An Introduction to Innovation – Typology

Session II
February 2023

Alan Mumby

Literature Research Exercise

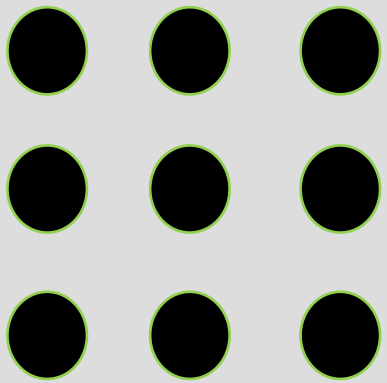
'Jugaad' - 'जुगाड़ (जुगाड' (*Hindi*) - or translated into english as 'the hack'.

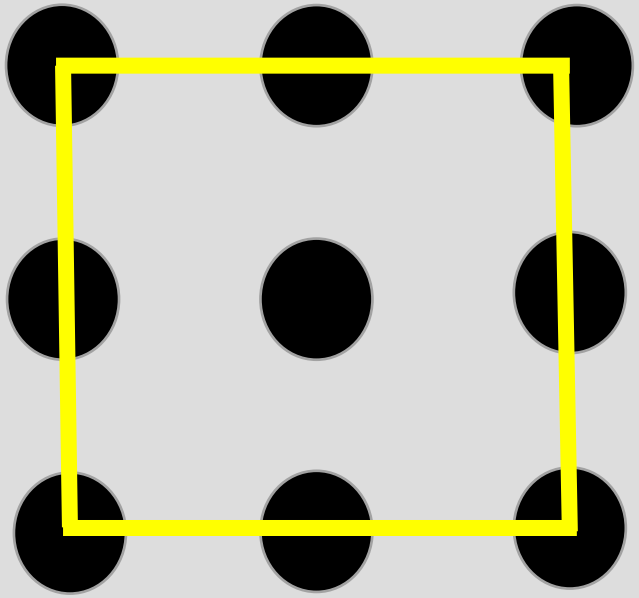
It is the basis of what is now commonly referred to as Frugal Innovation or Frugal Engineering.

Via the university's library service only - carry out a literature research in an around the subject of ***Frugal Engineering / Innovation*** and discover more about the subject and then consider how meaningful it might be to businesses here in Wales.

The focus of our '*Tuesday Seminar Tutorial'* session on 21st February 18:30 – 19:30

student biog and piccie.....!

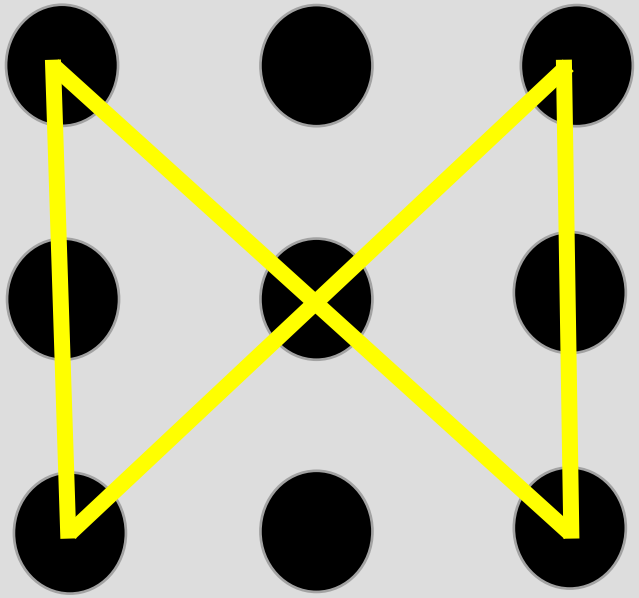




Connect all nine dots with:

1. four straight lines
2. without lifting your pencil
3. without retracing your steps

Prifysgol Cymru
Y Drindod Dewi Sant
University of Wales
Trinity Saint David
MADE
MANUFACTURE ADVANCED DESIGN ENGINEERING
Cronfeydd Strwythurol a Buddosoddi Ewropeaidd
European Structural and Investment Funds



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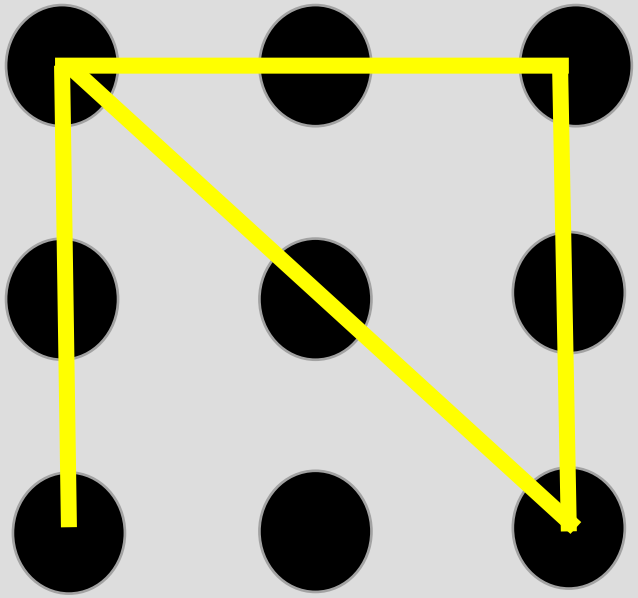

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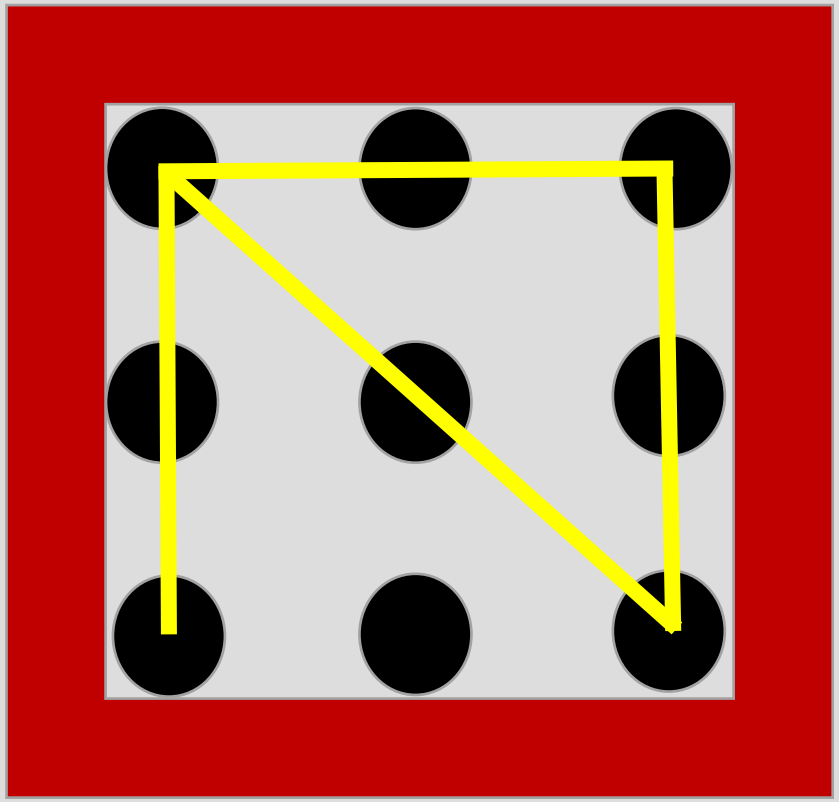

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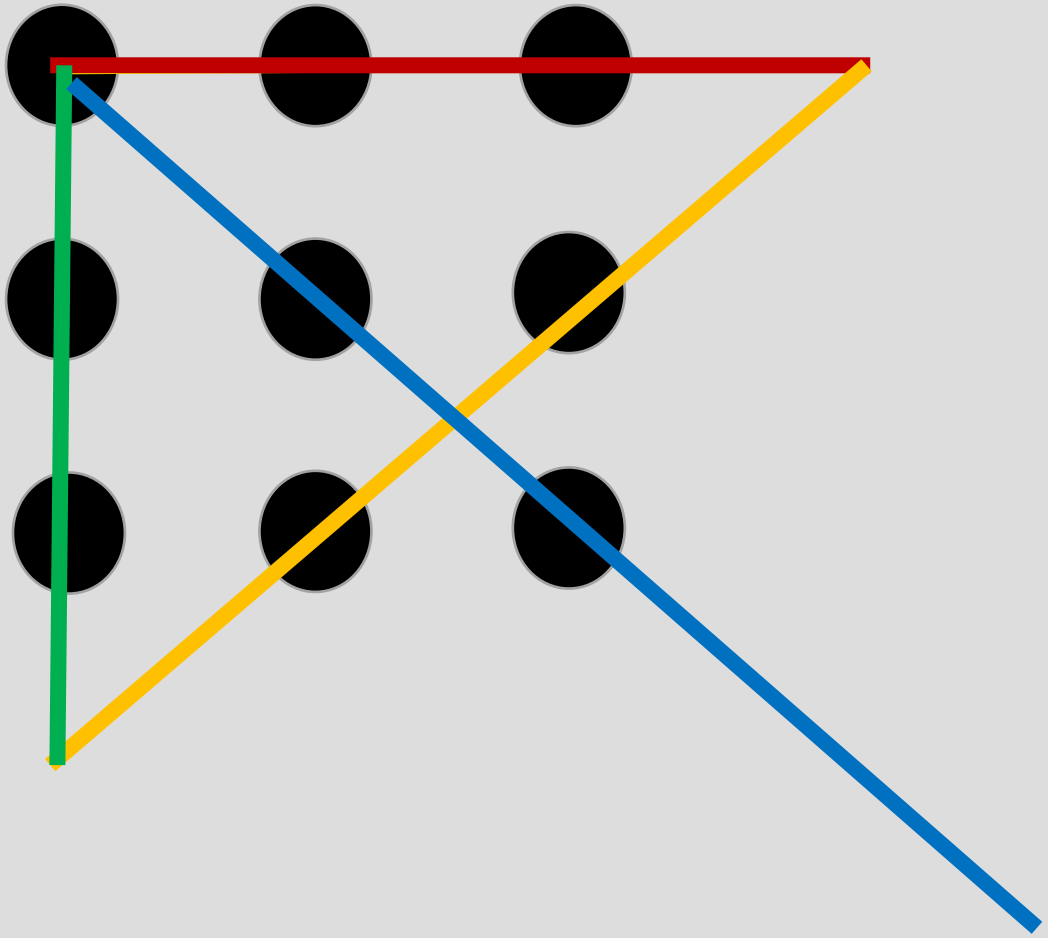

