The Ideal Final Result is achieved when the contradiction is resolved. The desired features should be obtained without compromise.

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Six Concepts

4. Functional analysis: Systems exist to create a functional output. Understanding systems functionally provides great insight into how the output is achieved and uncovers problems (contradictions), potential resources and, therefore, opportunities.
5. Patterns of evolution: Systems evolve according to certain patterns, not accidentally. The patterns can be used many ways to get new ideas and predict the evolution of the system.
6. Innovative principles: These principles give concrete cues for solutions and illustrate what the patterns can mean.

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Design

Form, function and experience

It is a rejection of the practice of viewing a product as a bunch of features stacked together.

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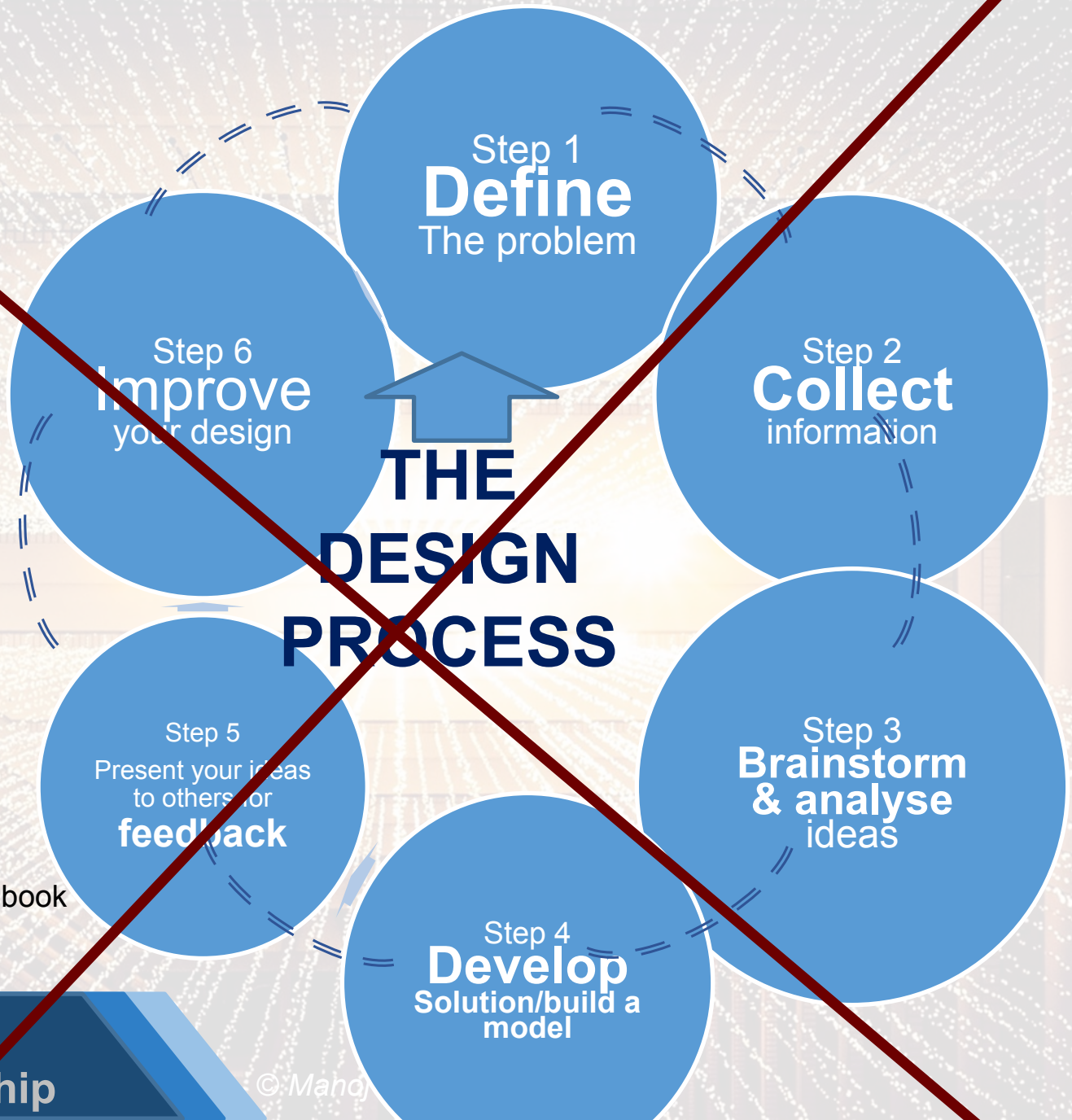
Design Process

The Design Process is a systematic approach to break down the phases of developing solutions to variety of problems.



Source: https://www.discoverdesign.org/handbook

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Design Thinking

for developing products, processes, services

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Design Thinking

- **Design thinking is "a discipline that uses the designer's sensibility and methods to match people's needs with what is technologically feasible and what a viable business strategy can convert into customer value and market opportunity." - Tim Brown of IDEO**

- ***Thinking like a designer can transform the way you develop products, services, processes—and even strategy.***

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- “To harvest the power of design thinking, individuals, teams, and organizations have to cultivate optimism. People have to believe that it is within their power to create new ideas that will serve unmet needs and that will have a positive impact.” - Tim Brown
- Whether you believe it or not, you are a designer. You have the ability to make observations about your surroundings, create simple prototypes, and experiment with new solutions.

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Continued

- In the process you can be more creative.
- Your designs will increasingly match the needs of the target group.

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- **Design Thinking**
  - Encourages people to explore alternatives
  - Creating options that did not exist before
  - Focuses on the needs of the users.
- **It is not just about the functionality**
- **It is about sensibilities. , it is about the context, the culture of the stakeholders.**
- **Direct observation and qualitative data whcih creates stories that people can empathise with. once the problem is understood the problem solver is more apt to define what the real problem.**
- **after diagnosing the true problem its time to ideate or brainstorm new ideas without the constraints of existing solutions because Design thinkers learn by doing these radical ideas are then made into simple prototypes that test possible outcomes rapid prototyping speed up the innovation process.**
- **The process of ideating, prototyping and testing is repeated early on so that mistakes are quick cheap and ultimately lead to success. So, why design thinking?**

Stanford - David Kelley & Tim Brown

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Design Thinking: More Explanation

- Design Thinking is a methodology that imbues the full spectrum of innovation activities with a human-centered design ethos.
- Need to designing products or services through direct observation, of what people want and need in their lives and what they like or dislike about the way particular products are made, packaged, marketed, sold, and supported.

