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Basics of Firm Innovation Policy (Innovation Management)

Strategic project of TBU in Zlín, reg. no. CZ.02.2.69/0.0/0.0/16_015/0002204

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- **What is innovation?**

“Discoveries consists of looking at the same thing as everyone else and thinking something different”

Albert Szent-Gyorgyi – Nobel Prize Winner

- „innovation“ and „innovat“,
- “innovat” means to renew or alter,
- the rest of the word “novare” brings or make new or being made in a new way,
- the new approaches bring solving problems in a technical, business or other field named “innovation”.

- examples of innovation,
  - the bow and arrow,
  - agriculture,
  - domesticated animals,
  - developed pottery and learned to weave,
  - abacus,
  - printing press.

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Source: Apple, 2018

Source: Eby, 2018

Source: Amazon, 2018

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- **case study of 11 innovation that changed history:**
  - **the printing press:**
  - **Johannes Gutenberg's printing press,**
  - **developed around 1440 in Mainz, Germany, Gutenberg's machine improved on already existing presses through the use of a mould that allowed for the rapid production of lead alloy type pieces.**

- **case study of 11 innovation that changed history:**
  - **the compass:**
  - **magnetic compass,**
  - **invented in China,**
  - **by the 14th century compasses had widely replaced astronomical means as the primary navigational instrument for mariners.**

- **case study of 11 innovation that changed history:**
  - **paper currency:**
  - **used in China in the ninth century, but did not appear in Europe until the late 1600s,**
  - **paper notes as a promise against future payments of precious metals,**
  - **a new era of international monetary regulation that changed the face of global economics.**

- **case study of 11 innovation that changed history:**
  - **steel:**
  - **industrial revolution,**
  - **evidence of steel tools dates back 4,000 years,**
  - **the Bessemer Process,**
  - **skyscrapers, engines.**

- **case study of 11 innovation that changed history:**
  - **the electric light:**
  - **Thomas Alva Edison,**
  - **Joseph Wilson Swan,**
  - **the first long-lasting light bulbs were patented in 1879 and 1880, liberating society from a near-total reliance on daylight.**

- **case study of 11 innovation that changed history:**
  - **domestication of the horse:**
  - **since their domestication some 5,500 years ago, horses have been inextricably tied to human development,**
  - **horses changed the nature of war.**

- **case study of 11 innovation that changed history:**
  - **transistors:**
  - **the transistor is an essential component in nearly every modern electronic gadget,**
  - **first developed in 1947 by Bell Laboratories,**
  - **used in radios, transistors have since become an elemental piece of the circuitry in countless electronic devices including televisions, cell phones and computers.**

- **case study of 11 innovation that changed history:**
  - **magnifying lenses:**
  - **use has offered mankind a glimpse of everything from distant stars and galaxies to the minute workings of living cells,**
  - **electron microscope,**
  - **the Hubble Space Telescope.**

- **case study of 11 innovation that changed history:**
  - **the telegraph:**
  - **the first in a long line of communications breakthroughs that later included radio, telephones and email,**
  - **pioneered by a variety of inventors in the 18th and 19th centuries, the telegraph used Samuel Morse's famous Morse code to convey messages by intermittently stopping the flow of electricity along communications wires,**
  - **the ability to send messages rapidly across great distances made an indelible impact on government, trade, banking, industry, warfare and news media, and formed the bedrock of the information age.**

- **case study of 11 innovation that changed history:**
  - **antibiotics:**
  - **a giant step forward in the field of medicine, antibiotics saved millions of lives by killing and preventing the growth of harmful bacteria,**
  - **Louis Pasteur and Josepf Lister,**
  - **Alexander Fleming,**
  - **penicillin,**
  - **a major improvement on antiseptics.**

- **case study of 11 innovation that changed history:**
  - **the steam engine:**
  - **cars, airplanes, factories, trains, spacecraft,**
  - **Thomas Savery ,**
  - **steam engines were then perfected in the late 1700s by James Watt.**

- **definitions of inovation:**

“Entrepreneurship is not “natural”; it is not “creative”. It is work. Entrepreneurial businesses treat entrepreneurship as a duty. They are disciplined about it…they work at it…they practice it.”

Peter Drucker, 1985

- definitions of inovation:
- Joseph A. Schumpeter:
  - as a process of structural changes,
  - five changes.

- **definitions of inovation:**
  - **five changes defined by Schumpeter:**
  - **launch of a new product or a new species of already known product,**
  - **application of new methods of production or sales of a product,**
  - **opening of a new market,**
  - **acquiring of new sources of supply of raw material or semi-finished goods,**
  - **new industry structure such as the creation of destruction of a monopoly position.**

- definitions of inovation:
- Freeman, Clark and Soete (1982),
- Rothwell and Gardiner (1985),
- Porter (1990),
- Kao (2007).

- **incremental innovation:**
  - **small improvements,**
  - **steps,**
  - **product x product lines,**
  - **processes,**
  - **more than 70 % of innovation is incremental.**

○ incremental innovation

Source: Vemula, 2016

Source: Duncan, 2018

- **radical innovation:**
  - **big change,**
  - **blows up existing system or process,**
  - **exploration of new technologies, new approaches,**
  - **new business models,**
  - **dramatic changes,**
  - **transformation,**
  - **very expensive,**
  - **lot of uncertainty.**

- **radical innovation:**
  - **basic innovation,**
  - **novelty,**
  - **revolution,**
  - **discoveries,**
  - **iPhone example x radical x incremental.**

- **disruption innovation:**
  - **products and services accessible to a large population,**
  - **new markets,**
  - **new values,**
  - **produced by outsiders or followers more often than leading companies.**

- **case study of thinking about innovation:**
  - **Aravind Eye Care System,**
  - **What is Aravind?**
  - **advantages,**
  - **disadvantages,**
  - **New ideas for improvement?**
  - **Innovation?**

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Introduction to Innovation Management

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- invention x innovation,
- the 'invention' is the outflow of an applied research, while 'innovation' is the successful introduction of an invention in the market as a functional solution (product or service),
- specialized knowledge,
- inventor x innovator.

- perspectives on innovation,
  - the process of innovation (the way innovation develops, disseminated and adopted),
  - the content of innovation (the specific technique or social nature of in-novation itself),
  - the environment of innovation (the environment in which innovation takes place and the environmental impact on innovation),
  - the impact of innovation (the social and technological change arising from the innovation process completion).

- **key factors of creativity and innovation:**
  - **environment,**
  - **content,**
  - **invention,**
  - **mechanization,**
  - **creativity and competition,**
  - **stabilization,**
  - **radical technologies.**

- **classification of innovation,**
  - **process innovations,**
  - **innovations of content,**
  - **administrative innovations.**

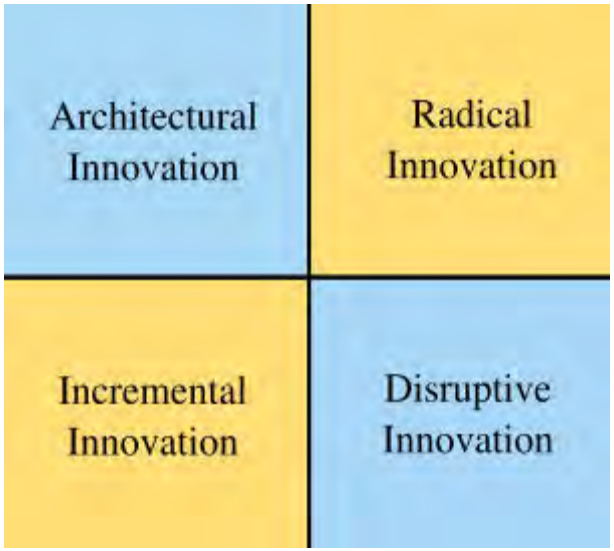
- **basic principles pertain to innovations:**
  - **the integrated organizational approach,**
  - **the incentives of innovations,**
  - **the systematic process to convert an invention into innovation,**
  - **communications,**
  - **learning,**
  - **project management.**

- activities that determine innovation management:
  - technological integration,
  - process of innovations,
  - strategic planning,
  - organizational changes,
  - development of an enterprise.

- **types of innovation:**
  - **according to object,**
  - **according to sector,**
  - **according to intensity.**

- **types of innovation:**
  - **radical or incremental,**
  - **continuous or discontinuous.**

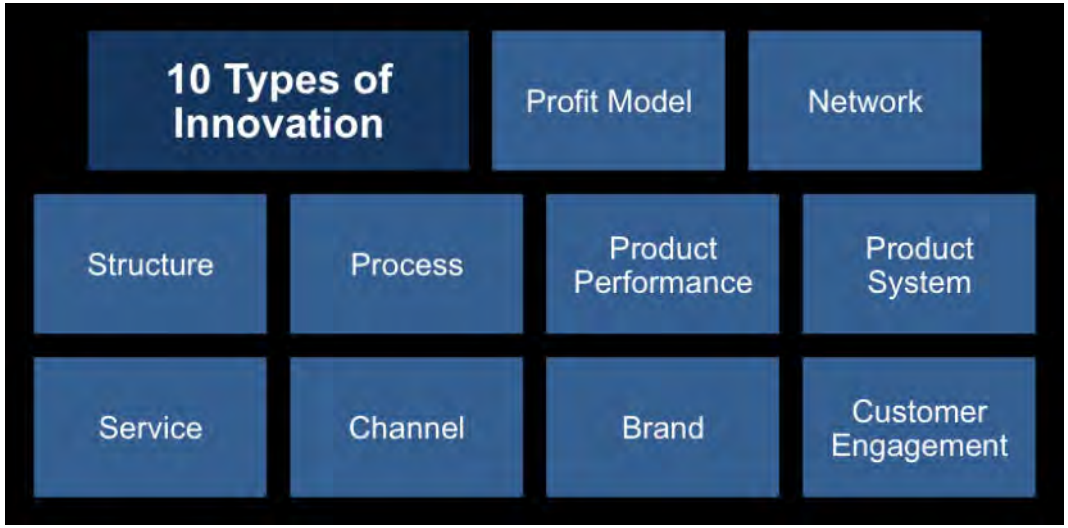
- **types of innovation:**



Source: Lopez, 2015

- **change in innovation:**
  - **product innovation,**
  - **process innovation,**
  - **position innovation,**
  - **paradigm innovation.**

- **ten types of innovation:**



Source: Keeley, 2013

- **ten types of innovation:**
  - **profit model,**
  - **network,**
  - **structure,**
  - **process,**
  - **product performance,**
  - **product system,**
  - **service,**
  - **channel,**
  - **brand,**
  - **customer engagement.**

- **case study of innovation in glass industry:**
  - **the change doesn't come in standard sized jumps,**
  - **a process of gradual improvement over time on dimensions,**
  - **the glass window business has been around for at least 600 years,**
  - **glass was made in approximately flat sheets which were then ground down to a state where they were flat enough for people to see through them.**

- **case study of innovation in glass industry:**
  - **Alastair Pilkington, working in the UK firm of the same name, began in 1952 working on a process which revolutionized glass making for the next 50 years,**
  - **the idea whilst washing up when he noticed that the fat and grease from the plates floated on the top of the water,**
  - **changes,**
  - **production.**

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Sources of Innovation

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- **internal value chain:**
  - **an idea can be generated and developed in R&D, the design transferred to manufacturing for production, and pricing, promotion, and positioning performed in marketing,**
  - **these ideas can be in the type and number of components used in the design, the core concepts that underpin each component, and the relationships among them,**
  - **3M,**
  - **Merck,**
  - **Intel.**

- **spillovers from competitors:**
  - **when firm benefits from the findings of another firm's R&D, it is said to have benefited from spillovers,**
  - **spillovers can be anything from basic scientific knowledge to advertising ide-as, both of which often cost a lot of money to develop,**
  - **cholesterol drugs,**
  - **Microsoft,**
  - **Coca cola.**

- **suppliers, costumers and complementary innovators:**
  - **suppliers, customers, complementary innovators, financiers, distributors, and any other entity that benefits from an innovation can also be a source of the innovation,**
  - **Alcoa,**
  - **Reynolds Aluminium.**

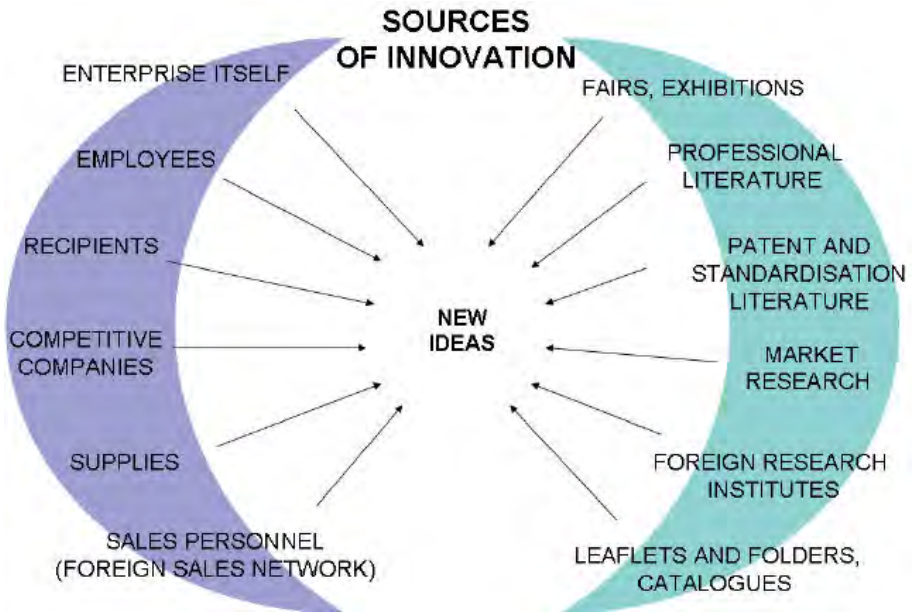
- university, government, private laboratories:
  - basic scientific research is usually performed without any particular product or service in mind,
  - it can be a source of inventions that firms can commercialize,
  - performed by universities, government research institutions, related industries, and competitors,
  - DNA,
  - the Internet,
  - nuclear science.