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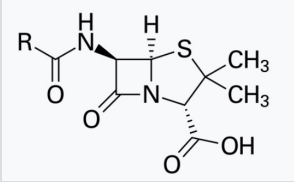
innovate /in-nuh-vayt/ v. (**innovates**, **innovating**, **innovated**) introduce new methods, ideas, or products.
■ **innovator** n. **innovatory** adj.
– ORIGIN Latin *innovare* 'renew, alter'.

innovation n. **1** the introduction of new methods, ideas, or products. **2** a new method, idea, or product.

innovative /in-nuh-vuh-tiv/ adj. **1** featuring new ideas or methods: *innovative designs*. **2** original and creative in thinking.

What is Innovation?



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1928

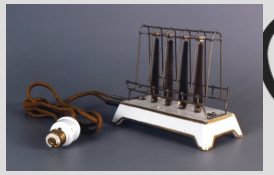
1939

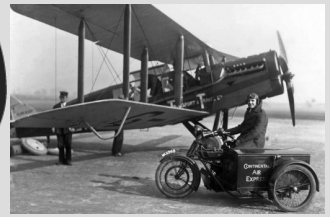
1917

1916

1949

1909





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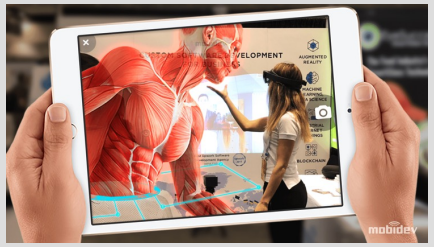


1956

2020

1982

1984

1994

1989

What is Innovation?

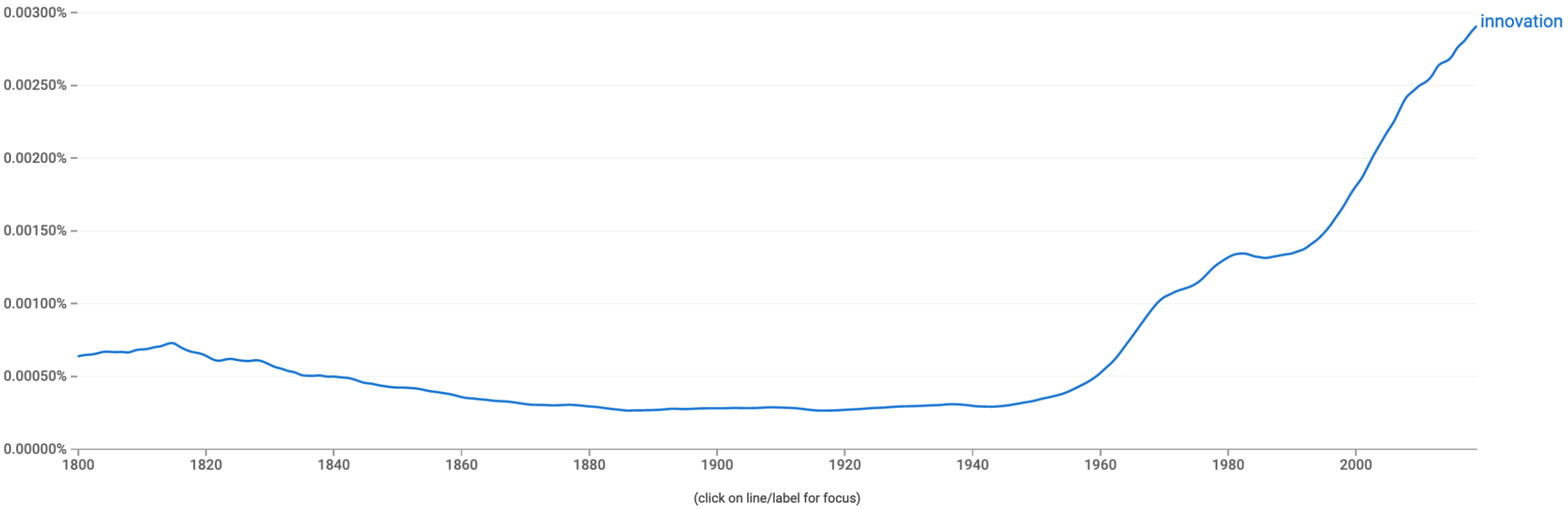
Innovation is truly a confusing buzzword which many people love to hate.

But every business leader agrees that it is important.

So can we agree on what it actually is - or what it means.

Google Ngram Viewer

Innovation Management



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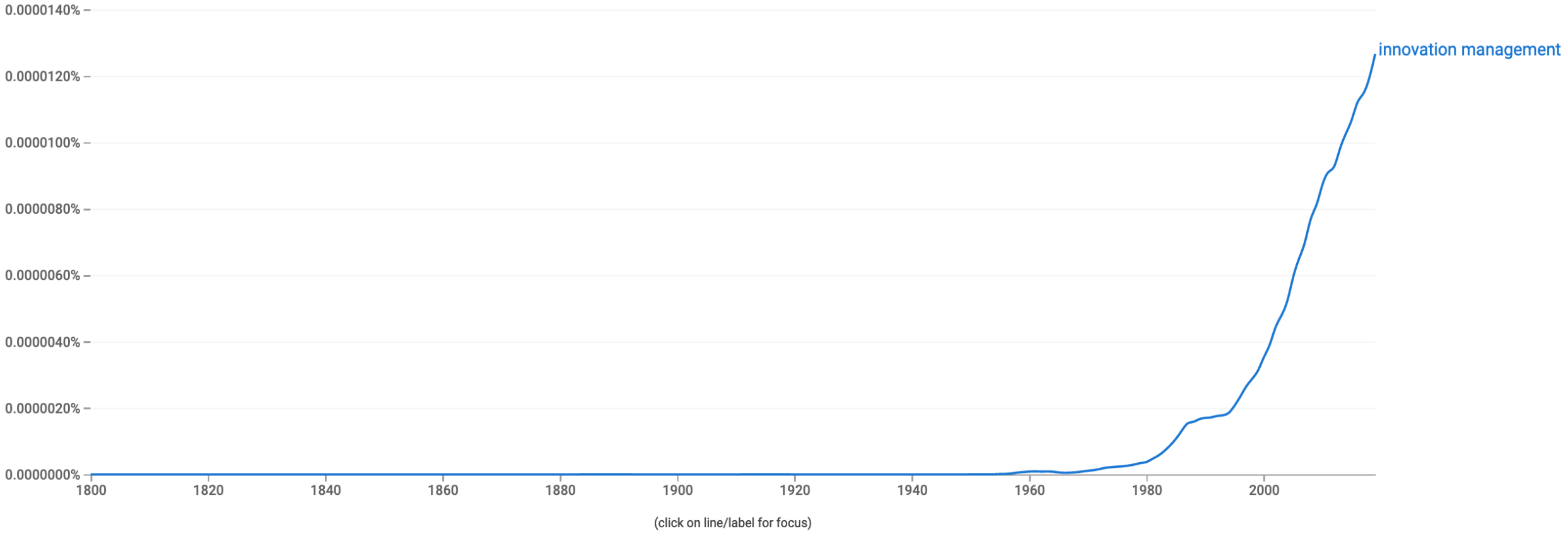