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Design Thinking: Design Mindset

A design mindset is not problem-focused, it's solution focused and action oriented towards creating a preferred future.

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- Effective design thinking entails more than applying design methods. To produce the best outcomes, organizations need to develop — and trust — peoples' design sensibilities.
- Design thinking is receiving a great deal of attention as increasing numbers of innovative organizations succeed in solving complex problems by creative means. In doing so, many of these firms implement specific "design methods" such as observational research, iterative prototyping and storytelling alongside more mainstream approaches. But as any professional designer will attest, design thinking entails much more than applying methods: to create value, methods must be applied together with design sensibilities.

- You have to be able view the world in someone else's perspective. Can you appreciate the architectural beauty of a city as an architect would do?

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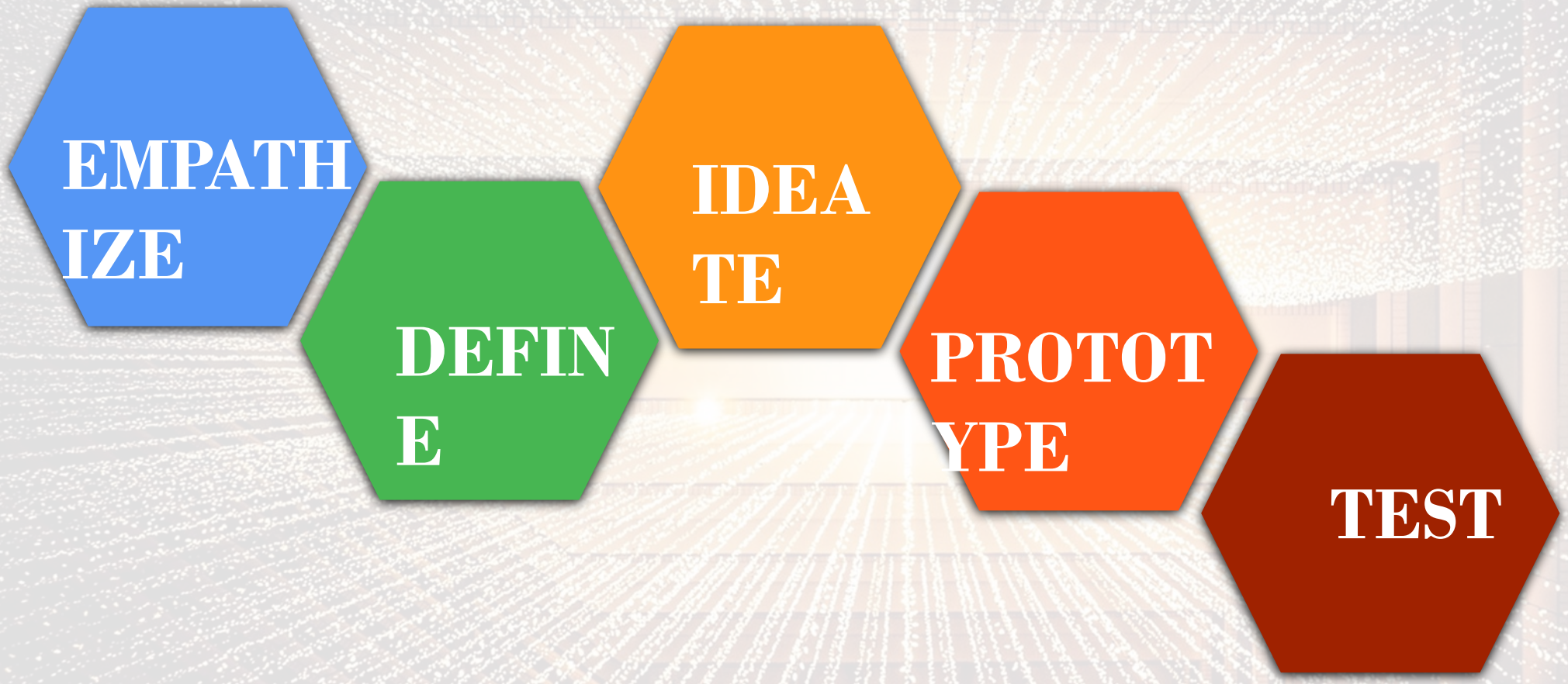
Design Thinking Steps to Innovation