- **international cooperation:**
  - **pharmaceuticals,**
  - **biotechnology,**
  - **software,**
  - **movie and television entertainment,**
  - **airplane manufacturing,**
  - **facsimile machines,**
  - **many other electronic components,**
  - **machine tools,**
  - **chemicals,**
  - **shoe industry.**

- **complementary of sources an timing:**
  - **interacting and complementary nature of the sources,**
  - **international cooperation.**

- **circumstantial sources of innovation:**
  - **planned firm activities,**
  - **unexpected occurrences,**
  - **creative destruction.**

- **sources of innovation:**



Source: ResearchGate, 2018

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Creating Innovation

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- **definition of innovation of Mckeown (2014):**
  - **a deviance which means that the rebellious personality is a natural resource for practical creativity,**
- **innovator creates a new status quo,**
- **openness to new ideas,**
- **to defy convention.**

- **innovation people behaviour,**
  - **soldiers,**
  - **conformers,**
  - **rebels,**
  - **mavericks.**

- **soldiers:**
  - **keep the rules,**
  - **conform to conventions,**
  - **follow, obey and are willing supporters of the success of the organization,**
  - **share the objectives of the group and they want the group to be successful,**
  - **may try to suppress different views and reject those who share them.**

- **conformers:**
  - **keep the rules,**
  - **want to fit in,**
  - **dress, speak and act in ways that are necessary to be seen as one of the group,**
  - **don't share the objectives of the group or necessarily want the group to be successful,**
  - **may obey even when the rules make no sense.**

- **rebels:**
  - **break the rules,**
  - **actively reject some or all of the group's traditions,**
  - **may think, dress and act in deliberate defiance of the way things are usually done,**
  - **have also rejected the objectives of the group and are not interested in whether the group succeeds,**
  - **are easy to spot.**

- **mavericks:**
  - **break rules,**
  - **challenge conventions and intentionally break with traditions,**
  - **interested in the overall well-being of the group,**
  - **often argue, suggest and disobey in what they see as the best interests of the group,**
  - **work and think for the greater good.**

- **innovation behaviour:**
  - **assess your existing blend of sameness and difference,**
  - **identify sources of dissent,**
  - **compare levels of creative diversity in your organization,**
  - **introduce the rebel, maverick, soldier, conformer concepts,**
  - **think about the difference between breaking rules and rejecting traditions,**
  - **help people to share dissenting opinions.**

- **new innovation ideas:**
  - **case study of the electric car,**
  - **discussion,**
  - **opinion.**

- **the XEROX company:**
  - **case study,**
  - **idea x innovation,**
  - **timing,**
  - **problem solving,**
  - **new solution?**

- **references:**

  - **Carayannis, E. G., Samara, E. T., & Bakouros, Y. L. (2015). *Innovation and entrepreneurship: theory, policy and practice*. Springer.**
  - **Mckeown, M. (2014). *The Innovation Book: How to manage ideas and execution for outstanding results*. Pearson UK.**

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Innovation and Competitiveness in public and private sectors

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- **innovation,**
- **competitiveness,**
- **innovator,**
- **competitor,**
- **businessman.**

- **innovation in public sector,**
- **innovation in private sector,**
- **innovation frequency.**

- **governments:**
  - **in charge of creating a stable and foreseeable political and macroeconomic environment using transparent policies,**
  - **reinforcing their legitimate rights and property rights,**
  - **facilitating the specialized development,**
  - **creating a business environment with low transaction costs,**
  - **offering sufficient incentives for creativity and innovation.**

- **enterprises:**
  - **should use competition strategies developing specialized networks to achieve performance,**
  - **increase of technological effort intensity,**
  - **build of new capacities and skills,**
  - **development of a modern infrastructure.**

- **universities:**
  - **aligned with the development policies and innovation priorities of the public sector as well as the strategies of the private sector to offer crucial and critical new ca-pabilities and skills to public and private bodies through appropriately targeted research,**
  - **non-governmental organizations (NGO) should serve as empowering agents, catalysts and accelerators of activities of public and private cooperatives.**

- **references:**
  - **Carayannis, E. G., Samara, E. T., & Bakouros, Y. L. (2015). Innovation and en-trepreneurship: theory, policy and practice. Springer.**

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Innovation process

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- a response to either a need or an opportunity that is context dependent,
- a creative effort that if successful results in the introduction of novelty,
- the need for further changes.

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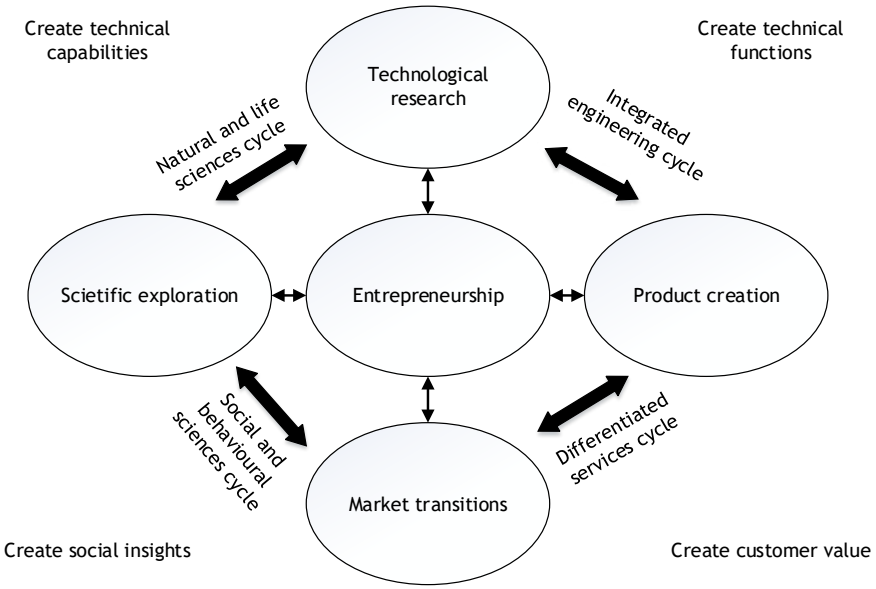
- **innovation needs to be managed,**
- **manager x leader x project manager.**

- **the innovation circle with interconnected cycles**



Source: Berkhout et. al. (2010)

- a cross-disciplinary view of change processes,
- behavioral sciences and engineering as well as natural sciences and markets are brought together in a coherent system of processes with four principal nodes that function as roundabouts,
- the combination of the involved changes leads to a wealth of business opportunities,
- without the drive of entrepreneurs there is no innovation,
- without innovation there is no new business.

- **interconnected cycles with feedforward and feedback connections,**
- **dynamic network environment,**
- **innovation framework,**
- **cyclic inovation model and its results,**
- **not a chain but a circle.**

- ideas create new concepts,
- successes create new challenges,
- failures create new insights,
- new ideas may start anywhere in the circle, causing a wave that propagates clockwise and anti-clockwise through the circle.

- **transparent business,**
- **high speed of propagation,**
- **minimum travel time.**

- **case study of Apple corporation:**
  - **products and diversification of the portfolio,**
  - **life cycle of the products,**
  - **mobile phone,**
  - **ipod and MP3 music,**
  - **computer.**

- **case study of Apple corporation:**
  - **iTune store,**
  - **services,**
  - **rise and fall of Apple,**
  - **Macintosh.**

Source: Wikipedie, 2018

- **case study of Apple corporation:**
  - **Pixar Animation Studios,**
  - **Newton (PDA),**
  - **a game consol,**
  - **Nokia.**

Source: Priceprice.com, 2018

- **case study of Apple corporation:**
  - **iMac,**
  - **iPod,**
  - **iPad,**
  - **iPhone,**
  - **successful of the brand,**
  - **lifestyle brand,**
  - **phenomenon.**
- **innovation?**

- **case study of a folding shipping container:**
  - **new idea?**
  - **new approach?**
  - **new business oportunity?**

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New product development

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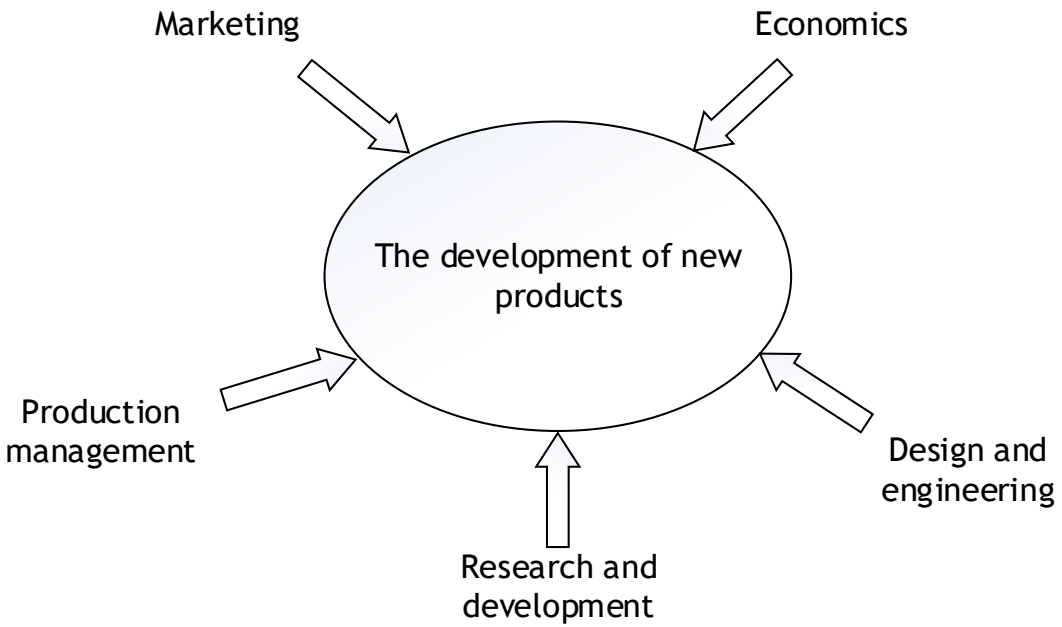
- **concerns the management of the disciplines,**
- **process x product,**
- **business x customer´s need.**

- **a variety of perspectives from which to analyze the development of new products:**



Source: Trott, 2012

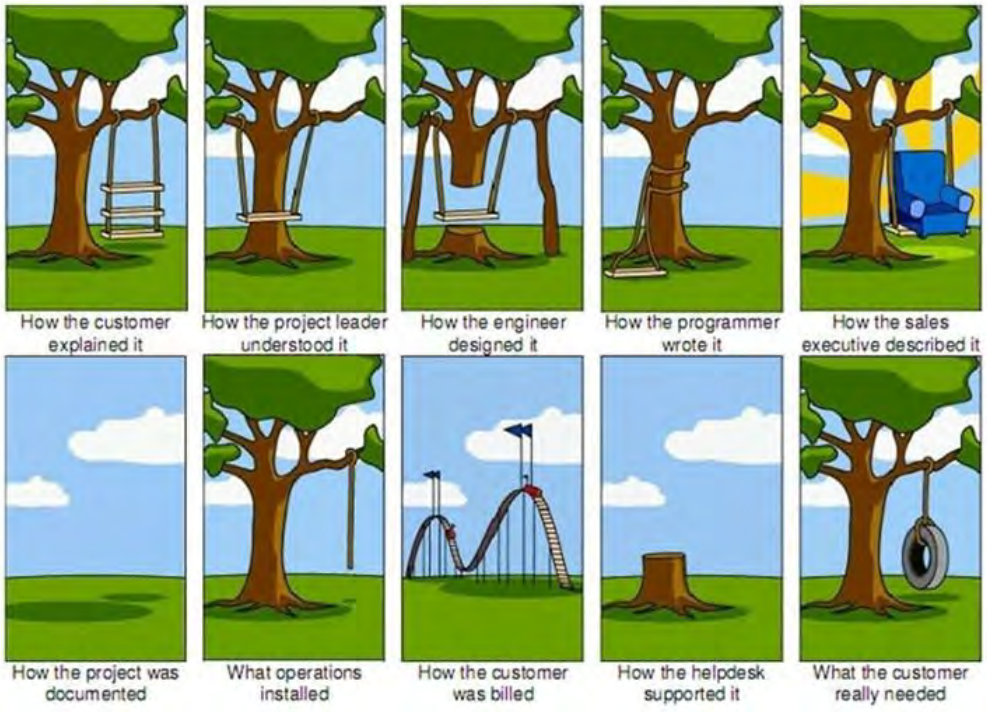
- marketing,
- economics,
- design and engineering,
- research and development,
- production management.