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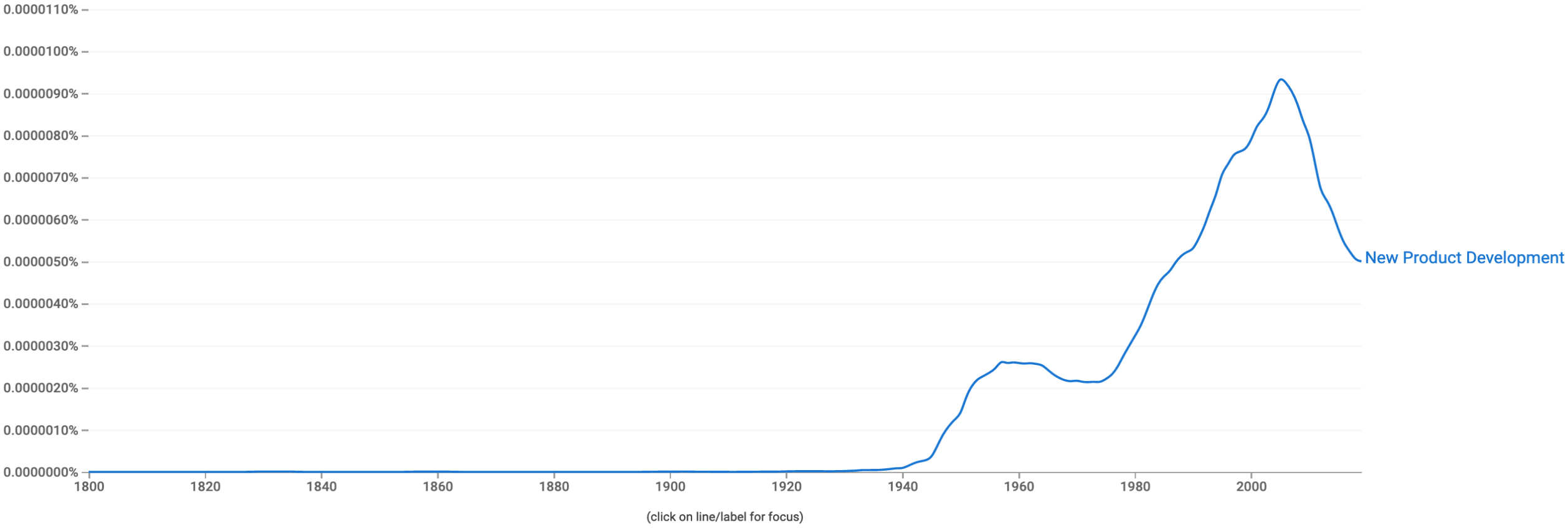

What is Innovation?

Asking Google for a definition of innovation.....

300 million results with thousands of definitions

Google - what is innovation ?

“the action - or process of innovating”.....?

What is Innovation?

There are many different definitions of innovation being used and the term often gets confused with invention.

Let's clarify the differences

An invention is "a device, contrivance, or process originated after study and experiment" and usually something that has not existed previously

(Merriam-Webster, 2016)

"Innovation, for its part, can refer to something new, or a change made to an existing product, idea, or field (of activity).

(Merriam-Webster, 2016)

What others say.....[from Trott's Innovation Management and New Product Development]

"Innovation is not a single action but a total process of interrelated sub-processes. It is not just the conception of a new idea, nor the invention of a new device, nor the development of a new market. The process is all of these things, acting in an integrated fashion."

(Myers & Marquis, 1969)

"It matters little, as far as human behaviour is concerned, whether or not an idea is 'objectively' new measured by the lapse of time since its first use or discovery . . . . If the idea seems new and different to the individual, it is an innovation."

(Rogers & Shoemaker, 1972)

What others say.....

"Innovation is the management of all the activities involved in the process of idea generation, technology development, manufacturing and marketing of a new (or improved) product or manufacturing process of equipment."

(Trott)

Innovation [as a continuum]

=

Conception + technical translation + commercial exploitation

What is Innovation?

- Innovation = change / change = risk
- Failure to innovate = risk
- ‘Over-innovation’ = risk
- Find and read “Risk, Innovation and the Extended Enterprise” by Keith Smith of the Institute of Risk Management

Creativity and Innovation.

Can you have one without the other?

No!

No creativity – no innovation!

Various typologies of innovation have been proposed including

Kahn (2018),

Trott (1998)

Satell (2017),

Chandy (2016),

Kotsemir, Abroskin & Meissner (2013),

Chandy (2010),

Tidd & Bessant (2009)

the form and scope (and intent) of these typologies varies

Satell's Matrix

How well is the task defined?		Not well	Well
	Well	BREAKTHROUGH Mavericks Skunk Works Open innovation	SUSTAINING INNOVATION Roadmaps R & D Design thinking Acquisitions
	Not well	BASIC RESEARCH Research divisions Academic collaboration Publications	DISRUPTIVE INNOVATION VC Model Innovation labs 15% / 20% rule Lean launch-pad

How well is the domain defined?

Type

Product innovation	Development of a new or improved product
Process Innovation	Development of a new manufacturing process
Organisational innovation	New internal arrangements, structures, divisions, teams etc.
Management innovation	New systems e.g. TQM, BPR etc.
Production innovation	New approaches, e.g. JIT, MRP etc.
Commercial innovation	New sales approaches, new accounting processes
Service innovation	New services e.g. Internet-based services

Type

Product innovation

Process Innovation

Business Model innovation

Supply Chain innovation

Production innovation

Organisational innovation ..... all sounds a bit familiar?

Think light bulb --> Innovation from Invention

an invention that drove the creation of electric power plants to light up cities, replacing dangerous gas lines / gas lamp systems.

But the electric power could then power other devices in the home (appliances) as well as industrial processes. It was an innovation in lighting methods powered by a disruptive invention made by an R&D organisation.

What is Innovation?

Very little is truly new in Innovation.....?

too often, we fail to appreciate that most innovations are based on previous advances.

Innovations don't have to be new to the world—only to a market sector or industry.

Think Beyond Products because innovation should be about more than products. They can encompass new ways of doing business and making money, new systems of products and services, and even new interactions and forms of engagement between your organization and your customers.

So at this point we could say

What is Innovation?

Tesla

So what's so new and innovative about this ?

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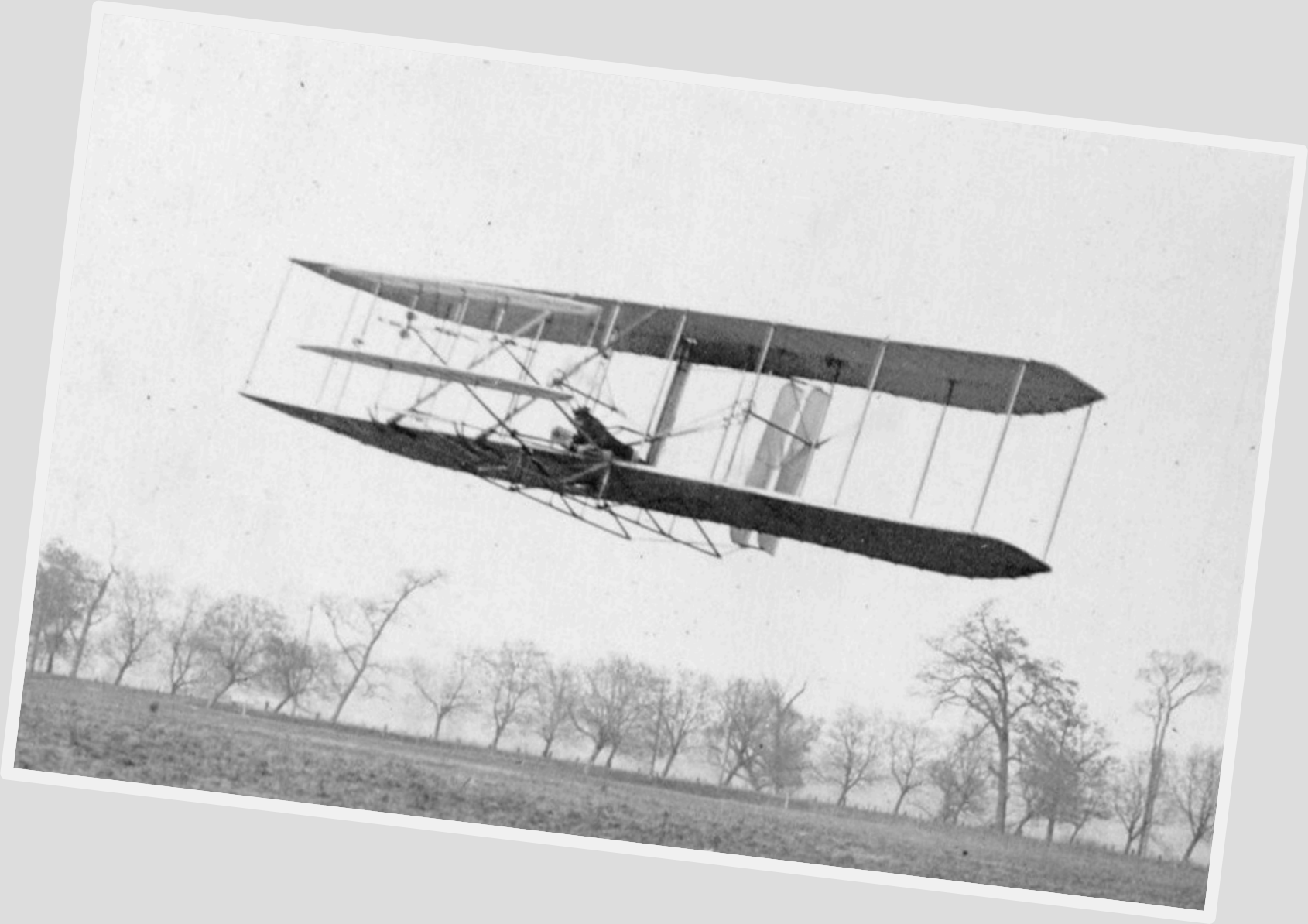


2 THE NEW YORK TIMES, SUNDAY, JANUARY 7, 1906.

Another Attempt to Solve Aerial Navigation Problem

Flying Machine Invented by the Wright Brothers Sails Through the Air Without Aid of Balloon or Gas Bag--Working On It in Secret for Years.