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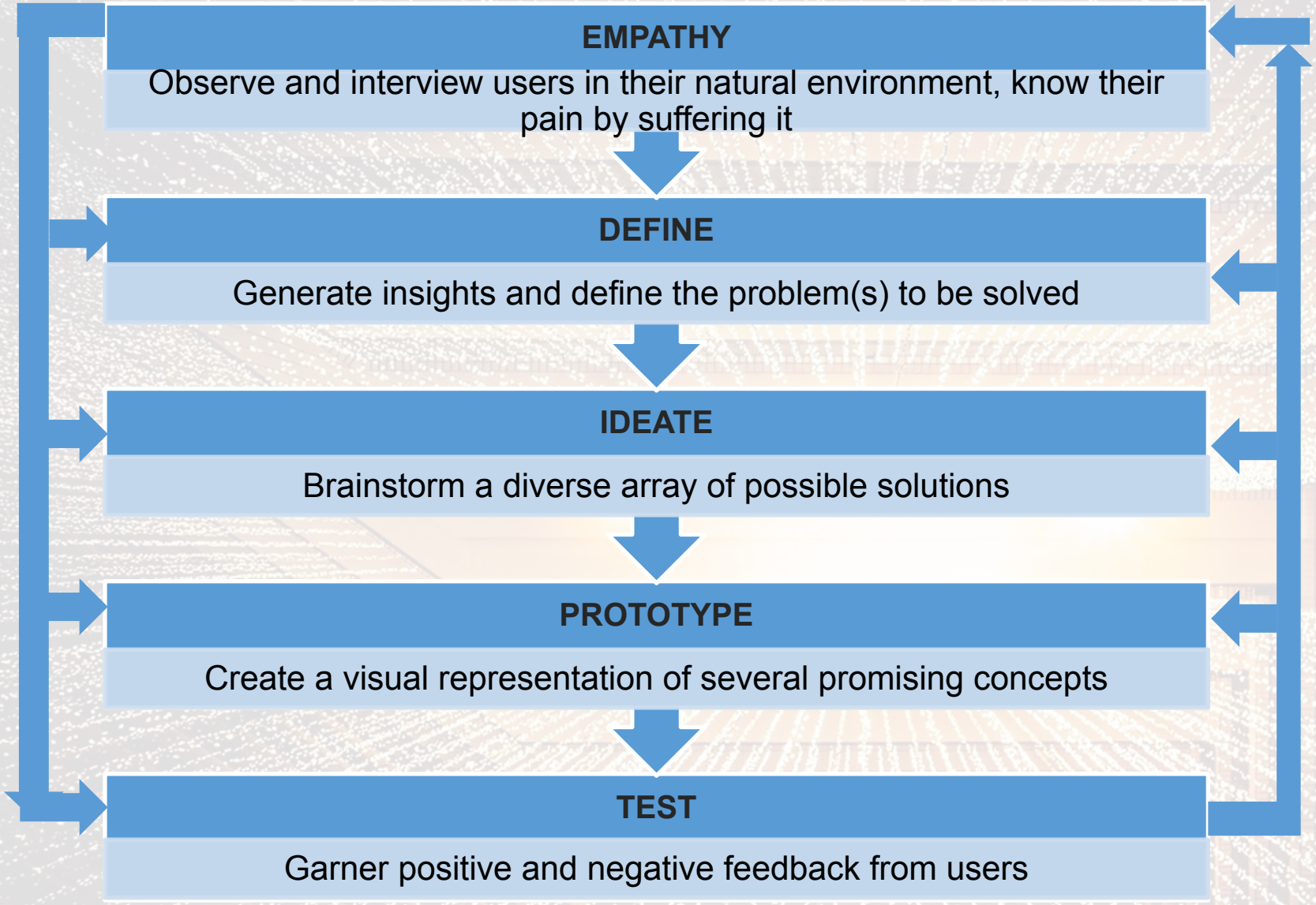
Design Thinking



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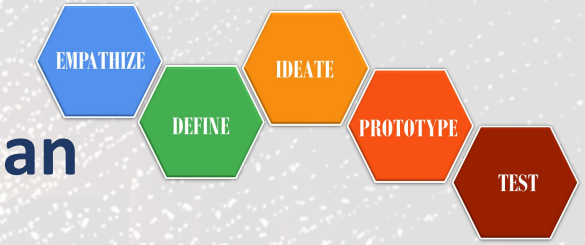
Empathize



- The best solutions come out of the best insights into human behavior.
- Design Thinking is about getting outside your own perspective and getting informed and inspired by the people you're creating for.

Why?

- Because our minds automatically filter out a lot of information without us even realizing. We need to see things "with a fresh set of eyes," and empathizing gives us those new eyes.

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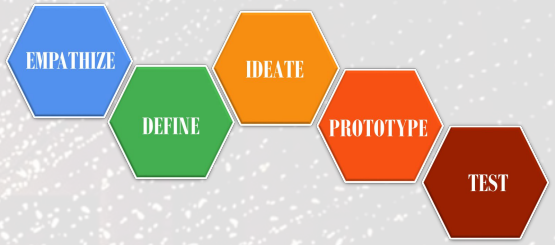

Empathize

- Observe – understand the challenges
- Listen – new ideas should be inspired by the description of the problem by the users. Sometimes users come up with great new ideas.
- Watch and engage – It is the combination of the above two.
- Understand the perspectives of users you are designing for is the foundation of human-centered innovation.
- Empathizing enables to discover the emotions that guide peoples' behavior and helps to capture physical manifestations of experiences.
- Your understanding defines the design space to a large measure.

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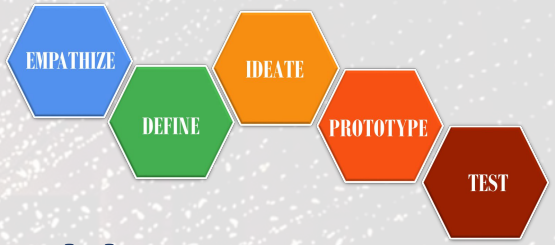
Define and Redefine (the problem)



- Empathizing gives the sense of the issue and define the problem.
- The goal is to craft an actionable problem statement.
- Synthesize the information, discover the connections and patterns.
- Comprehensiveness of the solution depends on how comprehensively you define the problem an aspiration of the customers.
- Continue to define and redefine the problem statement from the user perspective in order to generate more profound ideas for the purpose of developing thorough human-centered prototypes.

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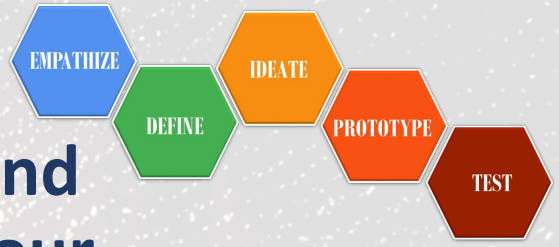
Ideate



- There are always many possible solutions. Try stepping beyond obvious solutions and increase the innovation potential of your solution set.
- Avoid following the bitten track or preconceived path. Uncover unexpected areas. Don’t throw away any idea as being crazy.
- Brainstorm to harness the collective perspectives and strengths of your teams. Listen to all and curate discrete ideas into optimum solution.
- During the process, you are expected to generate lots of ideas till you find the unique solutions.