- **key questions need to be discussed:**
  - **What are the target values of the product attributes?**
  - **What will the product concept be?**
  - **What variants of the product will be offered?**
  - **What is the product architecture?**
  - **What will be the overall physical form and industrial design of the product?**
  - **Which components will be designed specifically for the product?**
  - **Who will design and produce the product?**
  - **What is the configuration of the physical supply chain?**
  - **What type of process will be used to assemble the product?**
  - **Who will develop and supply the process equipment?**

- **models of product development:**
  - **departmental-stage models,**
  - **activity-stage models and concurrent engineering,**
  - **cross-functional models (teams),**
  - **stage-gate process of new product development,**
  - **conversion-process models,**
  - **response models.**

- **departmental-stage models:**
  - **early form of new product development models,**
  - **based around the linear model of innovation, where each depart is responsible for certain tasks,**
  - **R&D provides the interesting technical ideas,**
  - **the engineering department will then take the ideas and develop possible prototypes,**
  - **the manufacturing department will explore possible ways to produce a viable product capable of mass manufacture,**
  - **the marketing department will then be brought in to plan and conduct the launch.**

- **how to design a new product:**



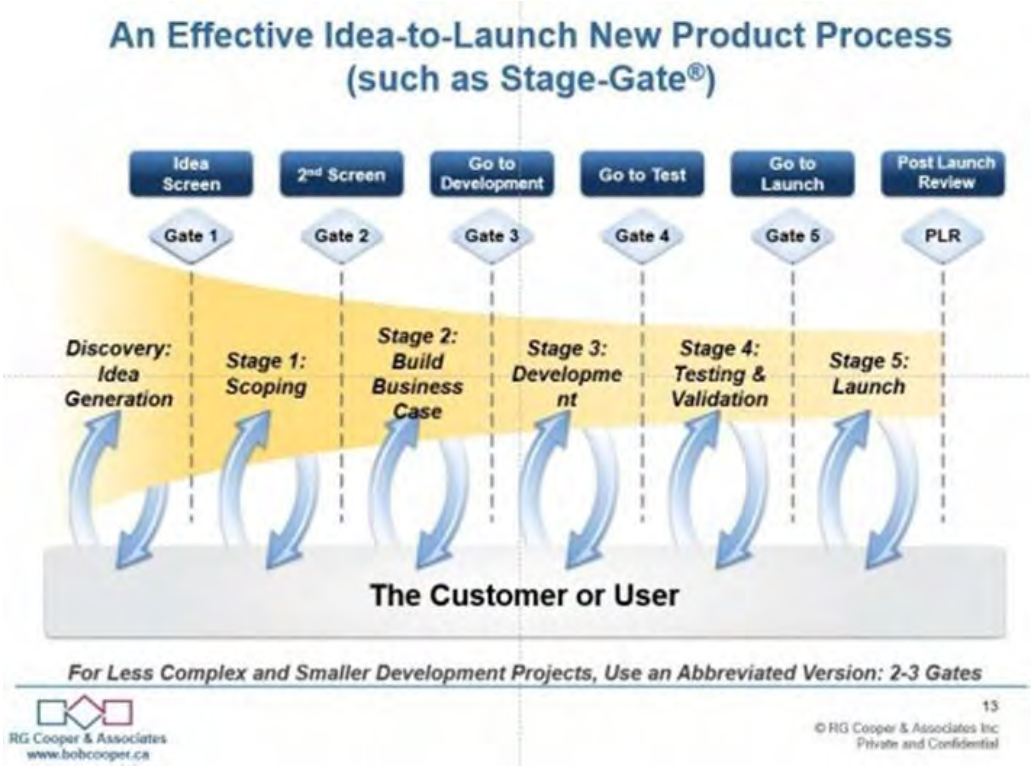
Source: Fleming, 2018

- **activity-stage models and concurrent engineering:**
  - **similar to departmental-stage models,**
  - **a better representation of reality,**
  - **iteration of the activities through the use of feedback loops,**
  - **the systematic method of concurrently designing both the product and its downstream production and support processes,**
  - **idea is to focus attention on the project as a whole rather than the individual stages primarily by involving all functions from the outset of the project,**
  - **change in philosophy from functional orientation to project orientation,**
  - **project teams.**

- **cross-functional models:**
  - **communications between different departments,**
  - **project team representing people from a variety of functions,**
  - **project management.**

- **stage-gate process of new product development:**
  - **a standard for new product development,**
  - **a machine where you put your ideas in, and after the machine prioritizes and processes them, it delivers a steady stream of successful new products into the marketplace,**
  - **a product innovation machine,**
  - **the original new product process,**
  - **a conceptual and operational model for moving a new product project from idea to launch.**

- **stage-gate process of new product development:**



Source: Sopheon, 2015

- **stage-gate process of new product development:**
  - **stages are where the action occurs,**
  - **each stage begins at the exit of a gate,**
  - **the team begins each stage with an approved forward plan and approved re-sources,**
  - **a date for the next gate is set, along with a list of required deliverables for the next gate,**
  - **stages are defined by the activities within them,**
  - **a fairly standard ox prescribed list of actions for each stage,**
  - **the activities in each stage are designed to gather and yield the information needed to make excellent decisions at the next gate,**
  - **designed as a risk management process.**

- **stage-gate process of new product development:**
  - **the parallel activities in each stage must be designed to gather vital information - technical, market, financial, operations,**
  - **each stage costs more than the preceding one,**
  - **the emphasis is on quality of execution,**
  - **stages are also cross-functional.**

- **stage-gate process of new product development:**
  - **Stage 0: Discovery,**
  - **Stage 1: Scoping,**
  - **Stage 2: Build the Business Case,**
  - **Stage 3: Development,**
  - **Stage 4: Testing and validation,**
  - **Stage 5: Launch.**

- **stage-gate process of new product development:**
  - **each stage is an entry gate or a Go/Kill decision point,**
  - **gates serve as quality control checkpoints: Is this project being executed in a quality fashion?**
  - **gates also serve as Go/Kill and prioritization decisions points: Gates provide the funnels, where mediocre projects are culled out at each successive gate,**
  - **gates are where the action plan for the next stage is approved, along with resource commitments.**

- stage-gate process of new product development:
  - gates:
  - a set of required deliverables,
  - criteria against which the project is judged in order to make the Go/Kill and prioritization decisions,
  - defined outputs: a decision (Go/Kill/Hold/Recycle).
- gate meetings are usually staffed by senior managers from different functions — the gatekeepers.

- **conversion-process models:**
  - **conversion-process models view new product development as numerous in-puts into a 'black box' where they are converted into an output.**

- **response models:**
  - **models focus on the individual's or organization's response to a new project proposal or new idea,**
  - **this approach has revealed additional factors that in-fluence the decision to accept or reject new product proposals, especially at the screening stage.**

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MINISTRY OF EDUCATION, YOUTH AND SPORTS

Building a Business Case

Strategic project of TBU in Zlín, reg. no. CZ.02.2.69/0.0/0.0/16_015/0002204

Eva Jurickova
TBU in Zlín, Faculty of Management and Economics

- **How to manage innovation?**
- **Best approach?**
- **Possibilities?**

- **project,**
- **project definition,**
- **project management,**
- **management of projects.**

- examples of innovation projects,
- knowledge,
- best experience,
- education,
- systematic approach,
- tools.

- the Business Case,
- standards of project management,
- Prince2,
- PMBoK,
- IPMA.

- **the Business Case:**
  - **developed both before the project starts and during the initiation stage,**
  - **a Project Mandate contains the reasons for the project,**
  - **project processes.**

- **the Business Case:**
  - **the purpose of the Business Case is to set out the justification for the project,**
  - **it provides a compelling argument to show why the project represents value for money and will give a good return on investment,**
  - **balances out the benefits that can be expected from the project against the cost of the initial project and any ongoing costs of operating the project's products.**

- **the Business Case:**
  - **takes into account any risks that the project or the organization will be ex-posed to as a result of the project,**
  - **is used to drive decision making in the project,**
  - **is used when the team is deciding whether to implement a change to the project's products.**

- **the Business Case:**
  - **content:**
  - **executive summary,**
  - **reasons,**
  - **business options,**
  - **expected benefits,**
  - **expected dis-benefits,**
  - **timescales,**
  - **costs,**
  - **major risks,**
  - **investment appraisal.**

- **case study of Building a Business Case:**
  - **structure,**
  - **information,**
  - **project definition,**
  - **project scope,**
  - **project triangle,**
  - **project funding,**
  - **time framework.**

- **case study – Building a Business Case:**

Business Case				
Project Name:				
Date:		Release:		Draft/Final
Authors:				
Owner:				
Client:				
Document Number:				

Source: Hinde, 2012

- **case study of Building a Business Case:**

Revision History			
Revision Date	Previous Revison Date	Summary of Changes	Changes Marked

Approvals				
Name	Signature	Title	Date of Issue	Version

Source: Hinde, 2012

- **case study of Building a Business Case:**

Distribution	
Name:	
Title:	
Date of Issue:	
Version:	

Overview	
Executive Summary:	
Reasons:	
Business Options:	
Expected Benefits:	
Expected Dis-Benefits:	
Timescale:	
Costs:	
Investment Appraisal:	
Major Risks:	

Source: Hinde, 2012

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Social entrepreneurship and Innovation

Strategic project of TBU in Zlín, reg. no. CZ.02.2.69/0.0/0.0/16_015/0002204

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- innovation is not a simple flash of inspiration but an extended and organized process of turning bright ideas into successful realities - changing the offering (product/service),
- the ways in which it is created and delivered (process innovation),
- the context and the ways in which it is introduced to that context (position innovation),
- mental models for thinking about what we are doing (business model or paradigm innovation).

- **entrepreneurship,**
- **business,**
- **challenge,**
- **innovation.**

- successful entrepreneurs they are typically ambitious, mission driven, passionate, strategic, resourceful and results oriented,
- target effort in a different, socially valuable direction,
- Wikipedia defines a social entrepreneur as „someone who recognizes a social problem and uses traditional entrepreneurial principles to organize, create, and manage a venture to make social change“.

- **business entrepreneurs typically measure performance in profit and return, social entrepreneurs often start nonprofits and citizen groups.**

- **characteristics of social entrepreneurs:**
  - **ambitious,**
  - **mission driven,**
  - **strategic,**
  - **resourceful,**
  - **result oriented.**

- **characteristics of social entrepreneurs:**
  - **ambitious:**
    - **social entrepreneurs tackle major social issues - poverty, healthcare, equal opportunities, etc. - with the underlying desire - passion even - to make a change,**
    - **may work alone or from within a wide range of existing organizations including those which mix elements of non-profit and for-profit aktivity.**

- **characteristics of social entrepreneurs:**
  - **mission driven:**
    - **their primary concern is generating social value rather than wealth - wealth creation may be part of the process but it is not an end in itself,**
    - **social entrepreneurs are intensely focused and hard-driving - even relentless - in their pursuit of a social vision.**

- **characteristics of social entrepreneurs:**
  - **strategic:**
    - **social entrepreneurs see and act upon what others miss: opportunities to improve systems, create solutions and invent new approaches that create social value.**

- **characteristics of social entrepreneurs:**
  - **resourceful:**
    - **social entrepreneurs often work in contexts where they have limited access to capital and traditional market support systems. As a result, they must be exceptionally skilled at mustering and mobilizing human, financial and political resources.**

- **characteristics of social entrepreneurs:**
  - **results oriented:**
    - **social entrepreneurs are motivated by a desire to see things change and to produce measurable returns. The results they seek are essentially linked to 'making the world a better place' - for example, through improving quality of life, access to basic resources, supporting disadvantaged groups, etc.**

- **case study of Healthcare in South Africa:**
  - **system of healthcare,**
  - **advantages,**
  - **disadvantages,**
  - **innovation,**
  - **new ideas for improvement?**

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Thank you for your attention.