A FLYING machine, or aeroplane, constructed by two young brothers, Orville and Wilbur Wright, has been propelled by its own power and without any aid of balloon or gas bag, for a distance of twenty-four miles in thirty-eight minutes, or at the rate of very nearly thirty-eight miles an hour.

These young inventors are the sons of a minister, now residing at Dayton, Ohio. They have been experimenting in strict secrecy for several years, but their final success is to be made public in connection with the exhibition of the Aero Club, to be held in conjunction with the Automobile Show at the Sixty-ninth Regiment Armory, Jan. 13 to 20. A model and photographs of the machines in flight will be there on view.

Not more than a dozen persons have been in the secret. Among these is A. I. Root, the apiculturist of Medina, Ohio, from whose statements the following details are mainly derived. The chief facts have been indorsed by members of the Aero Club.

+ + +

The Wright brothers first turned their attention to the subject of aeroplanes when, as boys, they made an apparatus on which they could slide down hill in the air a few inches from the ground. They made a number of these gliding machines, and experimented with them during their Summer vacations until they found that they could to a considerable extent control their movements while in the air, and turn them from side to side, as well as slightly up or down. They then began the study of the flight of birds and insects, and read up the history of the numberless attempts that have been made to solve the problem of aerial navigation. The Wrights now possess one of the largest collections of books on this subject in the world.

Thus the boys developed into scientific explorers. They were familiar with what others had done or were trying to do, and they laid their own plans so carefully that there has been no waste of effort, but a progressive accumulation of experiences on which to build up both theory and practice. At the same time they have maintained a discreet and consistent silence.

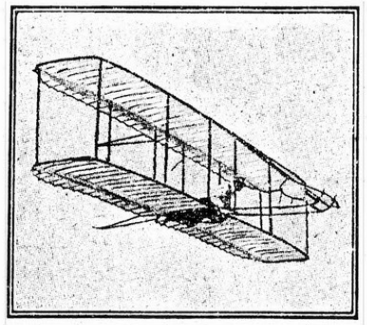
They experimented with their gliding machines for several Summers. They used to glide down hill against the wind, so that the wind helped them to carry the machine up again. When they were satisfied both that the wings were constructed as nearly perfect as possible, and that they were able to control the machine within broad limits, they bought a gasoline engine, attached a propeller to the apparatus, and obtained some slight success in flying through the air at the end of the Summer of 1903.

+ + +

They resumed their secret experiments in the Summer of 1904, and conducted their investigations in a large level field of eighty-seven acres of pasture near Dayton, Ohio. The location allowed them a straight run of about half a mile, and a circular course of a little less than a full mile. In their first trials with gasoline propulsion they kept near the marshy ground, but this precaution proved unnecessary, because in none of their experiments did any accidents happen that occasioned more than a scratch either to the machine or the brothers.

At first the aeroplane, when driven by the engine, persisted in going up and down with a wave-like motion, but when, after a large number of trials, fifty pounds of cast iron were placed on the "nose" of the machine, or at the head of the forward steering gear, this fault was remedied. Other defects were likewise overcome with patience and ingenuity.

Toward the end of the Summer of 1904 the brothers were able to fly one at a time in their machine for a few seconds, and to attain a height of fifty or sixty feet above the ground. On these short flights, and going against the wind on the straight course, they attained a velocity of from thirty to forty miles an hour, with the ballast increased to seventy pounds. They did not at that time try going with the wind, but they experimented turning corners, until on Sept. 20, 1904, the aeroplane went round the circular track of about one mile and came back to its starting point without touching the ground once. This achievement was witnessed by Mr. Root and a few others, and proper notes were made of the facts connected with the event. In the next few weeks they succeeded in making as many as four complete circles without alighting, and on one flight the machines remained in the air for five minutes and twenty seconds.



ORVILLE WRIGHT IN HIS GLIDING MACHINE.

The last flight of the season, made on Dec. 1 could have been prolonged but that the operator's hand became cramped on the rudder. In the season of 1904 altogether a hundred flights were made, and certain facts as to the behavior of the aeroplane had been positively ascertained. In rounding corners it was found that it was necessary to ascend to at least twenty or thirty feet, so that the tip of the inner wing (the wings being forty feet long) would always clear the ground. The machine turns corners in the same manner as a bird, by raising the outer wing. In the earlier trials the machine was always run against the wind, so that the operator would be longer in the air, and have more opportunity to make experiments, and also because the inventors did not at first wish to go very far from the shed in which the machine was housed. After they found that they could turn around, they felt it advisable to start with the wind, and in this way, for short distances, they attained a speed of one mile a minute.

+ + +

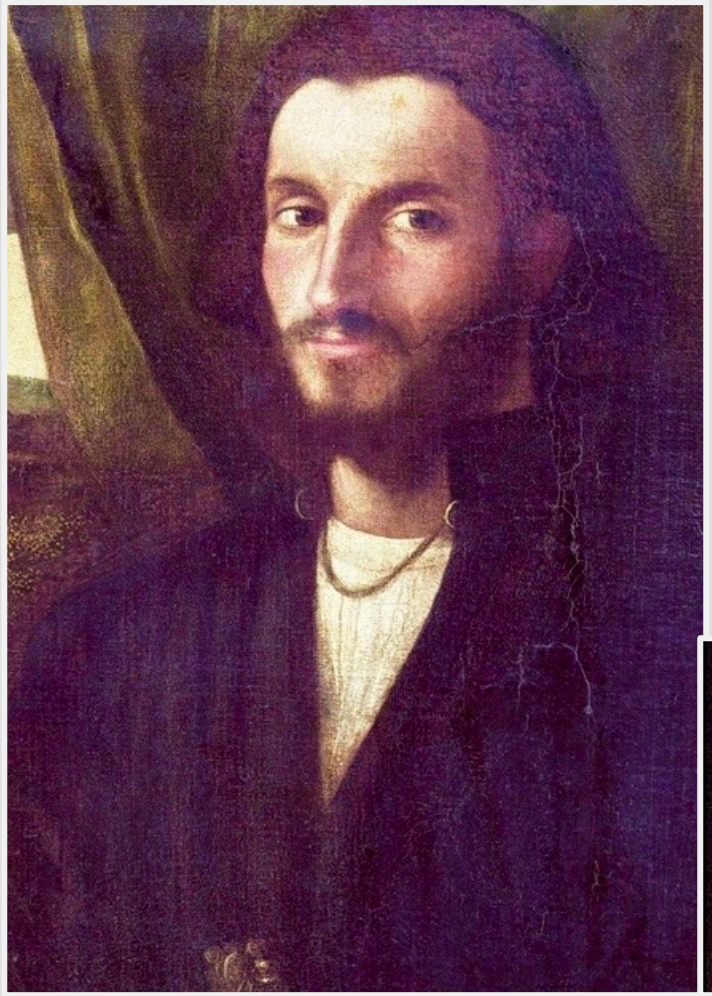
Last Summer the experiments were continued, and late in the Fall the machine, with one of the brothers on board, went round and round the circular track for a distance of twenty-four miles in thirty-eight consecutive minutes, or at the rate of nearly thirty-eight miles an hour. On the half-mile straight portion of the course the speed was greater. This flight was accomplished at a height of from seventy-five to one hundred feet above the ground, but no attempt was made to drive the engines at the fullest speed nor to mount any higher. The gasoline gave out at the twenty-fourth mile, but seeing that forty pounds of ballast were carried, it would have been easily possible to carry enough fuel for a full hour's flight or even longer. But the Wright brothers have not sought for spectacular success, such as flying from city to city, but are determined to go along step by step and test everything that they do.