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Divergence and convergence

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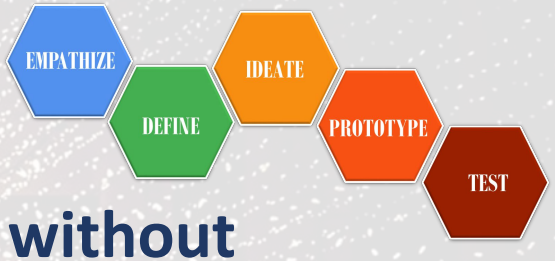
Idea Generation



- Design thinking advocates generation of large number of ideas without much attention to tenability, practicality, or realism.
- Let there be divergence of ideas at the beginning.
- Analyze all ideas without bias and gradually converge to a limited number, may be one or two for further brainstorming and prototyping.
- Keep a sharp eye on users' perspective from all possible angles such as economy, culture, unique environment of working, available infrastructure & utilities (road, power, fuel, water), maintainability, serviceability, preservability, etc.
- Converge to the best possible framework of the design under given circumstances.

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Prototype

- Prototyping is revealing. Challenges remain hidden at the idea stage. Ideas are intangible. Prototype provides realistic view and you get to know the limitations of the idea.
- Prototype provides opportunity for fast failing and you can pivot with refined ideas limiting the time and resources spent on an untenable idea.
- Prototype enables a practical engagement with the users and you get deeper empathy.
- Build rough prototypes to learn how to make ideas better.

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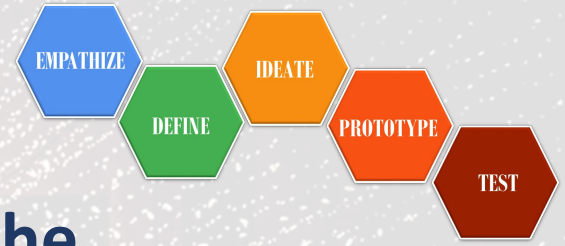
Test



- Put the prototype to perform in the actual context, invite the users, check the efficacy, get feedback.
- Be mindful that users are not always complete in describing their problem and scope of possible solution. They will reveal further once the prototype is before them. In the process, you get deeper understanding of hidden user needs.
- Expect negative surprises that will help redesign or ideate afresh.

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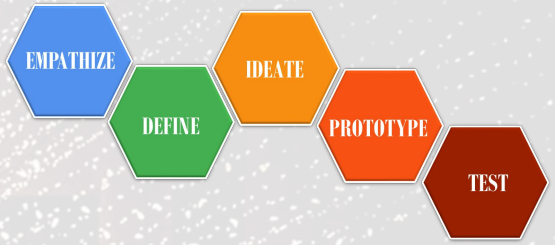
Redefine if necessary



- Continuously obtain customers' feedback and solve residual issues, meet their incremental expectations and aspiration.
- With all the hard work, a product launched successfully may not be able to receive growing customers' acceptances. Further refinements (at times complete redesigning) is almost always necessary.

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Profile of a Design Thinker - 1

- **Empathy.**

They can imagine the world from multiple perspectives—those of colleagues, clients, end users, and customers (current and prospective). By taking a "people first" approach, design thinkers can imagine solutions that are inherently desirable and meet explicit or latent needs.

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Profile of a Design Thinker - 2

- **Integrative thinking.**

They not only rely on analytical processes (those that produce either or choices) but also exhibit the ability to see all of the salient—and sometimes contradictory—aspects of a confounding problem and create novel solutions that go beyond and dramatically improve on existing alternatives.

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Profile of a Design Thinker -3

- **Optimism.**

They assume that no matter how challenging the constraints of a given problem, at least one potential solution is better than the existing alternatives.

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Profile of a Design Thinker -4

- **Experimentalism.**

Significant innovations don’t come from incremental tweaks. Design thinkers pose questions and explore constraints in creative ways that proceed in entirely new directions.

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Profile of a Design Thinker -5

- **Collaboration.**

The increasing complexity of products, services, and experiences has replaced the myth of the lone creative genius with the reality of the enthusiastic interdisciplinary collaborator.

The best design thinkers have significant experience in more than one domains.

IDEO is known to employ people who are engineers *and* marketers, anthropologists *and* industrial designers, architects *and* psychologists.

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Design and Simplicity

- “That’s been one of my mantras — focus and simplicity. Simple can be harder than complex. You have to work hard to get your thinking clean to make it simple. But it’s worth it in the end because once you get there, you can move mountains.” - Steve Jobs
- Simplicity - It is a design philosophy that is championed by many successful companies and fans of the products made by those companies alike.

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Four Ways to Make the Design Simple

1. Maintain Clarity: Understand and Design for your Users' Main Goals
2. Make Use of Automation: Design for a Minimum Amount of Conscious and Cognitive Effort
3. Limit Options: Design for a Strong "Information Scent"
4. Reduce the Gulf of Execution: Make your Users see how your Product can Help them Achieve their Goals