Strategic project of TBU in Zlín, reg. no. CZ.02.2.69/0.0/0.0/16_015/0002204

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Basics of Firm Innovation Policy

(Innovation Management)

Eva Jurickova

2019

Strategic Project of TBU in Zlín, reg. no. CZ.02.2.69/0.0/0.0/16_015/0002204

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INTRODUCTION

Dear students,

this study text was prepared for the subject Basics of Firm Innovation Policy. The main purpose of this subject is to present basics about innovation in a context of new development of this area and new knowledge of today.

This studying material brings new tools and techniques used in innovation management and many case studies introducing a solving problem. You will examine this area during lectures divided into nine chapters followed by practical case studies presented in seminars. These demonstrations will make your knowledge practical and deeper.

I wish you lots of success in your studies.

Author

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1 WHAT IS INNOVATION?

"Discoveries consists of looking at the same thing as everyone else and thinking something different"

Albert Szent-Gyorgyi – Nobel Prize Winner

1.1 History of innovation

Mckeown (2014) explains innovation in a meaning of the word 'innovation' which has its origins in the Latin word "innovat". "Innovat" means to renew or alter. The rest of the word "novare" brings or make new or being made in a new way. The new approaches bring solving problems in a technical, business or other field named "innovation". McKeown (2014) also gives examples what had been invented as the bow and arrow, and agriculture, domesticated animals, developed pottery and learned to weave. Some of us figured out how to irrigate crops, others how to smelt copper for tools, then bronze and iron. The ancestors of those living in Iraq, Syria, Turkey, Iran and Kuwait - or Mesopotamia - gave us the wheel, written language and glass. Those in China invented the abacus, those in Egypt the calendar while the Greeks gave us the catapult. As populations grew, so did our desire to live in larger groups. And the more of us that gathered together in one place, the more we shared. New and old ideas competed for attention. We fought, but also discovered, copied and invented.

Although we'd been creatively problem-solving for thousands of years, the development of the printing press, in the 14th century, fed and nurtured a new enthusiasm for the pursuit of knowledge through discovery and learning. While not universal, this renaissance was deliberate, wide-spread and contagious. It developed principles for describing laws of nature - how things worked - and aimed to use that knowledge to improve human life through practical inventions and innovation.

New and old ideas continued to do battle, often with dogma and tradition. Those in power were also suspicious of the disruptive energy of ideas to change the nature of society. Some rulers sought influence through harnessing the new waves of knowledge, while others fought each new tide. Galileo was famously forced to kneel and recant his insights about the earth revolving around the sun but, despite this kind of persecution, the curious continued to connect with the curious.

By the 17th century, the west was benefiting from an increasingly methodical approach to discovering knowledge, through science, sharing what was discovered, via education and media, and making knowledge useful at the hands of inventors, workers, industry and society more generally.

Through to the 21st century, the flow of new ideas was never entirely predictable or completely painless - yet seemed unstoppable. Revolutions in agriculture, industry, medicine, transport and computing have continued in waves. Some waves are below and others above the surface, driven by the restless curiosity of creative obsessives and the near insatiable appetite for newer and better.

1.2 Case Study: 11 innovations that changed history

Andrews (2012) published a study focusing on the 11 innovations that changed history, described in a chapter below.

1.2.1 The Printing Press

Prior to the rise of the Internet, no innovation did more for the spread and democratization of knowledge than Johannes Gutenberg's printing press. Developed around 1440 in Mainz, Germany, Gutenberg's machine improved on already existing presses through the use of a mould that allowed for the rapid production of lead alloy type pieces. This assembly line method of copying books enabled a single printing press to create as many as 3,600 pages per day. By 1500 over 1,000 Gutenberg presses were operating in Europe, and by 1600 they had created over 200 million new books. The printing press not only made books affordable for the lower classes, but it helped spark the Age of Enlightenment and facilitated the spread of new and often controversial ideas. In 1518 followers of the German monk

Martin Luther used the printing press to copy and disseminate his seminal work "The Ninety-Five Theses," which jumpstarted the Protestant Reformation and spurred conflicts like the Thirty Years' War (1618-1648). The printing press proved so influential in prompting revolutions, religious upheaval and scientific thought that Mark Twain would later write, "What the world is today, good and bad, it owes to Gutenberg."

1.2.2 The Compass

Magnetic compasses may have been made somewhat obsolete by satellites and global positioning systems, but their impact on early navigation and exploration was inestimable. Originally invented in China, by the 14th century compasses had widely replaced astronomical means as the primary navigational instrument for mariners. The compass provided explorers with a reliable method for traversing the world's oceans, a breakthrough that ignited the Age of Discovery and won Europe the wealth and power that later fueled the Industrial Revolution. Most importantly, the compass allowed for interaction—both peaceful and otherwise—between previously isolated world cultures.

1.2.3 Paper Currency

Throughout much of human history, money took the form of precious metals, coins and even raw materials like livestock or vegetables. The inception of paper money ushered in a bold new era—a world in which currency could purchase goods and services despite having no intrinsic value. Paper currency was widely used in China in the ninth century, but did not appear in Europe until the late 1600s. Spurred on by frequent shortages of coins, banks issued paper notes as a promise against future payments of precious metals. By the late 19th century many nations had begun issuing government-backed legal tender that could no longer be converted into gold or silver. The switch to paper money not only bailed out struggling governments during times of crisis—as it did for the United States during the Civil War—but it also ushered in a new era of international monetary regulation that

changed the face of global economics. Perhaps even more importantly, paper currency was the vital first step in a new monetary system that led to the birth of credit cards and electronic banking.

1.2.4 Steel

While early human societies made extensive use of stone, bronze and iron, it was steel that fueled the Industrial Revolution and built modern cities. Evidence of steel tools dates back 4,000 years, but the alloy was not mass-produced until the invention of the Bessemer Process, a technique for creating steel using molten pig iron, in the 1850s. Steel then exploded into one of the biggest industries on the planet and was used in the creation of everything from bridges and railroads to skyscrapers and engines. It proved particularly influential in North America, where massive iron ore deposits helped the United States become one of the world's biggest economies.

1.2.5 The Electric Light

While they are easy to take for granted, all it takes is a short power outage to remind us of the importance of artificial lights. Pioneered in the early 19th century by Humphry Davy and his carbon arc lamp, electric lights developed throughout the 1800s thanks to the efforts of inventors like Warren de la Rue, Joseph Wilson Swan and Thomas Alva Edison. It was Edison and Swan who patented the first long-lasting light bulbs in 1879 and 1880, liberating society from a near-total reliance on daylight. Electric lights went on to be used in everything from home lighting and street lamps to flashlights and car headlights. The complex networks of wires erected to power early light bulbs also helped lead to the first domestic electrical wiring, paving the way for countless other in-home appliances.

1.2.6 Domestication of the Horse

Since their domestication some 5,500 years ago, horses have been inextricably tied to human development. They enabled people to travel great distances and gave different cultures the chance to trade and exchange ideas and technology.

Equine strength and agility meant that horses could also carry cargo, plow farmland and even clear forests. Perhaps most influential of all, horses changed the nature of war. Nothing was more feared than a horse-drawn chariot or a mounted warrior, and societies that mastered the use of cavalry typically prevailed in battle.

1.2.7 Transistors

A criminally underappreciated innovation, the transistor is an essential component in nearly every modern electronic gadget. First developed in 1947 by Bell Laboratories, these tiny semiconductor devices allow for precise control of the amount and flow of current through circuit boards. Originally used in radios, transistors have since become an elemental piece of the circuitry in countless electronic devices including televisions, cell phones and computers. The amount of transistors in integrated circuits doubles nearly every two years—a phenomenon known as Moore's Law so their remarkable impact on technology will only continue to grow.

1.2.8 Magnifying Lenses

Magnifying lenses might seem like an unremarkable invention, but their use has offered mankind a glimpse of everything from distant stars and galaxies to the minute workings of living cells. Lenses first came into use in the 13th century as an aid for the weak-sighted, and the first microscopes and telescopes followed in the late 16th and early 17th centuries. Figures like Robert Hook and Anton van Leeuwenhoek would go on to use microscopes in the early observance of cells and other particles, while Galileo Galilei and Johannes Kepler employed the telescope to chart Earth's place in the cosmos. These early uses were the first steps in the development of astonishing devices like the electron microscope and the Hubble Space Telescope. Magnifying lenses have since led to new breakthroughs in an abundance of fields including astronomy, biology, archeology, optometry and surgery.

1.2.9 The Telegraph

The telegraph was the first in a long line of communications breakthroughs that later included radio, telephones and email. Pioneered by a variety of inventors in the 18th and 19th centuries, the telegraph used Samuel Morse's famous Morse code to convey messages by intermittently stopping the flow of electricity along communications wires. Telegraph lines multiplied throughout the 1850s, and by 1902 transoceanic cables encircled the globe. The original telegraph and its wireless successors went on to be the first major advancements in worldwide communication. The ability to send messages rapidly across great distances made an indelible impact on government, trade, banking, industry, warfare and news media, and formed the bedrock of the information age.

1.2.10 Antibiotics

A giant step forward in the field of medicine, antibiotics saved millions of lives by killing and preventing the growth of harmful bacteria. Scientists like Louis Pasteur and Joseph Lister were the first to recognize and attempt to combat bacteria, but it was Alexander Fleming who made the first leap in antibiotics when he accidentally discovered the bacteria-inhibiting mold known as penicillin in 1928. Antibiotics proved to be a major improvement on antiseptics—which killed human cells along with bacteria—and their use spread rapidly throughout the 20th century. Nowhere was their effect more apparent than on the battlefield: While nearly 20 percent of soldiers who contracted bacterial pneumonia died in World War I, with antibiotics that number dropped to only 1 percent during World War II. Antibiotics like penicillin, vancomycin, cephalosporin and streptomycin have gone on to fight nearly every known form of infection, including influenza, malaria, meningitis, tuberculosis and most sexually transmitted diseases.

1.2.11 The Steam Engine

Cars, airplanes, factories, trains, spacecraft—none of these transportation methods would have been possible if not for the early breakthrough of the steam engine. The first practical use of external combustion dates back to 1698, when

Thomas Savery developed a steam-powered water pump. Steam engines were then perfected in the late 1700s by James Watt, and went on to fuel one of the most momentous technological leaps in human history during the Industrial Revolution. Throughout the 1800s external combustion allowed for exponential improvement in transportation, agriculture and manufacturing, and also powered the rise of world superpowers like Great Britain and the United States. Most important of all, the steam engine's basic principle of energy-into-motion set the stage for later innovations like internal combustion engines and jet turbines, which prompted the rise of cars and aircraft during the 20th century.

1.3 Definitions of innovation

According to Matthews and Brueggemann (2015) is innovation driven by entrepreneurship, the power behind changing product, processes and services which comes from individuals – who make innovation happen. Peter Drucker notes (Butler-Bowdon, 2017):

"Entrepreneurship is not "natural"; it is not "creative". It is work. Entrepreneurial businesses treat entrepreneurship as a duty. They are disciplined about it…they work at it...they practice it."

One of the greatest economist, Joseph A. Schumpeter defined a role of innovation and entrepreneurship in the economy and economic growth. In his work "Theory of economic development (1912)" he described development as a process of structural changes. First types of models were based on the development phase of innovation process and did not contain the whole process from the idea phase to the launch. Schumpeter defined five types of changes (Śledzik, 2013):

- launch of a new product or a new species of already known product,
- application of new methods of production or sales of a product,

- opening of a new market,
- acquiring of new sources of supply of raw material or semi-finished goods,
- new industry structure such as the creation of destruction of a monopoly position.

Various definitions of innovation are found in the literature based on authors' experience and knowledge:

Freeman, Clark and Soete (1982) reports: "The industrial innovation involves technical design, manufacturing, administrative and commercial activities related to the marketing of few (or improved) products or with the first commercial use of a new (or improved) process or equipment".

Rothwell and Gardiner (1985) highlight the following: "...innovation does not only mean commercialization of a significant advantage at the highest technical level (radical innovation), but it also includes taking advantage of small scale changes in the know-how (improvement or incremental innovation)..."