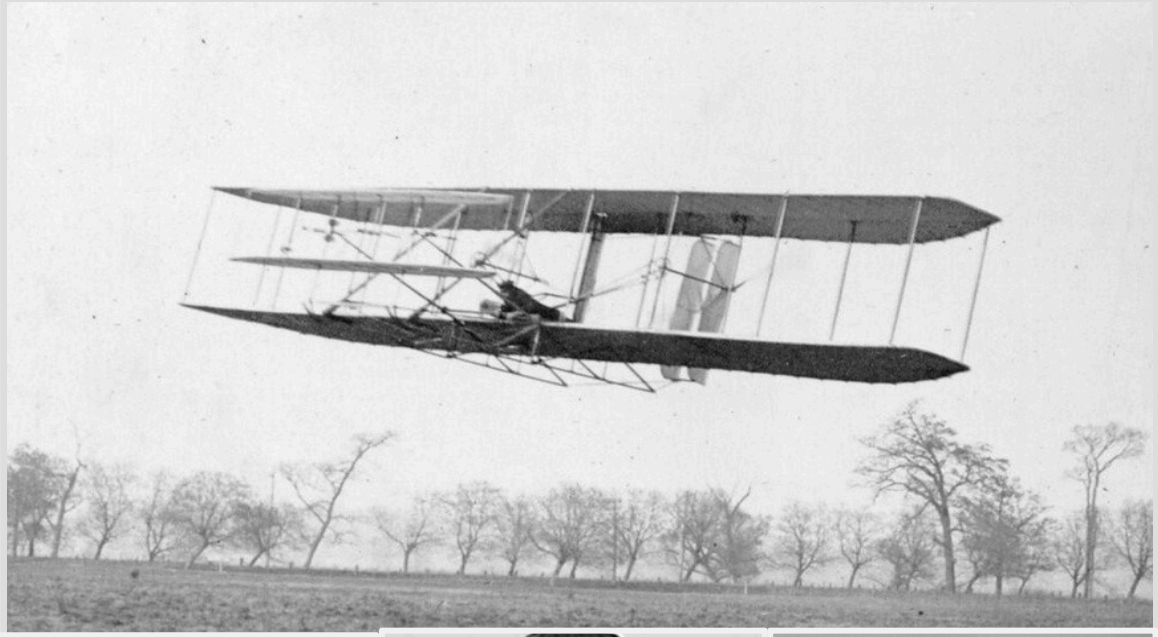
The Wright aeroplane consists of two wings or planes, forty feet long, about four feet broad, and arranged above each other on a slight wooden framework, with the planes about five feet apart. The sails are of white canvas, and the framework, strengthened by diagonal wire braces, is painted white. The "planes" or wings are not strictly speaking planes, but each is slightly concave. The front edges of the wings are stiffened by means of light wooden rods, but at the rear the canvas is free to bend. The whole construction is built on the same principle as the wing of an albatross, except that it is rectangular in shape. In the middle of the machine, a rudder, controlling the up and down movement, projects about six feet in front, and a turning rudder is attached in a similar manner at the rear. The front rudder is a small independent plane, which can be raised or lowered by the hand of the operator. The rear rudder consists of two vertical planes made to rotate on a pivot.

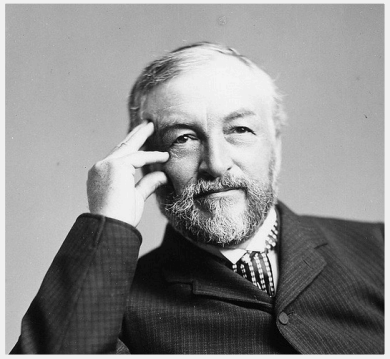
+ + +

The operator reclines across the middle of the lower wing and the gasoline engines are beside him. The engines are of aluminium, and of about the power required to drive a two-passenger automobile. Each of the two engines has four cylinders, which drive a shaft stretching out at the rear. On each shaft is a two-bladed propeller working on either side of the back rudder. When preparing for a trip through the air the machinery is started and gets up speed gradually, and at the right moment an ingenious tripping device releases the mooring, and the aeroplane quickly soars aloft from the short metal track on which it reposes when not in use. The aeroplane can be started as quickly as an automobile. When the power is shut off while flying, the apparatus glides quietly to the ground and slides along its runners for perhaps six yards. There is no difficulty in alighting on a fairly smooth field, and it is found better to come down while traveling at a good rate, say, thirty miles an hour, rather than to drop down straight on stopping the engine. Speed can be reduced by raising the forward rudder, so that the air acts as a brake.

Innovation







What is Innovation?

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What is Innovation?

Potential elements of innovation could be discovery

Scientists make a critical distinction between discovery and invention.

Simply put - an invention doesn’t exist until someone conceives and builds it.

Where as a discovery is true, whether you know it or not.

? ..... What !

Take a couple of hydrogen atoms and bond them to an oxygen atom and you are going to get a water molecule. Every time: no mystery, no magic.

A discovery

The challenge is to discover this structure, its mechanisms and its properties—to know that it turns to a solid at 0°C and that it becomes a gas at 100°C.

.....and then - how do we make use of this knowledge ?

What is Innovation?

Knowing Where to Innovate (often as important as what to innovate)

Mining for gold depends far more on knowing where to dig rather than the digging itself.

Identify the right innovation opportunities

be very clear about the nature of the innovation you intend to create before you begin a project.

INCREMENTAL - do what we do, but do it better

RADICAL – do something different

Innovation Types... (Tidd and Bessant)

product innovation – changes in the design of the things which the company or organisation offers, the products or services or both.

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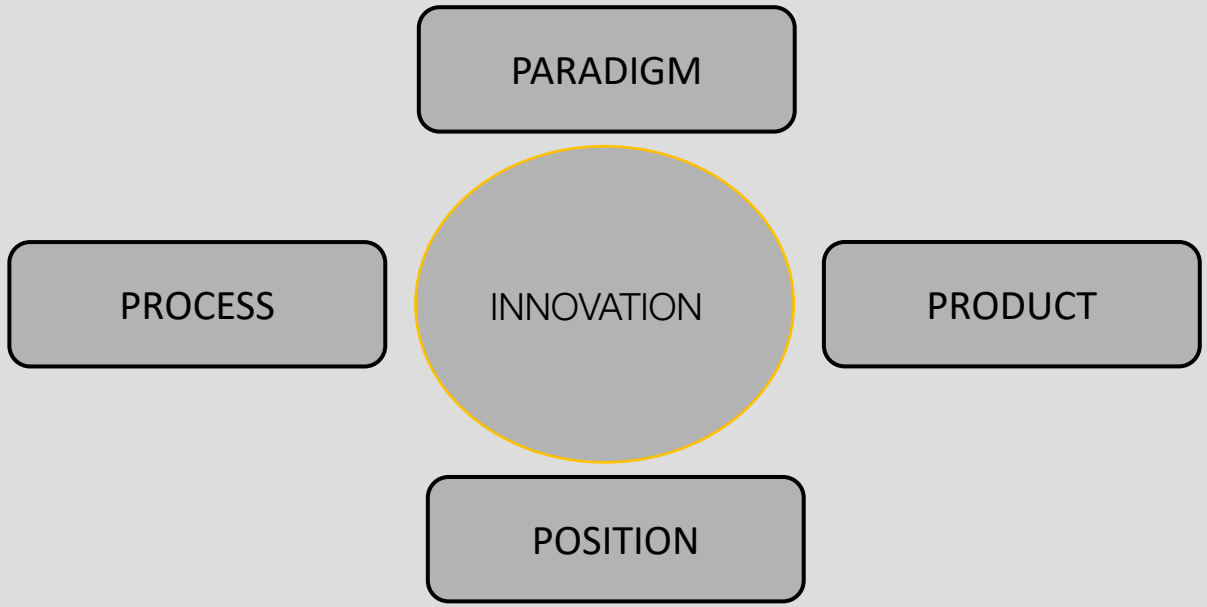
exploring innovation space ... (Tidd and Bessant)



Innovation Types?

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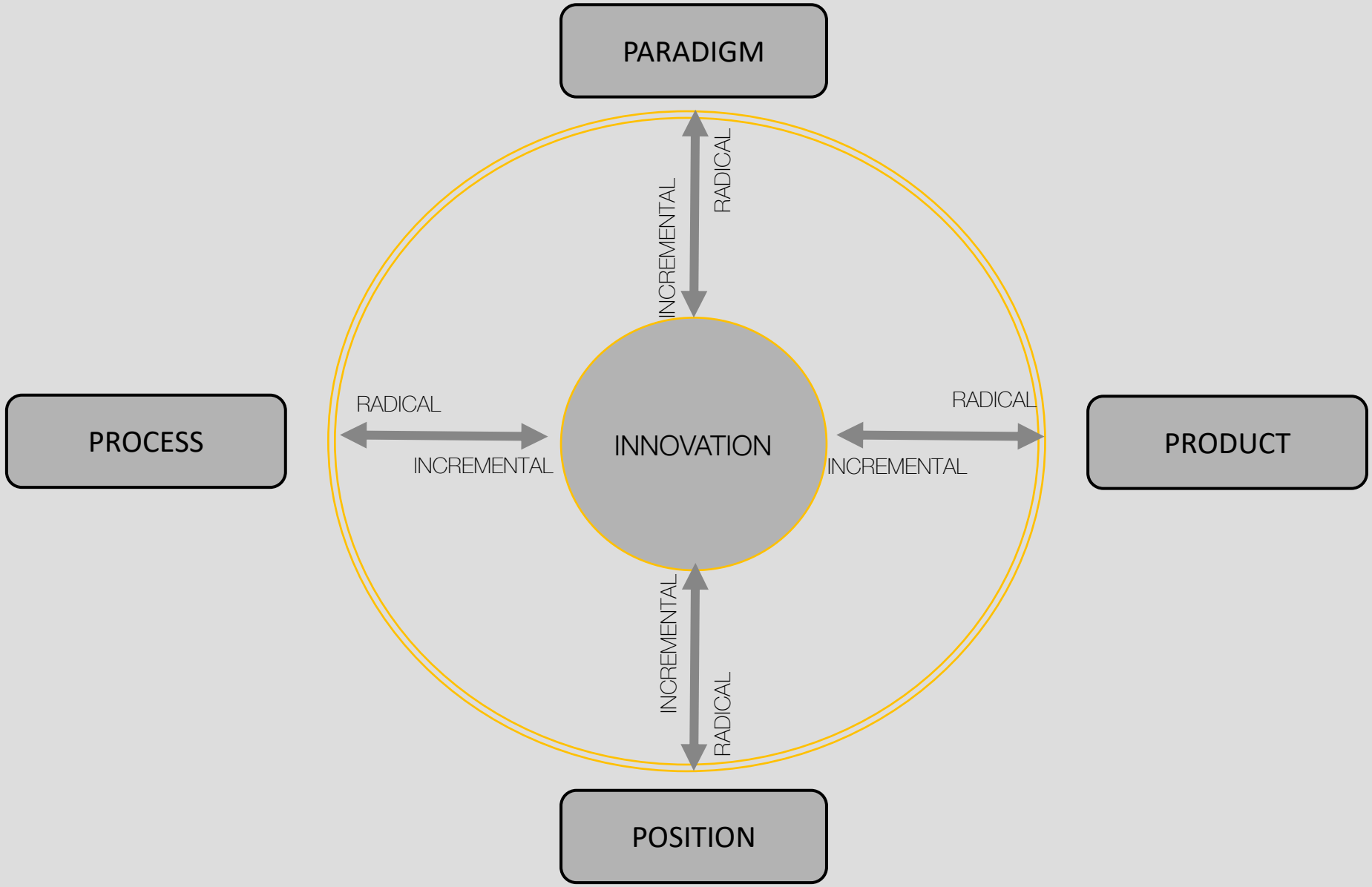