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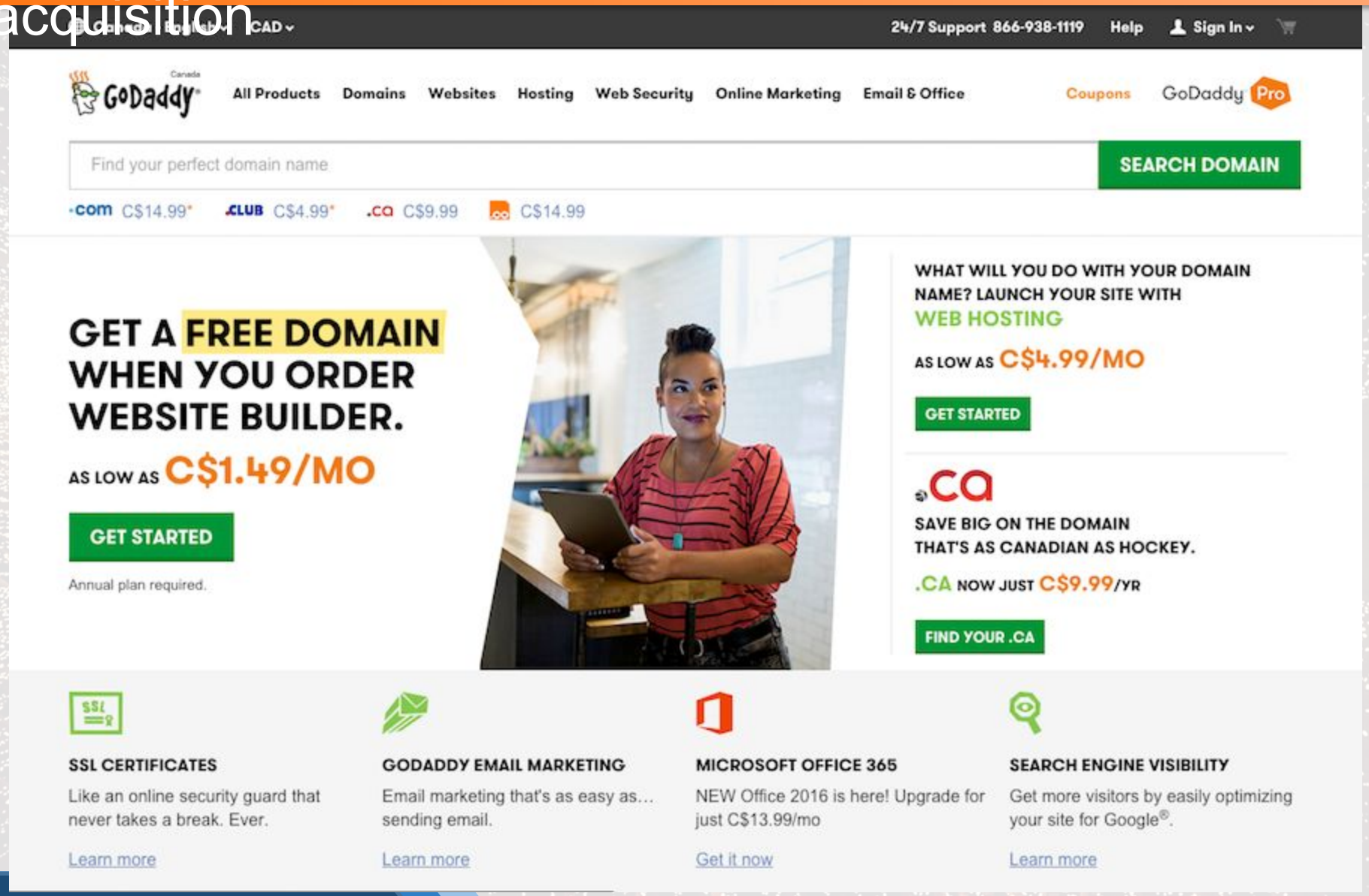
A cluttered complex design of a landing page

Simplified with transformative change in customer acquisition



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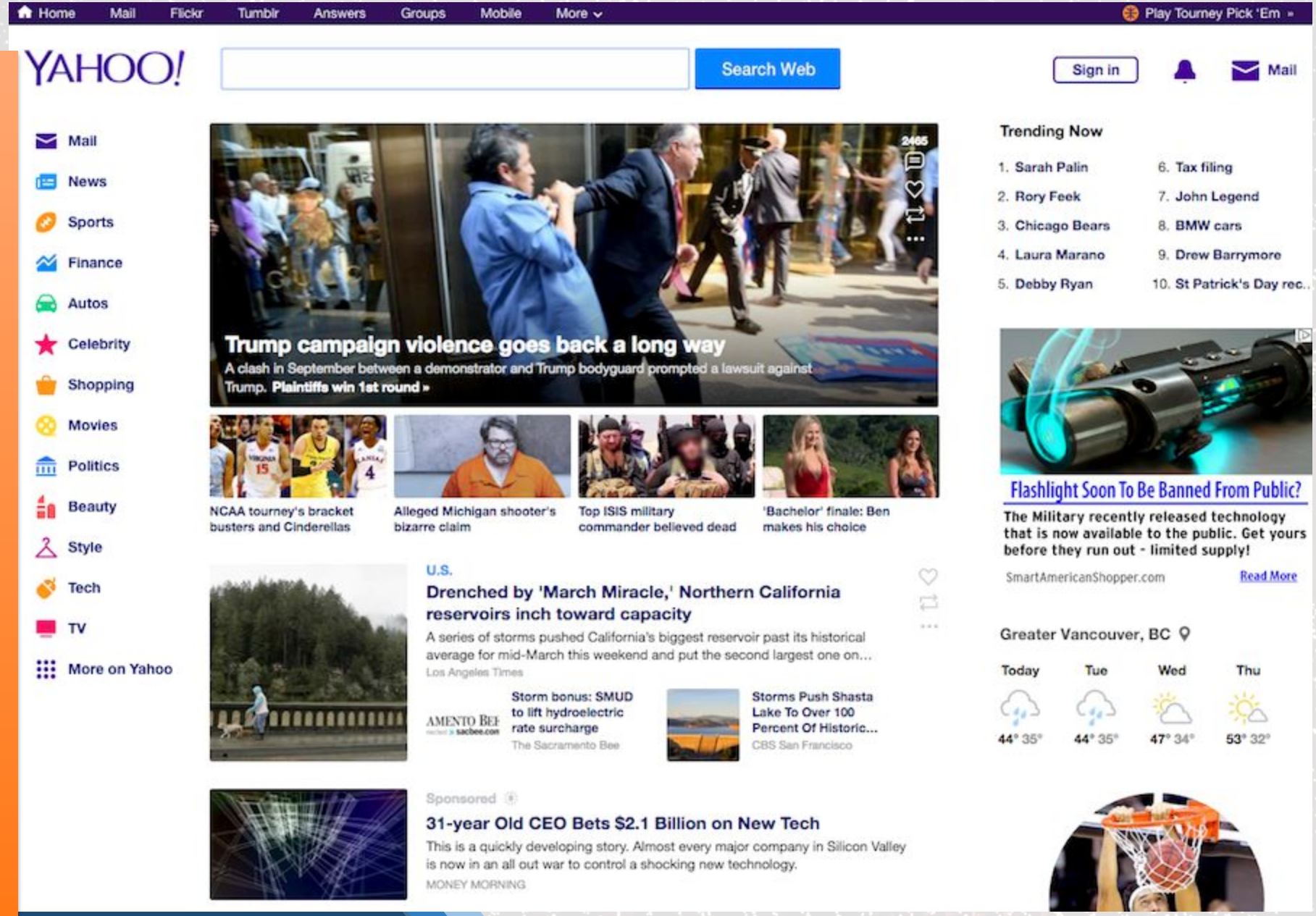
Compare this with Google