Drucker (1985) stresses that: "innovation is the special tool of businessmen to utilize change as an opportunity for a different activity or service. It is possible to appear as a discipline, to be learned, to be practiced".

Porter (1990): "enterprises acquire a competitive advantage through acts of innovation. They approach innovation in its broader sense, including new technologies and the new way to do things".

For European Commission is innovation a key factors for EU competitiveness. Kao (2007) defined innovation in publication of European Commission called "Innovation Union" as:

"Innovation is the ability of individuals, companies and entire nations to continuously create their desired future."

European Commission, 2013

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2 INTRODUCTION TO INNOVATION MANAGEMENT

Carayannis et al. (2015) explains a clear difference between the concepts of invention and innovation. The famous economist Joseph Schumpeter (1942) was the first to have observed and defined this difference: the 'invention' is the outflow of an applied research, while 'innovation' is the successful introduction of an invention in the market as a functional solution (product or service). Scientific discovery is also assessed on the basis of whether it has contributed to understanding natural phenomena. Due to the fact that innovation includes specialized knowledge and the latter's main attribute is its being a public good, the state enshrines legally the intellectual rights of an inventor-innovator by awarding him/her a patent, safeguarding thus for the benefit of the inventor-innovator the economic exploitation of the new product in a specific geographical region and for a specific period of time.

2.1 Perspectives on innovation

Carayannis and Alexander (2002) advocate an approach for the concept of innovation classification and in four basic dimensions:

- the process of innovation (the way innovation develops, disseminated and adopted),
- the content of innovation (the specific technique or social nature of innovation itself),
- the environment of innovation (the environment in which innovation takes place and the environmental impact on innovation),
- the impact of innovation (the social and technological change arising from the innovation process completion).

The key factors linking creativity and innovation are the following (Carayannis et al., 2015):

- environment: the environment where the above dimensions take place,
- process: what is the process actualizing all the above,
- content: what is the content of the above taking into account the interaction with other factors,
- invention: what is being invented determines the content of innovation,
- mechanization: it is a necessary but no satisfactory condition for innovation,
- creativity and competition: they may be extrinsic factors to competitiveness. Competition facilitates or inhibits competitiveness.
- stabilization: it may reproduce satisfaction,
- radical technologies: they can renew competitiveness with significant productivity profits.

Tidd (2001) classified innovation in three categories: in content innovations, process innovations and administrative innovations:

- process innovations regard the change in the methods adopted by a company to offer products and services. A case in point is the use of the internet to manage the supply chain, whereby ordering, pricing and monitoring are carried out through the internet.
- innovations of content reflect the changes in the final products and in a company's services. Such an example is the addition of a new characteristic, i.e. remote control in TV sets to facilitate users.
- administrative innovations refer to the changes in the characteristics of an organization or an institution. Such examples are the changes in policy, structure and distribution of sources.

Models of innovation can be various. These basic principles pertain to innovations (Carayannis et al., 2015):

- the integrated organizational approach,
- the incentives of innovations,
- the systematic process to convert an invention into innovation,
- communications,
- learning and,
- project management.

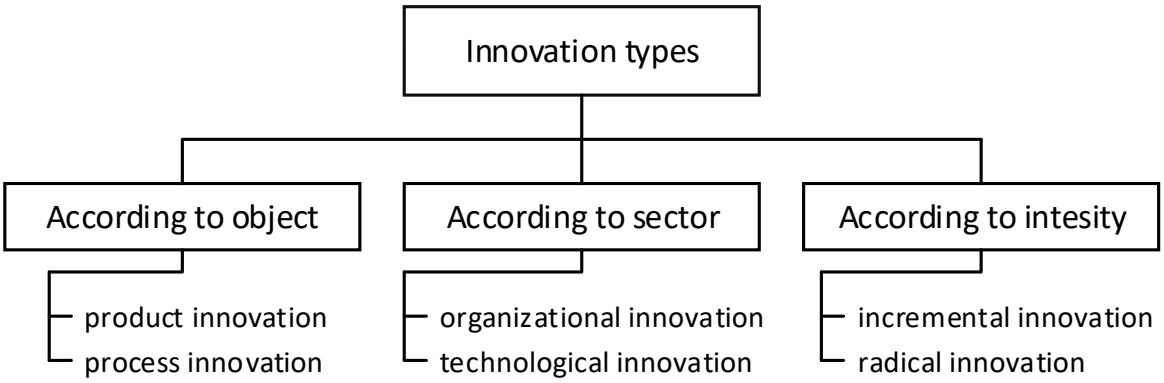
Drejer (2002) defined five activities that determine innovation management:

- technological integration: the technological integration regards the relation between technologies and the company's products,
- process of innovations: the process of innovations involves functions creating and preserving innovations,
- strategic planning: strategic planning refers to planning of innovation-related technologies,
- organizational change: organizational change encompasses the disruptive nature of innovations related to requirements for knowledge and skills, new markets, new employees, etc.,
- development of an enterprise: the development of an enterprise refers to the creation of new markets for the products of innovations.

2.2 Types of innovation

The types of innovation vary depending on the object, the sector it refers to, the scope or its intensity. These types are not independent one from the other. There exist though some recognizable attributes, without having dividing lines. The types of innovation are classified in three groups (Carayannis et al., 2015).

Image 1: Types of innovation



Source: Carayannis et al., 2015

Dogson et al. (2008) defined type of innovation according to whether it is:

- radical or incremental: that is, the extent to which a technology has changed, or the degree of novelty of an innovation. Radical innovations include breakthroughs that change the nature of products and services, such as synthetic material, and may contribute to the technological revolution. Incremental innovations include the "million little things" that involve minor changes to existing products, which cumulatively improve the performance of products and services.
- continuous or discontinuous: that is, whether it affects existing ways of doing things (Tushman and Anderson, 1986), or whether it is sustaining or disruptive (Christensen, 1997). Firms commonly find it very difficult to break away from previous technologies and ways of innovating, and managers may need to explore new ways of doing things that are destructive of existing success.

Bessant and Tidd (2011) announced we can change in innovation:

- product innovation: changes in the things (products/services) which an organization offers,

- process innovation: changes in the ways in which they are created and delivered,
- position innovation: changes in the context in which the products/services are introduced,
- paradigm innovation: changes in the underlying mental models which frame what the organization does.

Bessant and Tidd (2011) give an example of product innovation a new design of car, a new insurance package for accident-prone babies and a new home entertainment system. And change in the manufacturing methods and equipment used to produce the car or the home entertainment system, or in the office procedures and sequencing in the insurance case, would be examples of process innovation.

Sometimes the dividing line is somewhat blurred - for example, a new jet-powered sea ferry is both a product and a process innovation. Services represent a particular case of this where the product and process aspects often merge - for example, is a new holiday package a product or process change?

Innovation can also take place by repositioning the perception of an established product or process in a particular user context. For example, an old-established product in the UK is Lucozade - originally developed as a glucose-based drink to help children and invalids in convalescence. These associations with sickness were abandoned by the brand owners. Beechams (now part of GlaxoSmithKline), when they relaunched the product as a health drink aimed at the growing fitness market where it is now presented as a performance-enhancing aid to healthy exercise. In 2009 it made £376m in sales. This shift is a good example of 'position' innovation. In similar fashion Haagen Dazs created a new market for ice cream, essentially targeted at adults, through position innovation rather than changing the product or core manufacturing process.

Sometimes opportunities for innovation emerge when we reframe the way we look at something. Henry Ford fundamentally changed the face of transportation, not

because he invented the motor car (he was a comparative latecomer to the new industry), nor because he developed the manufacturing process to put one together (as a craft-based specialist industry, car-making had been established for around 20 years). His contribution was to change the underlying model from one which offered a hand-made specialist product to a few wealthy customers to one which offered a car for 'Everyman' at a price he/she could afford. The ensuing shift from craft to mass production was nothing short of a revolution in the way cars (and later countless other products and services) were created and delivered. Of course making the new approach work in practice also required extensive product and process innovation - for example, in component design, in machinery building, in factory layout and particularly in the social system around which work was organized.

Recent examples of paradigm innovation - changes in mental models - include the shift to low-cost airlines, the provision of online insurance and other financial services, and the repositioning of drinks like coffee and fruit juice as premium 'designer' products. Although in its later days Enron became infamous for financial malpractice, it originally came innovation in the utilities business. In a climate of deregulation and with global interconnection through grid distribution systems, energy and other utilities like telecommunicate bandwidth increasingly became commodities which could be traded much as sugar or cocoa futures.

Paradigm innovation can be triggered by many different things - such as n technologies, the emergence of new markets with different value expectations, new le rules of the game, new environmental conditions (climate change, energy crises), etc. I example, the emergence of Internet technologies made possible a complete reframing how we carry out many businesses. In the past similar revolutions in thinking were triggered by technologies like steam power, electricity, mass transportation (via railways a: with motor cars, roads) and microelectronics. And it seems very likely that similar reframing will happen as we get to grips with new technologies like nanotechnology or genetic engineering (Bessand and Tidd, 2011).

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3 SOURCES OF INNOVATION

Afuah (2003) distinguishes two sources of innovation: functional and circumstantial. Five major functional sources of innovation are explained in this chapter below:

- internal value chain functions,
- external value-added chain of suppliers, customers, and complementary innovators,
- university, government, and private laboratories,
- competitors and related industries.
- other nations or regions.

3.1 Internal value chain

Any of the functions within a firm's value chain can be a source of innovation. An idea can, for example, be generated and developed in R&D, the design transferred to manufacturing for production, and pricing, promotion, and positioning performed in marketing. These ideas can be in the type and number of components used in the design, the core concepts that underpin each component, and the relationships among them. Some of the more innovative firms such as 3M, Merck, and Intel spend a high percentage of their revenues every year on R&D to generate ideas for innovation. But ideas for innovation do not always come out of R&D. In performing their value-adding activities, manufacturing, marketing, and service also have an opportunity to innovate. For some industries low cost and product differentiation come largely from innovations in manufacturing. These are mainly so-called process innovations—new methods, techniques, input materials, types of equipment used, and information flow mechanisms that are used to manufacture a product or offer a service. In marketing, a new idea can be turned into an advertising campaign that alters the customers' perception of a product and therefore differentiates the product from those of competitors. Financial innovations from the finance department can result in lower cost of capital, which translates

into lower cost for new products. In short, any part of a firm's value chain can be the source of innovations.

3.2 Spillovers from competitors

When firm benefits from the findings of another firm's R&D, it is said to have benefited from spillovers. Spillovers can be anything from basic scientific knowledge to advertising ideas, both of which often cost a lot of money to develop. For example, a firm conducting research on cholesterol drugs may see some of its findings on how the body makes cholesterol spill over to its competitors. It may also see the chemical structure of its new blockbuster cholesterol-reducing drug copied by the same competitors. Some firms live off spillovers from others. They engage in strategies such as fast follower, imitator, follower, and cloner, all of which wait for other firms to invent products first. Microsoft did not invent most of the software products in which it has a commanding market share lead. Diet and caffeine free colas were not invented by Coca Cola, although the firm is the leader in both markets. Spillovers are a function of the extent to which the scientific knowledge or invention can be protected from imitators—a function of its appropriability regime. This is a function of the protection accorded the intellectual property and of the tacitness and quantity of knowledge in question. Copyright protection is tighter than patent protection, and patent protection is tighter in pharmaceuticals than in semi-conductors. The more tacit and the more knowledge based, the more difficult it is to imitate.

3.3 Suppliers, Customers, and Complementary Innovators

Von Hippel (2007) showed that manufacturers are not always the source of innovations. Suppliers, customers, complementary innovators, financiers, distributors, and any other entity that benefits from an innovation can also be a source of the innovation. These benefits can be economic or strategic. For example, Alcoa and

Reynolds Aluminum invented the two-piece aluminum can to compete with the three-piece tin-plated steel can. Their intention was to turn the process over to can manufacturers so as to increase sales of their aluminum. Second, a supplier can also develop another product, B, which is complementary to component C. That way the customer can demand more of C. For example, a maker of microprocessors can give away software. Thus as more software becomes available for personal computers, more of them will sell, and the firm will sell more microprocessors.

Customers who require special features in a product they use may add these features to the product. If these are features that other customers can use, the manufacturer can incorporate them into its products.

A complementary innovator is a firm whose products are critical to the success of a manufacturer, but over whom the manufacturer has very little or no direct control. For example, Microsoft's software is critical to the success of personal computer makers such as Compaq, yet Compaq has no direct control over Microsoft. To build good complementary products, a complementary innovator often has to understand some aspects of the primary product very well. This gives it an opportunity to be the source of innovations for the product.