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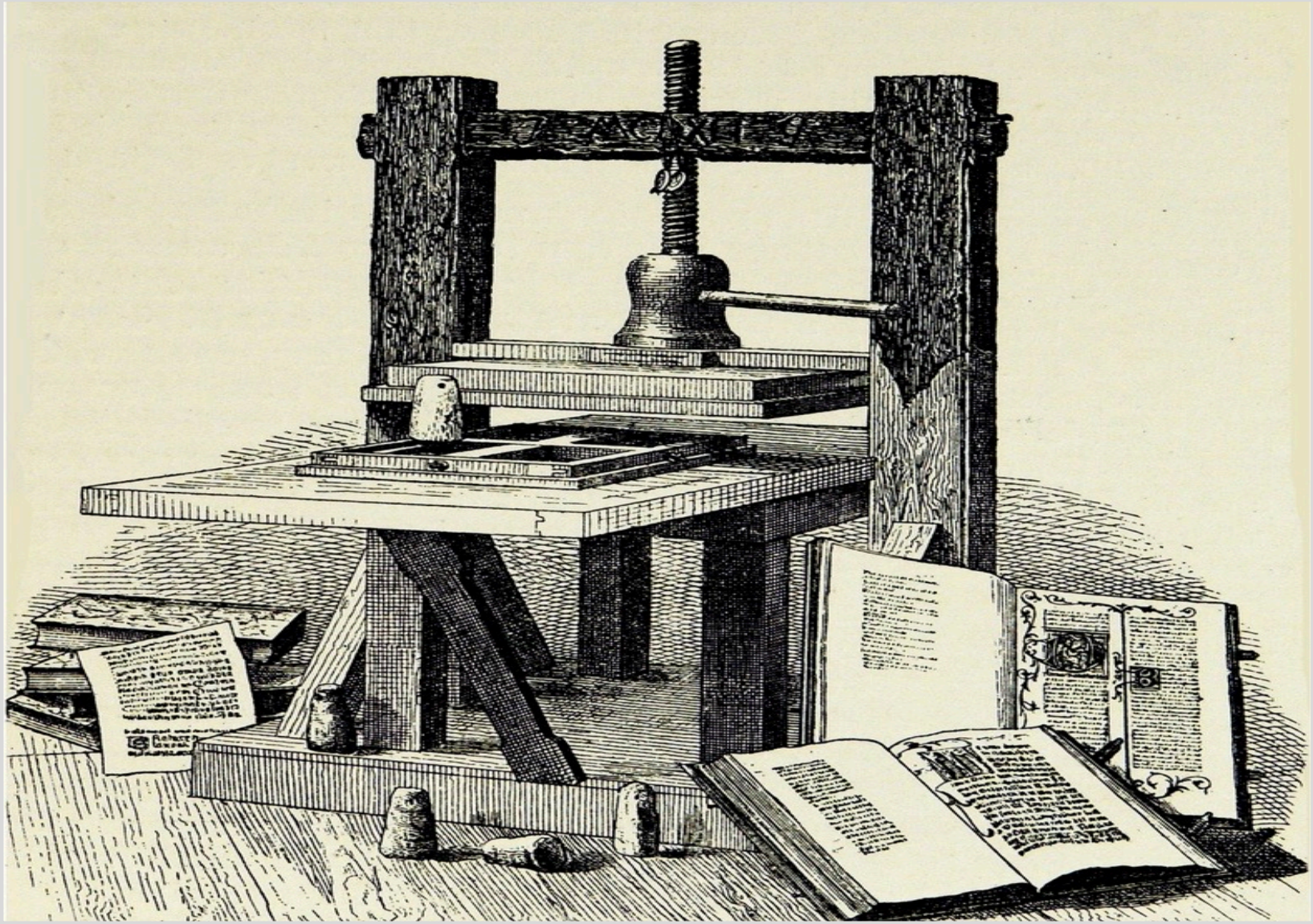

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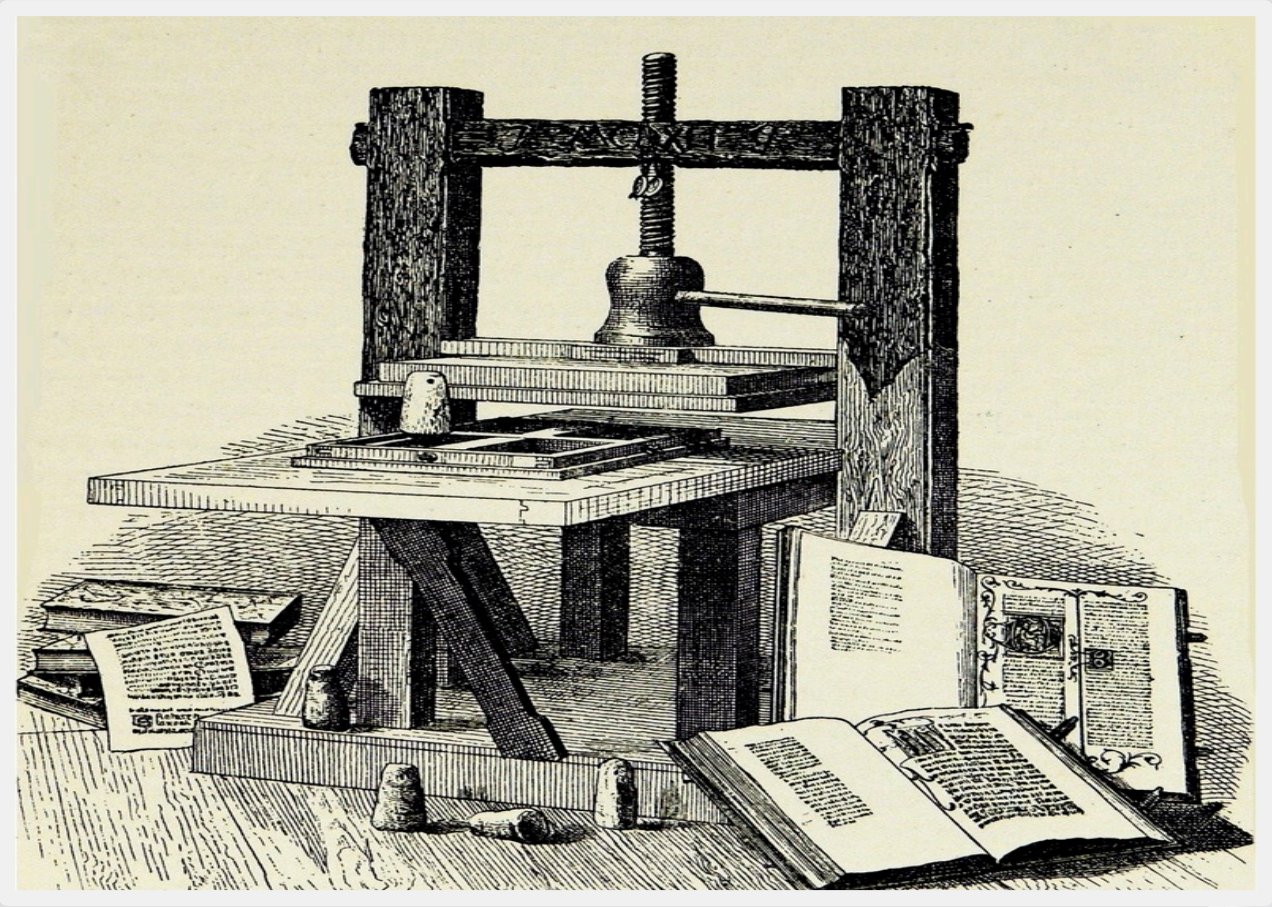

a new concept for a development ?

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The opportunity to be innovative

Eli Whitney 1765 –1825

a new concept for a development ?