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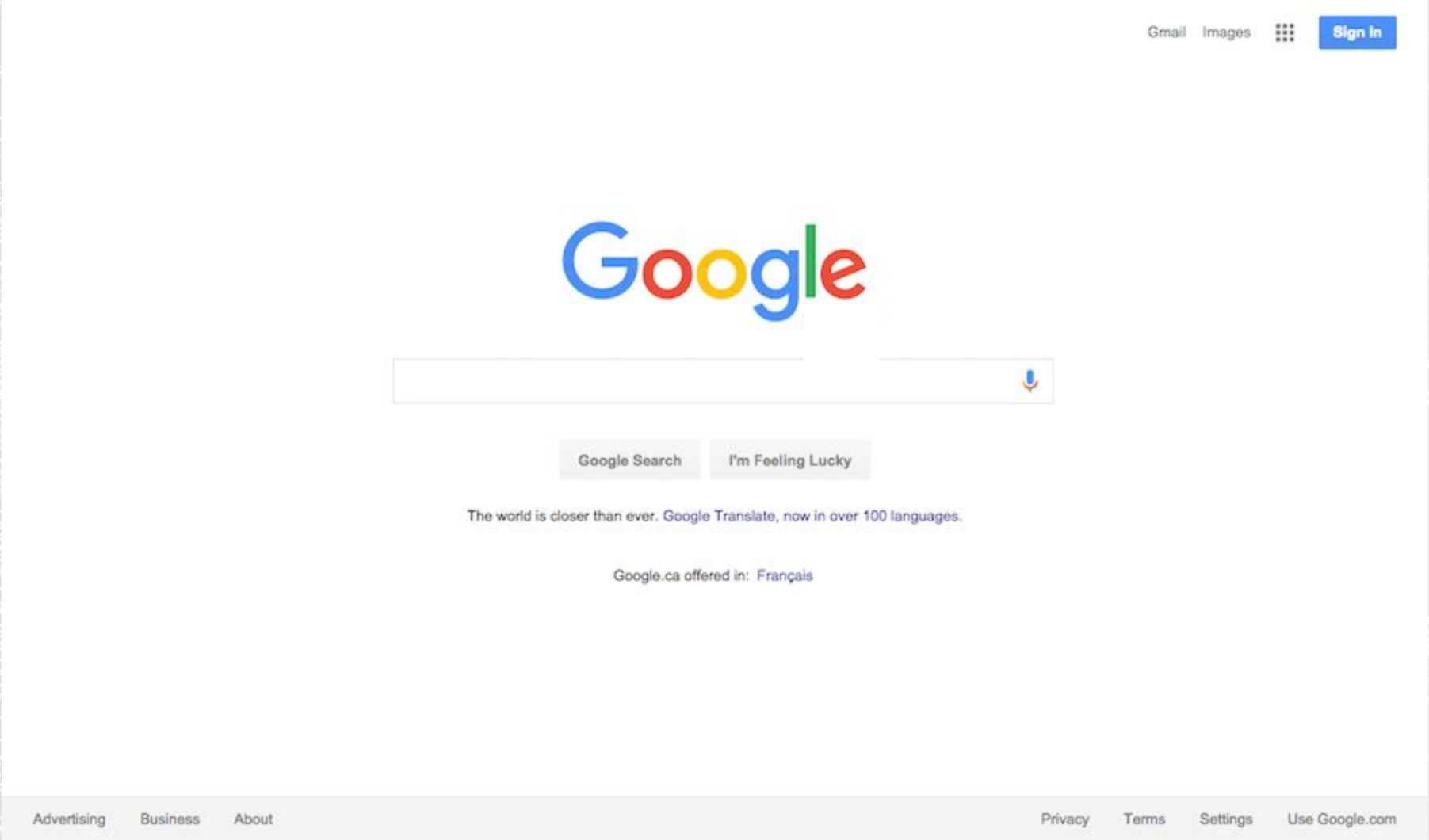
Simple design



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Open Innovation

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Definition

- Open innovation is the “use of purposive inflows and outflows of knowledge to accelerate internal innovation, and expand the markets for external use of innovation , respectively (Henry Chesbrough, 2003).
- The boundaries of companies adopting open innovation are permeable allowing sharing of resources with the external entities.

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Definition

“Open Innovation is a paradigm that assumes that firms can and should use external ideas as well as internal ideas, and internal and external paths to market, as the firms look to advance their technology.” - *Henry Chesbrough*

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Developing Technology in Isolation Is not Easy

- Any product or process has several constructs.
- Developing every construct requires new ideas.
- The process of generating new ideas, refining and testing them requires time, resources, and intellectual capital.
- It may be difficult for any single company to master all of them and develop a complete product or process very economically.
- It is rather easier to add incremental value and add new designs to existing product.

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Open Innovation and the Contrary

- Open innovation (OI) embraces external ideas and knowledge in conjunction with internal R&D.
- Firms that can harness outside ideas to advance their own businesses, while leveraging their internal ideas outside their current operations, will likely thrive in this new era of open innovation.
- Others (not adopting OI), who are internally oriented, have centralized approach to R&D.

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External Use of Innovation

- Xerox discarded many of their innovations terming them as commercially irrelevant.
- Many startups took those technologies, refined them to suit customer requirements and have become successful entrepreneurs.
- The combined market value of those spinoffs entities more than exceeded Xerox's own market value.
- It may be viewed as open innovation from the perspective of those spinoffs.