3.4 University, Government, and Private Laboratories

Although basic scientific research is usually performed without any particular product or service in mind, it can be a source of inventions that firms can commercialize. It is performed by universities, government research institutions, related industries, and competitors. Popular examples of the results or consequences of basic research by universities and government and private laboratories include DNA, the Internet, and nuclear science. The results of basic research are normally disseminated in the form of journal papers and conference presentations and are usually available to anyone who wants them. If a firm believes that some

of these results are promising (are potential inventions), it can perform more research on them, and this time with a particular application targeted, that is, applied research.

The research performed by universities and government and private laboratories is not limited to basic research. It extends to applied research. Popular examples include the computer, the jet engine, nuclear power, and the World Wide Web. Again, to take advantage of the results of R&D performed by these institutions, firm needs to perform related research and build an absorptive capacity.

3.5 International

Some nations are better at certain kinds of innovations than others. The United States leads in pharmaceuticals, biotechnology, software, movie and television entertainment, airplane manufacturing, and so on. Japan and Korea lead in facsimile machines and many other electronic components. Germany dominates in machine tools and chemicals, and Italy in shoes and specialty leather. These examples suggest that different nations can be better sources of certain innovations than other nations.

3.6 Complementarity of Sources and Timing

It is important to note the interacting and complementary nature of these sources. Consider this case. A U.S. pharmaceutical firm recognizes the potential of a market for cholesterol-lowering drugs and is determined to capitalize on it. It wants to develop a drug that curbs the ability of the body to produce cholesterol as compared to existing drugs, which try to use up the cholesterol that has already been produced and is in the blood stream. Meanwhile, years earlier, a Japanese firm has discovered a compound that inhibits cholesterol synthesis in cultured human cells. With public funding, U.S. scientists help the medical community, through publications and presentations, to better understand the scientific basis

for this inhibition and, in the process, pick up a Nobel Prize in Medicine. The U.S. firm invests lots of money and effort in performing its own search for similar compounds. It successfully discovers a similar compound and turns it into a blockbuster drug of more than a billion dollars in annual sales. Thus the firm's own research, spillovers from a Japanese firm, and basic research from U.S. scientists all contribute to the technological knowledge that underlies the development of the billion-dollar-a-year drug. Often it is this ability to integrate information from different sources that is critical.

Circumstantial sources of innovation defined Afuah (2003) as:

- planned firm activities,
- unexpected occurrences,
- creative destruction.

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4 CREATING INNOVATION

Mckeown (2014) considers innovation as deviance which means that the rebellious personality is a natural resource for practical creativity. As an innovator, you need to reject the old to establish a new (better) status quo. One of the most powerful sources of newness is the rebel (or maverick) mind. Innovation needs openness to new ideas but the people who desperately need openness are also the least likely to embrace those ideas that can save them. You need people who defy convention because it helps create space for new ideas and learning throughout your group, team or society.

When a patent clerk, Genrich Altshuller, proposed improvements to how the USSR innovated, he was imprisoned as an enemy of the state. He survived interrogation and labour camps through his quick-witted problem-solving. Later, his ideas about practical creativity spread into Russian universities where idea scouts brought the techniques back to Samsung in Seoul. The rebel mind persecuted under one system became a powerful source of innovation in an idea-hungry culture.

When a second patent clerk, Albert Einstein, proposed radical new theories about space and time, he shared his thought experiments with friends. Yet his brilliant rebelliousness was rejected by the idea-toxic culture of Nazi Germany. They burned his books and put a price upon his head. Many such beautiful minds brutally discarded by narrow prejudice were embraced warmly in the USA.

Many organizations unintentionally reduce innovation through efforts to increase consistency. There are formal job advertisements with essential and desirable attributes. These are added to formal job descriptions within the formal hierarchy. And let's not forget formal review processes, with managers sorting people into categories based on formal performance criteria. To complete the sameness filter, some systems fire those who are at the bottom of the rankings. Unfortunately, despite good intentions, this is a process that can damage the ability of the group to adapt to new conditions *or* introduce new ideas that can transform the future.

One problem is that people with new ideas can pay a personal price for sharing them. And they may be offered no encouragement to defend, develop or distribute their new ideas. The group likes stability even if stability is often an illusion. Colleagues may minimize, attack or deny opinions just because they are different. People may fight against new ideas because they feel criticized, feel their way of life is threatened, or feel stupid. Innovation needs openness to new ideas but the people who desperately need openness are also the least likely to embrace those ideas that can save them. You need people who defy convention because it helps create space for new ideas and learning throughout your group, team or society. You also need enough people to work within convention to make any new ideas work.

McKeown (2014) defined four types of innovation people behavior in the “The Innovation Book”, described below.

4.1 Behavioral types of people

4.1.1 Soldiers

Soldiers keep the rules. They conform to conventions. They follow, obey and are willing supporters of the success of the organization. They share the objectives of the group and they want the group to be successful. They may try to suppress different views and reject those who share them.

4.1.2 Conformers

Conformers also keep the rules. They want to fit in. They dress, speak and act in ways that are necessary to be seen as one of the group. But they don't share the objectives of the group or necessarily want the group to be successful. They may obey even when the rules make no sense.

4.1.3 Rebels

Rebels break the rules. They actively reject some - or all - of the group's traditions. They may think, dress and act in deliberate defiance of the way things are usually

done. They have also rejected the objectives of the group and are not interested in whether the group succeeds. They are easy to spot.

4.1.4 Mavericks

Mavericks also break rules. They challenge conventions and intentionally break with traditions. But they are interested in the overall well-being of the group. They often argue, suggest and disobey in what they see as the best interests of the group. They are working and thinking for the greater good.

These behaviors are not fixed. Good soldiers can learn to challenge traditions when challenging traditions is seen as something that is good for the group. Unhappy mavericks can become rebels if they stop believing in the purpose of the group. The smart leader of innovation can try to shape a climate of adaptability that responds to the needs of the moment with conformity or creativity.

4.2 Case study - New innovation ideas

The electric car is an idea but not a new idea. There were electric cars in the 19th century but they didn't prove as successful as the internal combustion engine. Recent efforts to make electric cars popular in the real world require more than an electric engine. They need better questions until the innovation is complete enough to solve enough valuable real-world problems to thrive.

Chetan Mami developed the Reva Electric Car Company in Bangalore as a series of smart questions. His father had asked how a small car could help India. Chetan asked how an affordable compact electric car could contribute to solving urban pollution. The company asked how it could reduce purchase costs and ended up in partnership with rental firms. It asked how it could improve the technology of electric cars and patented breakthrough engine management systems.

Asking better questions is business-as-usual for Reva. Asking how the company could get access to global technology led to the original joint venture with a US

company. Asking how it could scale up production helped it give up a controlling interest for investment from Mahindra and Mahindra - one of India's largest manufacturers. The company has now launched the Ask Movement' to encourage people inside and outside to ask better questions that will help create real progress.

The case study was published in the book “The Innovation Book: How to manage ideas and execution for outstanding results “, written by Mckeown (2014).

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5 INNOVATION AND COMPETITIVENESS IN PUBLIC AND PRIVATE SECTORS

Carayannis et al. (2015) consider competiveness as a product and a function of creativity and innovation reserves and supply, being determined and modified through various types, ways and kinds of knowledge (up to bottom and bottom up, acting proportionately, succeeding or failing through the exchange of capabilities, cooperatives, technological activity, supranational knowledge, domestic knowledge as well as through special knowledge and inventiveness (the 'when', 'how' and 'why' of creativity and innovation).

- Governments are in charge of creating a stable and foreseeable political and macroeconomic environment using transparent policies, reinforcing their legitimate rights and property rights, facilitating the specialized development, creating a business environment with low transaction costs and offering sufficient incentives for creativity and innovation.
- Enterprises should use competition strategies developing specialized networks to achieve performance (social profit), increase of technological effort intensity (more sources for R&D), building of new capacities and skills (human and intellectual profit) and development of a modern infrastructure. Suppliers and importers of services, materials and infrastructure should be harmonized with the international standards of quality, distribution and cost.
- Universities and research institutes should be aligned with the development policies and innovation priorities of the public sector as well as the strategies of the private sector to offer crucial and critical new capabilities and skills to public and private bodies through appropriately targeted research. Non-governmental organizations (NGO) should serve as empowering agents, catalysts and accelerators of activities of public and private cooperatives.

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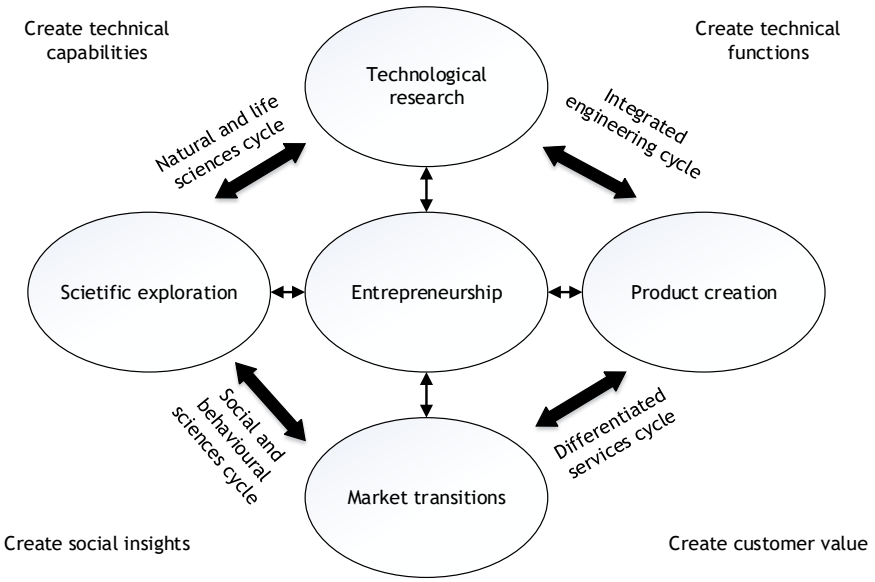
6 INNOVATION PROCESS

The innovation process involves (Trott, 2012):

- a response to either a need or an opportunity that is context dependent;
- a creative effort that if successful results in the introduction of novelty;
- the need for further changes.

According to Trott (2012) the innovation needs to be viewed as a management process. We need to recognize that change is at the heart of it. And that change is caused by decisions that people make. The framework in Image 2 attempts to capture the iterative nature of the network processes in innovation and represents this in the form of an endless innovation circle with interconnected cycles. This circular concept helps to show how the firm gathers information over time, how it uses technical and societal knowledge, and how it develops an attractive proposition. This is achieved through developing linkages and partnerships with those having the necessary capabilities ('open innovation'). In addition, the entrepreneur is positioned at the centre.

Image 2: The innovation circle with interconnected cycles



Source: Berkhout et. al. (2010)

Trott (2012) states the framework in Image 2 is referred to as the “cyclic innovation model” (CIM) described in a book of Berkhout et al., 2010. A cross-disciplinary view of change processes (and their interactions) as they take place in an open innovation arena. Behavioral sciences and engineering as well as natural sciences and markets are brought together in a coherent system of processes with four principal nodes that function as roundabouts. The combination of the involved changes leads to a wealth of business opportunities. Here, entrepreneurship plays a central role by making use of those opportunities. The message is that without the drive of entrepreneurs there is no innovation, and without innovation there is no new business. The CIM model displayed in Image 2 shows that the combination of change and entrepreneurship is the basis of new business.

Adopting this approach to the management of innovation should help firms as processes should not be forced into simple one-way pipelines, but rather be organized by interconnected cycles with feedforward and feedback connections: from linear to non-linear thinking. In that way, a dynamic network environment is created in which the social and behavioral sciences are linked to engineering, and where the natural and life sciences connect with market goals (Berkhout, 2000). This is what is captured in the proposed innovation framework. Supported by today's powerful communication technology, serial process management along a linear path is replaced by parallel networking along a largely self-organizing circle. Vital decisions in innovation do not occur in the gates of a staged project management pipeline, but do occur on the innovation shop floor itself; or in the nodes of the cyclic networks. In Trott’s experience young people like to work in such an environment. Moreover, according to Salkowitz (2010), young entrepreneurs around the world are blending new technologies and next-generation thinking, building radically new kinds of organizations adapted to a flat and crowded world.

The cyclic innovation model is the result of a combination of analysis of theory and practical evidence, based on many years of experience within industries that work with scientists to develop valuable new products and services. Furthermore, evidence has been gathered from Delphi, a science-industry consortium which

consists of a large number of international companies within the field of geo-energy (Berkhout et al., 2010).