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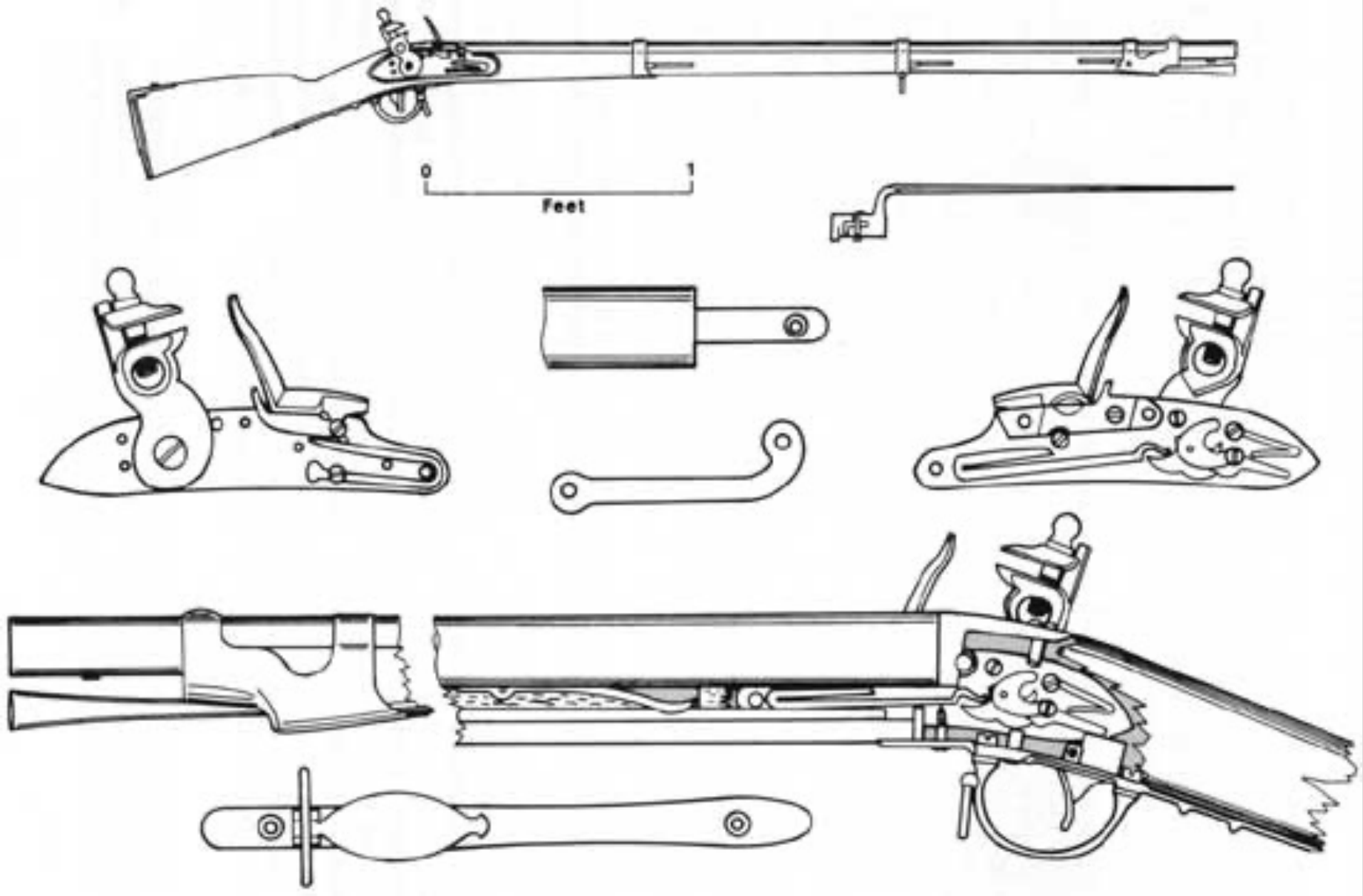


Artisan ‘gunsmith’ Vs Skilled Machinist

- innovative parts templates produced by skilled machinists
- developed the milling machine to create parts
- machines produced interchangeable parts reducing the need for skilled artisans
- increased production rates.
- ….fulfilment of contract with the American Federal Government

Innovation Types?

Keeping things basic ……for now…….

product innovation – changes in the design of the things which the company or organisation offers, the products or services or both.

process innovation – changes in the way the products or services are created and delivered, the manufacture and delivery process.

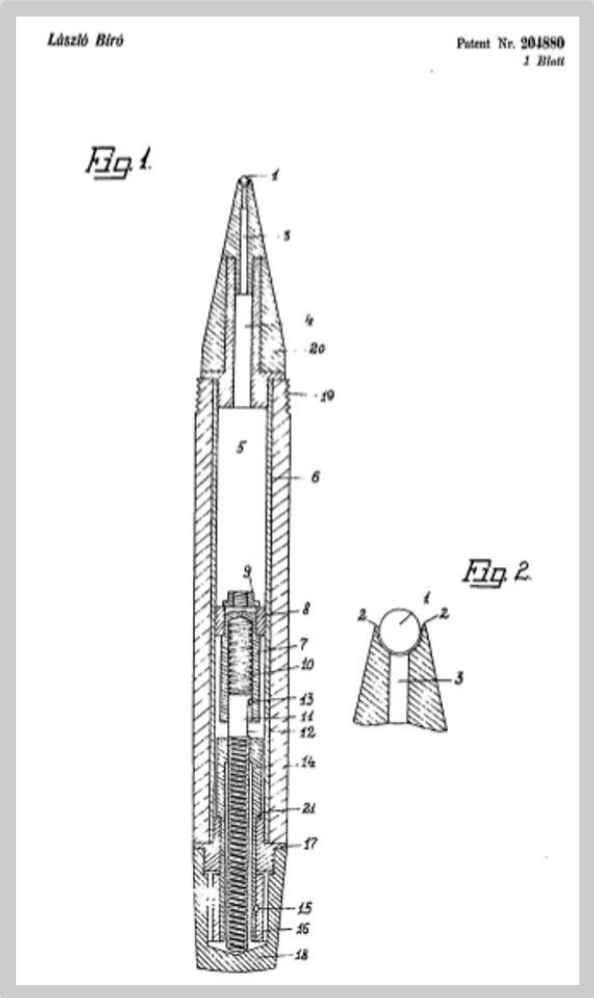
position innovation – changes in the context in which products and services are introduced

paradigm innovation changes in the underlying models which frame what the company or organisation does.

a new concept for a development ?