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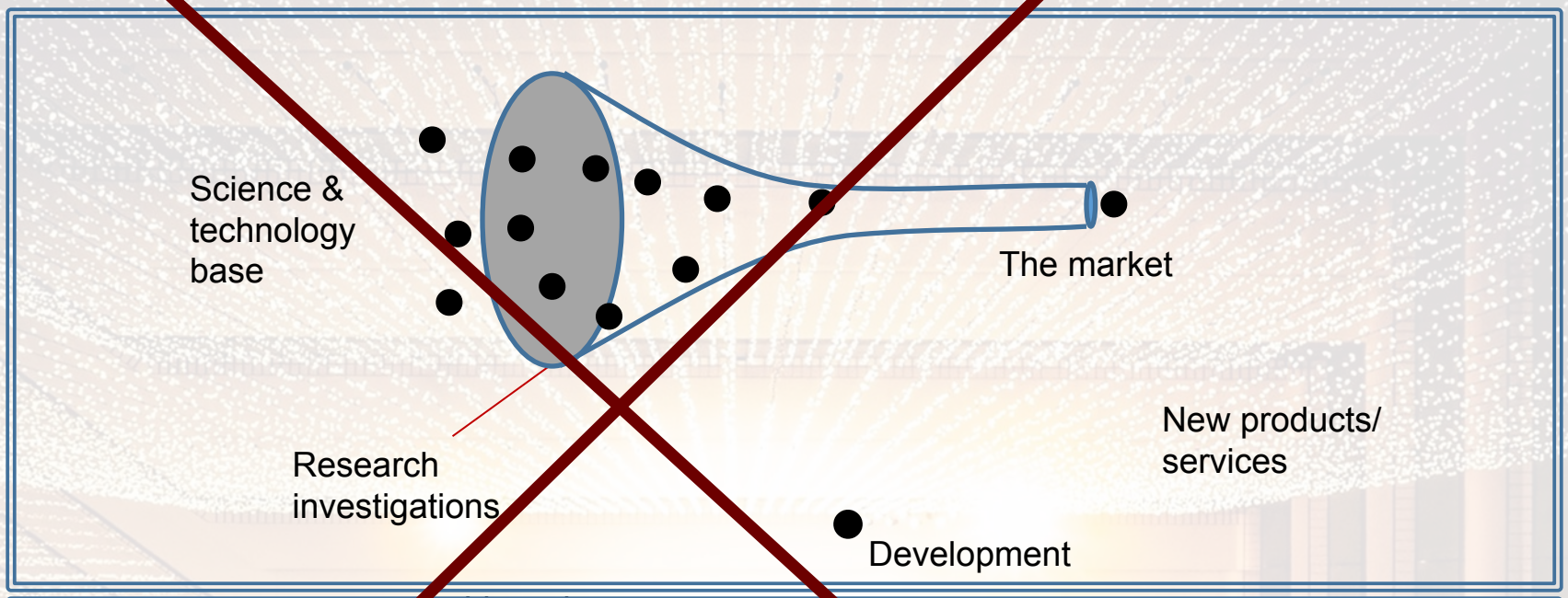
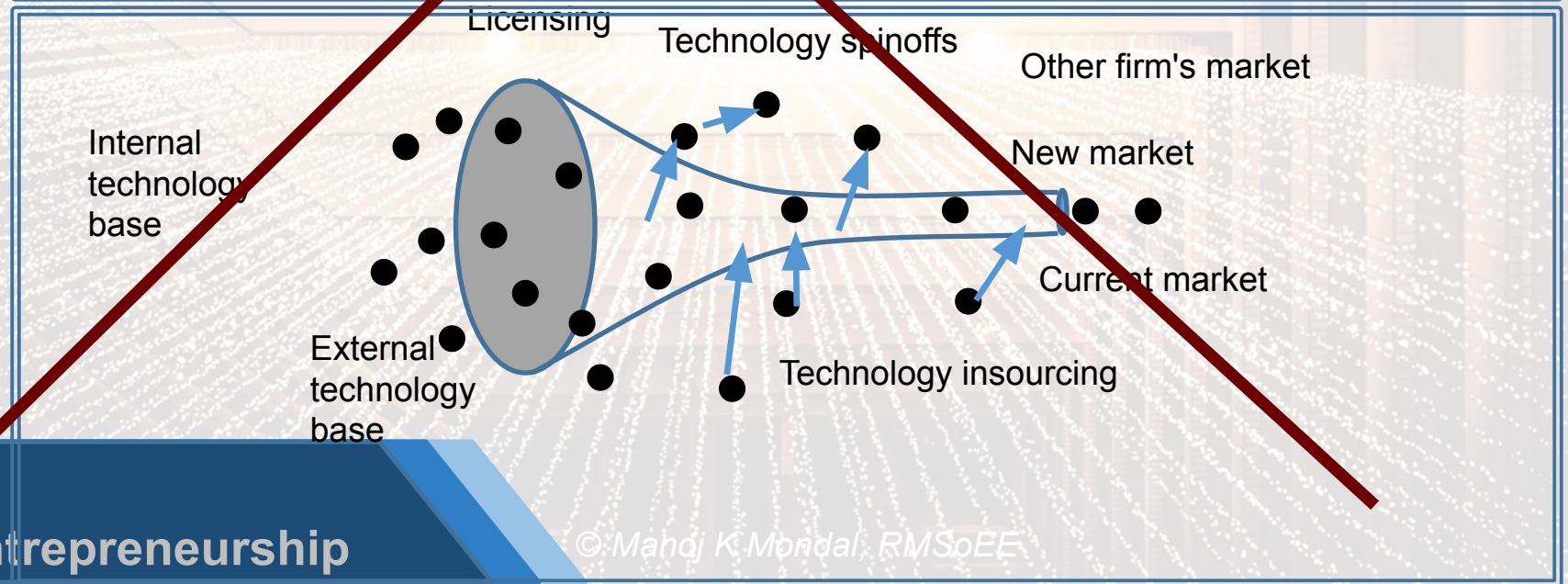
Open Innovation





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Innovations at Xerox that helped several successful companies

- Graphical interface
- Bitmap screen
- Ethernet networking protocols
- Font rendering program, PostScript
- Web searching
- Indexing technologies
- Online conferencing technologies

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- Apple
- Adobe
- Microsoft

Total about 30 companies that took birth based on technologies that Xerox invented but failed to commercially exploit.

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Open Innovation: Advantages

- Accelerate development process
- Reduces cost of product development
- Reduces resources requirement
- Reduces skill gaps
- Help to beat competition
- It reduces risk

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A current example of open innovation involving an Indian laboratory and an American company

Aug 16, 2017: A new research program aims to capitalize on CSIR-IMTECH's world-class expertise in microbial technology and the proven R&D capabilities of Johnson & Johnson's pharma company Janssen to strengthen the collective potential of both entities.