The most important feature of CIM is that the model architecture is not a chain but a circle; innovations build on innovations. Ideas create new concepts, successes create new challenges, and failures create new insights. Note that new ideas may start anywhere in the circle, causing a wave that propagates clockwise and anti-clockwise through the circle. In an innovative society businesses are transparent and the speed of propagation along the circle is high, resulting in minimum travel time along the innovation path. Today, time is a crucial factor in innovation. Indeed, when it comes to managing the process within the firm the stage-gate approach dominates practice. This is because the project management advantages tend to outweigh the limitations it poses to the innovation process. The central position in the innovation circle is frequently occupied by a manager, who adopts a stage-gate approach and culture, rather than an entrepreneur; having an entrepreneur in the centre enhances the innovation process.

6.1 Case study – Apple

The Apple case study is featured in the book of Trott (2012) and describes the rise of Apple Corporation and its product innovations.

The Apple iPod is one of the most successful product launches of recent years, transforming the way the public listens to music, with huge ramifications major record labels. More than 100 million iPod's been sold since its launch in November 2001. Mobile phones have long been regarded as the most credible challenger to MP3 players and iPods. The launch of digital download services via mobile phones illustrates the dramatic speed of convergence between Telecoms and media industries, which has ushered in a new era of growth for smart phones. Users are willing to pay more for additional services and many analysts predict that mobile phone handsets will eventually emerge as the dominant technology of age, combining personal organizers, digital music players and games consoles in a single device. Indeed, Microsoft founder Bill Gates predicted that mobile phones would

supersede the iPod as the favoured way listening to digital music. Apple has responded this challenge by launching the iPhone, but will this be enough. Apple faces tough competition from not only Microsoft, but also Blackberry, Google and Nokia.

6.1.1 Apple and the iPod

For those not yet fully plugged into digital music listening, MP3 is an acronym for MPEG layer 3, which is a compressed audio format. A compression ratio of up to 12 to 1 compression is possible, which produces high sound quality. Layer 3 is one of three coding schemes (layer 1, layer 2 and layer 3) for the compression of audio signals. It reduces the amount of data required to represent audio, yet still sound like a faithful reproduction of the original uncompressed audio to most listeners. It was invented by a team of German engineers of the Fraunhofer Society, and it became an ISO/IEC standard in 1991. This format of compression facilitates the transfer of audio files via the internet and storage in portable players, such as the iPod, and digital audio servers.

The remarkable success of the iPod music player has propelled Apple back into the FT100 ranking of global companies. This marks a return of the technology company to the ranks of the world's top companies after falling out of the list in 2001. Its shares have risen dramatically in the past two years, valuing the company at $220 billion (£150 billion), finally surpassing its great rival Microsoft in 2010. Apple, founded (in 1975) 35 years ago by Steven Jobs, who is now chief executive, has seen its fortunes ebb and flow. Mr. Jobs has achieved a transformation since his return to the company in 1997 after leaving some 10 years earlier following a dispute with John Sculley, who was then chief executive (Coggan, 2005).

Historically Apple is a computer company and its core customer base today is only about 10 million active users; in a world of 400 million Windows users. Apple has always understood that its core franchise was very closely connected to the core computer franchise. Consumer electronics products, for example, are sold through

different channels and they have different product life cycles. Making the transition has been extremely hard. What made the iPod transition easier is that the iPod began as a PC peripheral, even though it is ultimately a consumer electronics product. Eventually, Apple recognized that the iPod could not be limited to the Mac and it had to become a PC peripheral as well. The move into the PC market enabled Apple to access a much broader market than its core customer base. Indeed, sales of the iPod started sluggishly as sales were directed initially towards a relatively small audience of Macintosh users, and even when a PC version of the iPod was released, its FireWire-only design limited its appeal to mainstream PC users.

6.1.2 Apple's iTune Music Store website

Apple's success with its iPod is helped by its iTune Music Store website (www.Apple.com/itunes), which offers consumers the ability to digitize all their CDs as well as download new music at 79p per song. This site has sold over 6 billion songs since its launch in April 2003, bringing considerable revenue to Apple (Schonfeld, 2009). However, downloads from the iTunes Music Store will only play on Apple's iPods (Webb, 2007). The site is universally regarded as being simple and fun; it also offers a legal way to add music to your library. To import songs into iTunes, you simply insert a CD into your computer and click “Import CD”. iTunes also compresses and stores music in AAC - a format that builds upon state-of-the-art audio technology from Dolby Labs. It also offers users the ability to select different audio formats. iTunes lets you convert music to MP3 at high bit-rate at no extra charge. Using AAC or MP3, you can store more than 100 songs in the same amount of space as a single CD. iTunes also supports the Apple Lossless format, which gives you CD-quality audio in about half the storage space.

6.1.3 The rise and fall and rise of Apple

Apple computers began in 1977 when Steven Wozniak and Steven Jobs designed and offered the Apple I to the personal computer field. It was designed over a period of years, and was only built in printed circuit-board form. It debuted in

April 1976 at the Homebrew Computer Club in Palo Alto, but few took it seriously. Continual product improvements and wider technological developments including microprocessor improvements led to the launch of the Apple Macintosh personal computer in 1984.

The Macintosh computer was different because it used a mouse driven operating system; all other PCs used the keyboard driven system known as MS DOS (Microsoft disc operating system). Early in the 1980s Microsoft licensed its operating system to all PC manufacturers, but Apple decided against this approach, opting instead to stay in control of its system. The 1980s was a period of dramatic growth for personal computers as virtually every office and home began to buy into the PC world. Slowly Microsoft became the market leader, not because its technology was better, but largely because its system became the dominant standard. As people bought PCs, so with it they would buy the operating system: MS Windows; hence it became the de facto dominant standard. The Apple operating system was only available if you bought an Apple PC. Consequently, Apple's market share plummeted. This was also the time when Steven Jobs quit Apple after disagreements with other members of the board. Interestingly in 1986 Steven Jobs became involved in another new venture, Pixar Animation Studios. By the mid-1990s Apple had grown to a $12 billion company, twice the size of Microsoft; but Microsoft was powering ahead on the back of the launch of Windows and It would soon become the colossus firm it is today (Schofield, 2005).

In 1993 Apple launched the Newton, its first completely new product in many years. Indeed, it represented Apple's entry into (and perhaps creation of) an entirely new market: personal digital assistants (PDAs). The PDA market was barely present when the Newton was released, but other companies were working on similar devices. The Newton Message Pad featured a variety of personal-organization applications, such as an address book, a calendar and notes, along with communications capabilities such as faxing and email. It featured a pen-based inter-

face, which used a word-based, trainable handwriting recognition engine. Unfortunately, this engine had been developed by a third party, and was notoriously difficult to use and was partly responsible for the product's failure.

In the mid-1990s Apple's future in the computer technology industry looked bleak, with a diversified product portfolio and a low market share within the PC market of only 3 per cent. It was also building a portfolio of product failures including the Apple Pipin (a games consol). Many were therefore surprised when Steven Jobs returned to the company as chief executive in 1997. He quickly set about culling many product lines and much of its operations and decided to focus on only a few products including the new looking iMac. This coincided with the economic boom in the late 1990s and allowed Apple to generate cash very quickly. This provided revenue for the development of the iPod, which was launched in 2003.

6.1.4 iPod dominates MP3 market, but competition is fierce

Since 2003 the spectacular growth of Apple's iconic digital music player sent the company's share price soaring. The challenge for Apple, however, is how to maintain the success of the iPod, especially with its indirect impact on sales of its PCs; most notably the iMac and its Notebook range of portable PCs, including the Mac Air laptop. Apple could continue to cut prices, but this would mean smaller margins. The launch of the iPhone, to capitalize on the convergence of technologies between mobile phones and media, has helped boost growth of the firm. In actual fact Apple began fighting the competition in the MP3 market by cutting prices and improving the product. In 2005 it launched lower-priced versions of its best-selling iPod digital music player, the Shuffle, with significantly improved battery performance, plus an ultra-thin iPod Nano. Later came the iPod Touch with its impressive touch screen interface (the precursor to the iPhone). However, at the same time a potential big threat in the form of Sony Electronics announced a new, low-price, high-performance digital music player under its Walkman brand. Since October 2001, when Apple first launched its iPod, it has slowly reduced the price and improved the performance of the product. The design and styling have significantly contributed to Apple's success with its 50 per cent market share for MP3

players. Competitors including Dell, Creative Technologies and Rio have launched many rival players, most cheaper and offering better battery performance. Yet it seems the iPod has an iconic status that is proving difficult to attack.

6.1.5 iPod patent battles

Despite the success of the iPod and iPhone Apple continues to fend off challenges to the propriety of its technology. In August 2005 Creative Technology, the Singapore maker of the Zen digital music player, suggested it was considering a legal battle with several digital music manufactures including Apple Computer, alleging that the US company's popular iPod and iPod mini music players use Creative's recently patented technology. Creative was one of the first companies to market digital music players in 2000, but the company's devices have been overshadowed by Apple's popular iPod product line.

Apple has extensive experience of fighting patent infringement cases and understands that such legal battles can take many years to settle. Its own battle with Microsoft over infringement of its operating system technology was eventually settled after eight years without a satisfactory outcome. It may be better for Creative to seek royalties from Apple, as patent cases can drag out for many years and are highly unpredictable.

More recently Apple has been fighting Nokia in a battle over mobile phone technologies. Nokia is suing Apple for violations of 10 patents it holds on several wireless technologies. The patents in question, Nokia says, are fundamental to making devices like the iPhone compatible with certain wireless network standards on which the iPhone operates around the world, as well as wireless LAN technologies, which means Wi-Fi and UMTS. Apple countersued Nokia in January 2010, claiming that Nokia phones infringe on 13 Apple patents. Nokia responded by asking that the countersuit be dismissed. Experts have suggested Nokia is probably seeking royalty payments from iPhone (and now iPad) sales, rather than a full injunction. This would afford Nokia a 1-2 per cent cut from each sale.

6.1.6 The rise of Apple as a lifestyle brand

iMac, iPod, iPhone, iPad have all been very successful products for Apple. The impact has been more than simply sales and profits. At the centre of Apple's recent success is the emergence of Apple as a lifestyle brand rather than as a technology company. Apple is very keen, for instance, to reinforce its California heritage (the person credited with designing the iPod is Johnathan Ive, a graduate from Newcastle Polytechnic and now Apple's vice president for design). Every iPod comes with the words “Designed in California”. Also, it may have been a subtle move, but remaining friendly - not just user-friendly but friendly, as opposed to the unfriendly giant Microsoft - may be helping to increase the brand's appeal. It may be that people at last have become tired of Microsoft and efficiency and effectiveness and now are searching for something different. If Apple can capitalize on the success of the iPod and iPhone and translate this into increased market share of the PC market, this will truly signify a dramatic turnaround for the firm in the PC industry.

To reinforce the idea of a lifestyle brand one need, look no further than the huge increase in accessories for the iPod. It seems cool-conscious iPod buyers cannot get enough of carrying cases, adaptors, microphones or software; these accessories give consumers the edge as they take their iPods on the road, into classrooms and on to the street. Indeed, the road provides a big growth opportunity for Apple and the iPod. The challenge for Apple is whether it can establish the iPod in the in-car entertainment market by becoming the product of choice for those wishing to move effortlessly from “home-to-car-to-sidewalk” without any interruptions to listening, simply by plugging and unplugging your digital music player.

6.1.7 Apps

App is short for application software. iPhone apps are applications for the Apple iPhone. Most iPhone apps are meant for the newer iPhone 3G model and will also work on the most recent versions of the iPod Touch. Free or purchased Apps can be downloaded from the iTunes music store to an iPhone or iPod Touch. When the new app is downloaded, it will place an icon on the screen of an iPhone or iPod

Touch, so you can access the app directly by touching the icon on the screen. Accessing applications this way eliminates the step of having to use the web browser. There are thousands of apps for the iPhone and iPod Touch. Categories of apps include Business, Games, Entertainment, Sports, Education, Medical, Fitness, News, Travel, Photography, etc. There are both paid and free app categories.

In March 2010 Apple launched its iPad. This is essentially a combination of a smartphone and a laptop. Many analysts and commentators argued the product offered nothing new and that it was too big as a phone and too small as a laptop. Yet, two months after its launch Apple announced sales of its iPad had reached 2 million units. The touchscreen tablet has been more successful than experts predicted. This may partly reflect the power of the Apple brand and its successful new product launch strategy.

6.1.8 The licensing question returns to haunt Apple

Since Apple launched the iPod in 2001 and the iPhone in 2007, doubters have said it was only a matter of time before Microsoft, Nokia or Google developed a cheaper industry-standard music player that would relegate Apple to the fringes of the market; just like Microsoft did with Windows. Few forget how Apple's refusal to license its technology contributed to its demise in the personal computer market and critics say the company appears determined to make the same mistake again. A key issue for Apple is whether it can sustain the huge premiums that it earns with the iPod and iPhone when Dell, Google, Nokia and others begin entering the market with much lower priced product offerings. Also, Apple is running into the same challenge as it experienced with the Mac of selling a proprietary solution. That is, music on the iPod cannot play on non-Apple devices.