László József Bíró

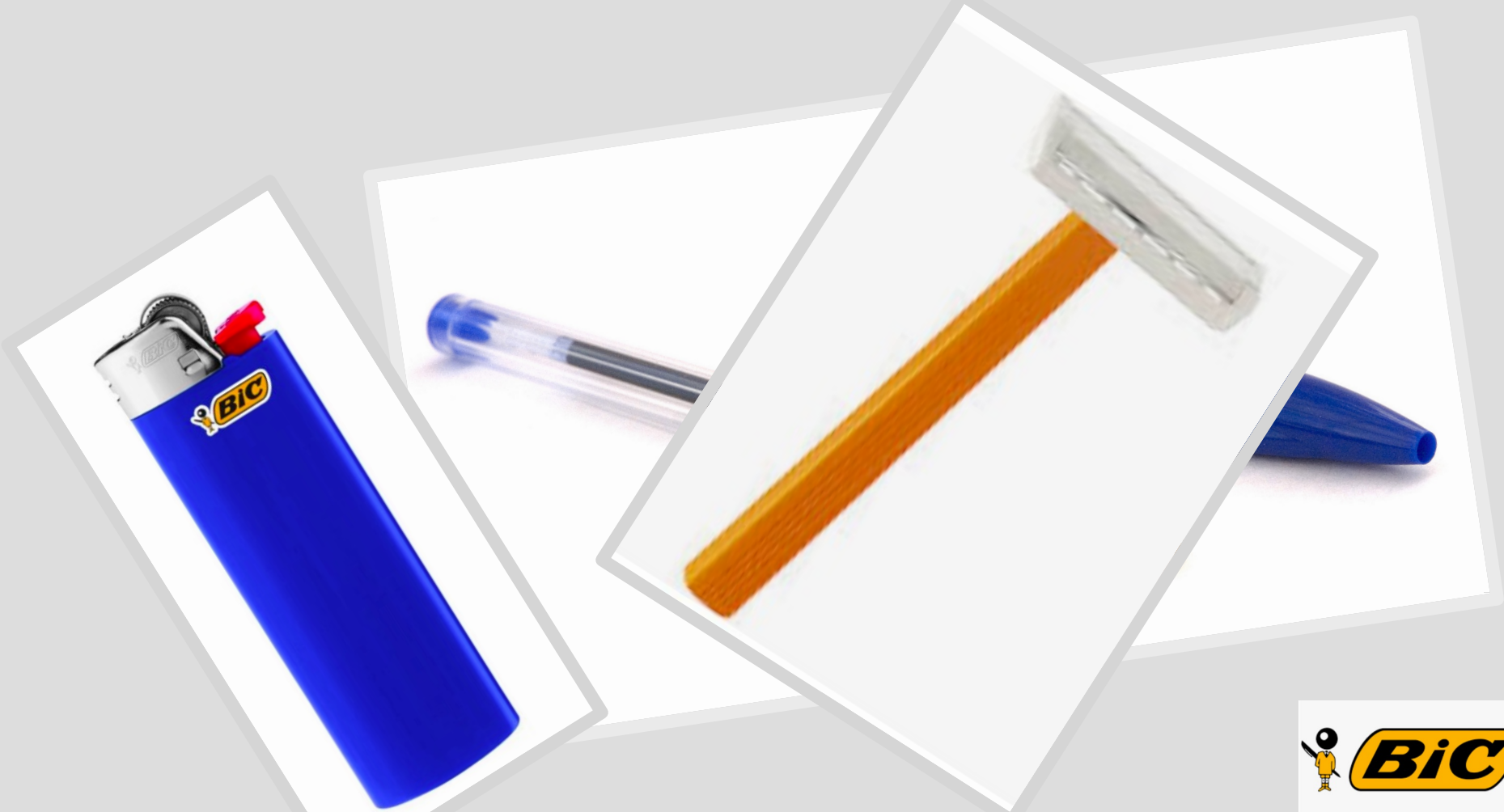
Marcel Bich



In 1945 László József Bíró sold his patent for his innovative pen to Marcel Bich

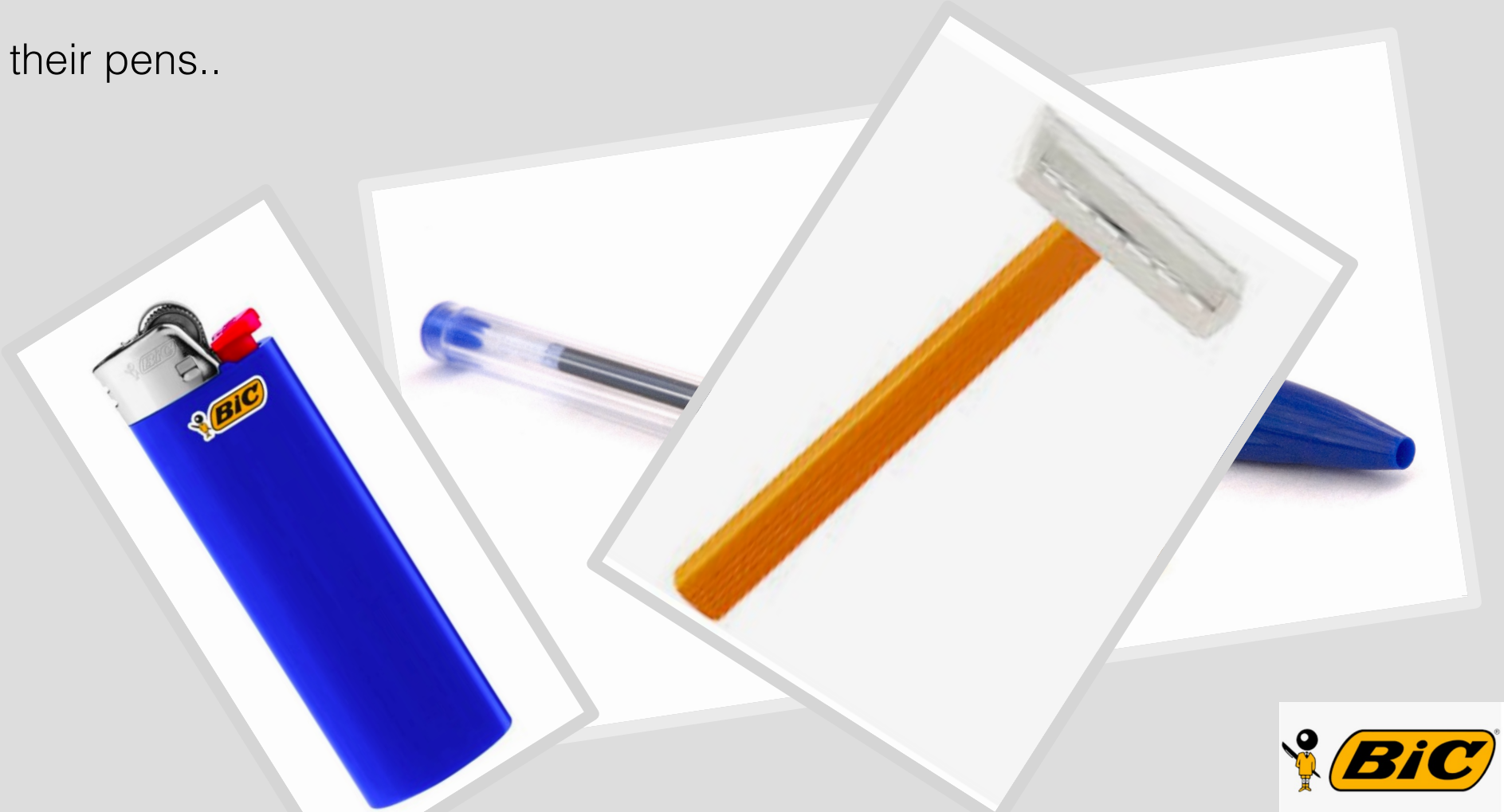
BIC was founded as a manufacturer of ballpoint pens. After some aggressive marketing campaigns the company started to dominate the market for cheap, yet reliable ball pens.

the decision makers realised that their company could also be seen as a producer of precision plastic products company and shifted their paradigm accordingly.



product innovation

They started to expand their range of products to include disposable lighters and razors where they could reuse some of the material characteristics that provided the good grip on their pens..



the company pressed for cheaper prices for their newly added product lines and so innovated the manufacturing and distributing process.

Furthermore, BIC decided to target specific age and gender groups with different products such as female and male razors and the BIC Megalighter for BBQ and kitchen use.

revenue of €2.0258 billion (2016)

failure !!!! ??

"BIC Crystal for Her"

…they don't get it right every time…

"designed to fit comfortably in a woman's hand" comes in an "attractive barrel design available in pink and purple.

Museum of Failure, Sweden

https://museumoffailure.com/

Innovation Project vs Core Business Project

Innovation Project	Core Business Project
unknown end goal	then that's a known
first time	and the goal is understood
totally unpredictable	∴ repeatable, you've done it before
approach? trial & error	the predictability of success would be high
probably start small	make use of your in-house experts
possible lack of internal know-how	you'd invest high (*time & resource*) and with little caution
need for people to be flexible	lowish risk
higher risk	

Innovation Management ?.....

..... transforms or converts an idea into something of value

Paper to be read before next week's session

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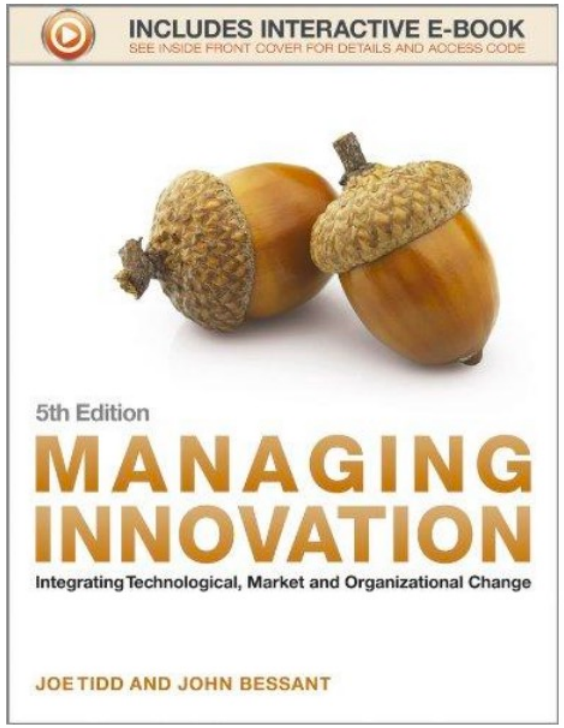
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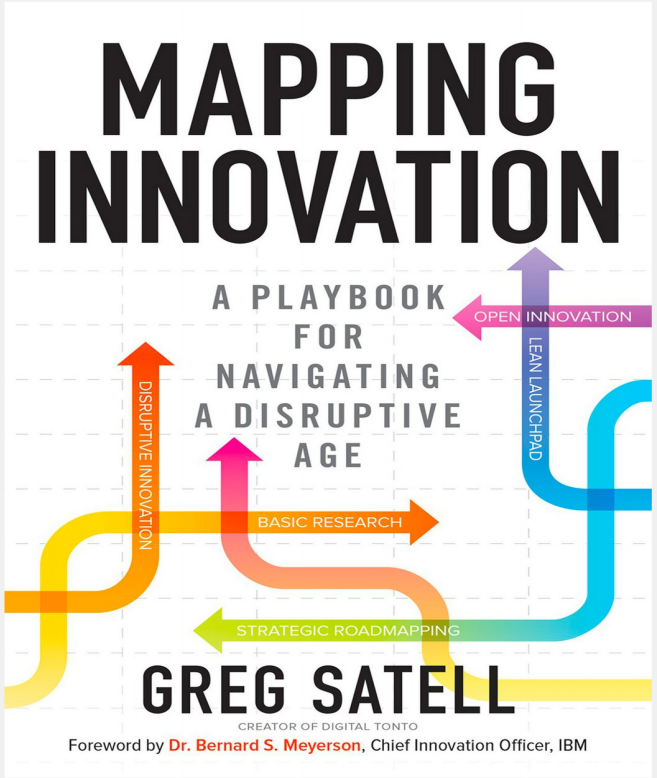
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