Initiated co-development of new drugs for treatment of tuberculosis.

http://timesofindia.indiatimes.com/business/india-business/india-may-become-the-first-country-to-roll-out-tb-treatment/articleshow/60084271.cms

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Ongoing Open Innovation: Examples

- Eli Lilly pioneered the modern idea of crowdsourcing in 2001 when they began to post research questions openly (online) to scientists and outsiders to augment their own R&D efforts. From this effort, they developed and spun off a new company—InnoCentive—to offer crowdsourcing to other companies.
- X-Prize: the X-PRIZE Foundation sponsors many competition and offer millions of dollars of prize money for solving critical problems.
- HeroX, a subsidiary of X-Prize, invites ideas for solving corporate and government problems against payment.

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Open Innovation in Gaming

- The use of “beta invitations” has been practiced for decades in the video game industry. In this model, which could be considered a form of OI crowdsourcing, a software developer releases a “beta” (or early, likely flawed) version to users for testing and commentary.
- This results in many expert hours of development being applied in a short time, thereby improving the product quickly and cost-effectively.

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Problems with open innovation

- Trust is difficult to build. Your valuable idea may be shared with your competitors.
- It is difficult to pin down the exact ownership of part ideas.
- There is also a chance that some teams, if not all, may have inflated impression about the worth of their ideas which may lead to disappointments.
- More daunting worry is that the adage that “great” ideas can’t come from a crowd, which inherently produce compromise and mediocrity.

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Open innovation: the case of Procter & Gamble

Procter & Gamble's radical strategy of adopting open innovation for technology/product development now helping them in producing more than 35% of their innovations and billions of dollars in revenue.

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P&G

- CEO A.G. Lafley decided that up to 50% of innovation must come in from the outside.
- Pringles potato chips: they discovered a bakery in Bologna, Italy run by a university professor who had already come up with a way of printing edible images on cakes and cookies and it only needed a few tweaks to be adapted to solve P&G's problems.
- Through a licensing partnership with OraLabs, Procter & Gamble market a number of different products, including Breath Mist, a fresh breath vaporizer and Scope Minibrush, an on-the-go toothbrush that doesn't require water.
- P&G continues its efforts of open innovation with more than 2,000 partners all over the world. This is a key plank of its strategy to deliver year-on year growth.

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Syllabus up to here.

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Intellectual Property Rights (IPR)

- Patent
- Design
- Trademark
- Copyright
- Geographical indications
- Plant variety protection
- Semiconductor integrated circuit layout design

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Patent

The right to an invention can be protected through patent.

- Must meet three criteria:
  - Novelty – uniqueness
  - Non-obviousness – inventive steps through which the knowledge has been created. Should not be obvious to a person skilled in the art.
  - Industrial use – commercial relevance
- Patent is protected for a maximum period of 20 years from the date of filing and within the territory where the patent application is valid.

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Design

- Unique features such as shape, pattern, composition, configuration, color combination, etc. making an object uniquely differentiated from the look of it.
- Valid initially for 10 years and can be extended for 5 more years.

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Trademark

- A unique text, symbol, device, logo, label, name, sign, number, shape, drawing, picture, emblem, and unique combination of any two or more of the above fall under trademark.
- Trademark is meant to be an identifier of a product or service around which a company creates value and customers build their perception on the quality, reliability, and efficacy of the product or services represented by the trademark.
- Valid initially for ten years and renewable indefinitely.
- Registering of trademark is not compulsory.

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Copyright

- Protects the right of creator on literary work, art, music, dramatic, cinematographic, sound recording, software code, and other mental unique creation of commercial value.
- Valid for 60 years after the death of the creator.

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World Intellectual Property Organization (WIPO)

- PCT or patent cooperation treaty – provides protection on your invention for 30 months from the priority date (first filing date).
- Without PCT, your invention will be protected only in those countries where you file patent application for protection and maintain.

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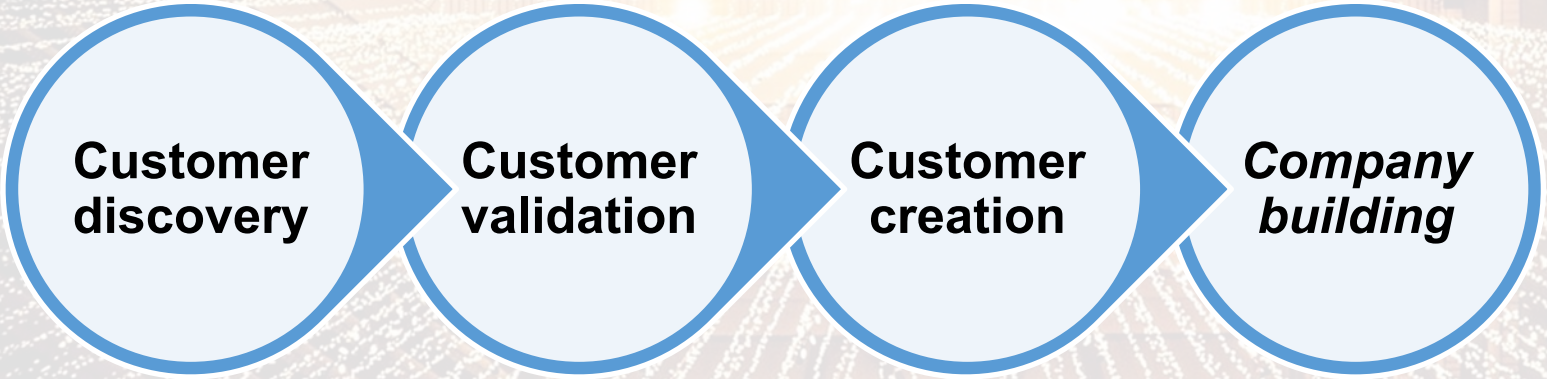
On a different note: Four Steps to Epiphany

- Most startups lack a process for discovering their markets, locating their first customers, validating their assumptions, and growing their business.
- All successful companies invent a customer development model.
- The model in simple form



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- **You should under-promise and over-deliver**

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Conclusion:

Continuous innovation is indispensable for sustaining successful business ventures.

The ability to innovate is, thus, a vital and essential component of entrepreneurship itself.

Innovation may be difficult but it is possible.

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THANK YOU !

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