Essentially, just like the mid-1980s, there is a standards war; just as there was between VHS and Betamax. There is a proprietary standard with iTunes, and there will be alternative standards pushed by Microsoft, Real Networks, and others. One can still detect an Apple orientated approach to growth rather than one driven by

absolute growth. For example, iTunes, was initially available only on the Mac. This was meant to drive Macintosh sales, and then six or nine months later Apple would bring out a Windows version. The problem is that it gave competitors six to nine months to bring out Window's products, which creates a more competitive environment. Some analysts argue that if Apple had really been thinking in terms of breaking away from Apple users and its heritage, it would have started out on Windows and come to Macintosh later like everybody else in the world. But, critics argue that is not the way Apple thinks.

There are clearly advantages when developing a new product to target the 400 million market and then target the total Apple user and ex-user market of 25 million. But there are also advantages of doing it the Apple way.

If Apple does not open itself up and make sure that it becomes the dominant standard, it could end up becoming again the niche product, which makes it a little bit less attractive for users. Apple may be able to learn from Sony's experiences, for although Sony lost the VCR industry standards battle it did win huge market shares with its Walkman. Sony drove the Walkman into a mass audience by drastically bringing down the price. Apple may be able to do this successfully with the iPod, but it has never been very good at very high volume manufacturing at very low costs. However, it may be that the iPod is becoming the dominant platform in MP3 players just as Microsoft managed with its Windows operating system. It is less clear though that the iPhone is equally becoming the dominant standard in the smartphone market.

The key issue here is whether Apple can do what Microsoft did in the 1980s and 1990s and get people to pay it large amounts of cash via licensing. Apple could license its technology to other manufacturers as Microsoft did with its DOS and later Windows operating systems. Every mobile phone or MP3 player that is sold would potentially result in a licensing fee to Apple, in the same way as Microsoft receives a royalty for every PC, laptop, notebook and netbook that is sold with Windows installed. This could be a serious windfall. Apple would have to change strategy and decide to license its iPod/iPhone technology to the “masses” and

undo its hardware exclusivity. If Apple adopted this approach it is likely that it would make up the money in its walled garden of iTunes and applications and Apple would really become the Microsoft of the next decade. However, this looks unlikely.

More significantly, new smart phones are emerging based on the Google open source Android operating system. Worryingly for Apple, in terms of technical performance, these look superior. Moreover, some of these products are much cheaper than the iPhone. For example, Blackberry and its RIM technology are gaining market share from Apple, and Blackberries are three times cheaper. If one peers into the future, and recognizing what we know from past experience, creativity is likely to emerge from the open source Android operating system, particularly as its use becomes more widespread. For Apple it may be that in seeking control it may be stifling creativity and innovation.

6.1.9 Troubles ahead?

The inexorable shift from separate devices to a single handheld device appears to be gathering momentum. In particular, third-generation (3G) smartphones offer the capability to download high-speed data over the airwaves including television pictures. Not surprisingly, Google, Blackberry, Nokia and others are entering the market with smartphones. Apple's iPod sales have grown every year since its 2001 launch. But during 2009 Apple sold fewer iPods than the previous year. This marks the first time that iPod sales have dropped year-over-year. Sales of the iPod have been replaced by sales of the iPhone and iPod touch, which look as if they may be the future of the iPod product line. Apple expects sales of its traditional MP3 players to decline over time as it cannibalizes sales for the iPod touch and the iPhone. Nonetheless, the products still perform a useful function as an introduction to the iPod line for first-time buyers.

An area of criticism levelled against Apple Inc. that has also received considerable media coverage is the issue of excessive secrecy and obsessive control exerted by

Apple on its suppliers. One of these suppliers is Foxconn, the world's biggest contract maker of IT goods including the iPhone. It is far less well known than the brands it assembles, but it is one of Taiwan's largest companies. Reuters news agency reported in 2010 that Apple goes to “extreme lengths” to protect even the smallest details of its new products under development (Pomfret and Soh, 2010). At Foxconn's assembly plant in Longhua, South China, workers swipe security cards at the gate and guards check the occupants of each vehicle with fingerprint recognition scanners. It resembles a fortress - so much for open innovation! Many of Apple's finished gadgets, from iPods to iPads, are assembled at industrial compounds like the one in Longhua. Some of Apple’s tactics seem like they have emerged from a James Bond film; information is assiduously guarded and handed out only on a need-to-know basis; employees suspected of leaks may be investigated by the contractor; and the company makes it that it will not hesitate to sue if secrets are spilled. To try to control information, Apple will give contract manufacturers different products, just to try them out. That way, the source of any leaks becomes immediately obvious.

Apple's obsession with secrecy is the stuff of legend in Silicon Valley. Over the years, it has fired executives over leaks and sued bloggers to stop trade secrets from being exposed. Apple also helps keep its components out of the mainstream by insisting on custom designs rather than off-the-shelf parts - a practice that leaves many suppliers frustrated. Not surprisingly, landing a contract with Apple will always include a confidentiality clause. And they usually come with stiff penalties in the event that a breach is discovered. Such agreements often come on top of unannounced checks by Apple officials to maintain standards. However, the difficulty lies in proving the source of a leak. In the absence of solid evidence, the most Apple can do is to switch suppliers once the contract runs out. At times all of this secrecy seems to run out of control. In a case that made global headlines, a Foxconn employee in China was believed to have jumped to his death after being

interrogated by his employer. According to local press reports, he was under suspicion of taking an iPhone prototype - to which he had access - out of the factory (Watts, 2010).

6.1.10 Conclusions

The success of the Apple iPod, and to a lesser extent the iPhone, has been remarkable by any measure. It has surprised Apple's competitors but, moreover, it has surprised market analysts and investors, who had largely believed Apple was a niche player in the computer world. To be successful in the mainstream mass market is unusual for Apple. Many people recognize the Apple brand, but far fewer buy its products. Profit margins are small for its range of PCs and laptops; this is why it is difficult for Apple to produce any revenue from the iMac despite its success. Indeed, it is the iPod that has delivered the cash for Apple.

Apple has been here before, 20 years ago in fact. The success of the Apple Mac in 1984 delivered piles of cash for Apple and a rising market share of the growing PC market, yet it was Microsoft that emerged the winner largely because it licensed its operating system to all PC manufacturers, whereas Apple decided against this approach, opting instead to stay in control of its system. Microsoft has gone on to be the dominant software company in the world.

In 2010 Apple's iPod/iPod Touch is the leading digital music player, but should it license its successful technology? There are certainly lots of mobile phone handset manufacturers that would like to incorporate iPod/iPhone technology into their products. And there are many electronic companies such as Sony, Sharp, Cannon and others that would be able to develop digital music players using iPod technology. It may be that Apple feels the technology, in this case the software, is an integral part of the physical product and that to separate the aesthetics of the music player/phone from the software would damage the brand, leading to a commoditization of the digital music player market and an overall decline in the iPod and iPhone. Furthermore, margins are relatively good for Apple and licensing the technology would surely mean increased competition and reduced margins.

Apple, once best known for its Macintosh computers, and now known for its iPod, iPhone and its iTune online Music Store is as last making up for its lack of market gains in the highly competitive PC market. It is necessary to remind students of business that ultimately this is about money and Apple was twice the size of Microsoft in 1992 and since then has largely failed to deliver growth for its shareholders. It is only in the past few years that Apple has started to repay investors, reaching an equivalent market value of Microsoft in 2010. Fortunes change quickly in technology intensive industries, but they change even quicker in the world of fashion.

6.2 Case study: A folding shipping container

This case study was published in the book of Van der Duin et al. (2015) named „Managing technology entrepreneurship and innovation".

The case study tells the story of how three MSc students at TU Delft in the Netherlands had an idea for a folding shipping container and went about building a business. There are many examples of university students starting businesses, but few of these have a potential to revolutionize world trade.

Almost all containers that you see today on ships, trains or trucks are 20 ft or 40 ft in length; the reason for the massive change in both transportation and the global economy is because of this simplicity size – a small set of standard sizes allowed ships, trucks, receiving bays and all of the related logistical systems to easily adapt to an industry-wide standard. Prior to standardization, there were major inefficiencies in commercial shipping: packaging and crating were inconsistent. But what about empty containers? Are there ships travelling the world with containers that are empty? If so, is this a business opportunity?

We are all aware of the anglepoise lamp, which uses springs to enable the movement of its steel arm and lamp. The same principle can be used to move much larger objects, providing one has much larger springs. Initially, the students thought about springs to raise and lower a bridge, but this was soon dismissed. A steel container that could be folded into a small space had many more attractions.

What are the benefits of a folding container? Maybe a folding container already exists? A working computer simulation is a long way from a folding 40-ft steel container. Would anyone be interested? And how they make any money out of the idea? Having interesting technology is a long way from a profitable money-making business.

The TU Delft friends faced a number of difficulties and many uncertainties. They needed advice: after all, they were engineers – very clever engineers, but not experts in developing businesses. Fortunately, the university had a business incubator that helped students develop their ideas and create businesses. It would be able to help them with their patent application, but Jan, Mark and Stephen soon realized they did not know simple answers to questions such as: Who would buy it? Who are the customers? How many containers are there in the Netherlands/Europe/the world? How much it cost to make a container? How much does it cost to buy one? It was soon clear that many days of research lay ahead.

The port of Rotterdam, which is only 15 km from Delft and is one of the world´s busiest container ports, provided an ideal opportunity to gather some information. The commercial director of the port explained to the entrepreneurs that, for their idea to succeed, they would need to receive the necessary certification from agencies such as Lloyd´s Register or Bureau Veritas. Their approval is required regarding the seaworthiness of any marine equipment. Without such certification, no shipping company will be interested. There seemed to be many obstacles to their business idea.

Containers are intended to be used constantly, being loaded with a new cargo for a new destination soon after being emptied of the previous cargo. This is not always possible, and, in some cases, the cost of transporting an empty container to a place where it can be used is considered to be higher than the worth of the used container. This can result in large areas in ports and warehouses being occupied by empty, abandoned containers. The shipping industry spends a great deal of time and money repositioning empty containers. If trade were balanced, there would be no empty containers. But trade imbalance, especially between Europe

and North America and Asia, has resulted in approximately 2.5 million TEUSs of empty containers stored in yards around the world, with empties constituting 20-23 per cent of the movement of containers around the world. According to research conducted by International Asset Systems, the average container is middle or undergoing repositioning for over 50 per cent of its lifespan. It also determined that shipping companies spend US$16 billion repositioning empties. To compensate for these costs, carriers add surcharges to freight rates, ranging from US$100 to US$1.000 per TEU.

Folding containers would provide further advantages. They would relieve congestion at ports. Storing empty containers takes up prime real estate. For example, the storage yards around the port of Jersey, UK, are cluttered with an estimated 100.000 empty containers belonging to leasing companies and an additional 50.000 belonging to ocean carriers. Folding containers would be quicker to load (four a time), resulting in faster turnaround time for ships. Energy costs would drop as well, as one trailer rather than four would transport empties. Finally, there´s also a security feature to the feature to the folded container built to ISO standards. Nothing can be smuggled in a collapsed empty. It was estimated that, if 75 per cent of empty containers were folded by 2010, the result would be a yearly saving in shipping of 25 million TEUs, or 50 per cent of the total volume of empty containers shipped.

The background research had been done. There was genuine interest from potential customers. The friends now needed money to build a working scale model of the folding container. They had to prove to everyone that it would work. Moreover, the concept also had to be compatible with existing equipment for intermodal transport. That is, the container would need to be exactly the same size, shape, weight, etc. It would also have to have proper sealing and locking devices and should interlock with other containers. Computer models were fine to a point, but physical model was now required, especially if they were going to convince people to invest. With the help of the university and the incubator, they set about constructing a fully working steel money. It was to be at one-tenth scale. So it would

be 2 ft long and and 0.8 ft high. Real working springs would have to be in place. The friends realized immediately that a patent drawing is theory, and it did not resemble reality. Numerous fabrication and manufacturing problems had to be overcome. Eventually, after 2 months of playing around with steel springs and welding equipment in the workshop, a fully working model emerged. It required two people to manoeuvre the steel box. More importantly, it had taken a considerable amount of time an investment in materials and equipment. When they demonstrated the model to senior figures at the port of Rotterdam, the latter were very impressed and immediately wanted to see a full-size version – a prototype. But, who would pay for a full-size prototype? It would be enormous. It would cost thousands of euros to produce.

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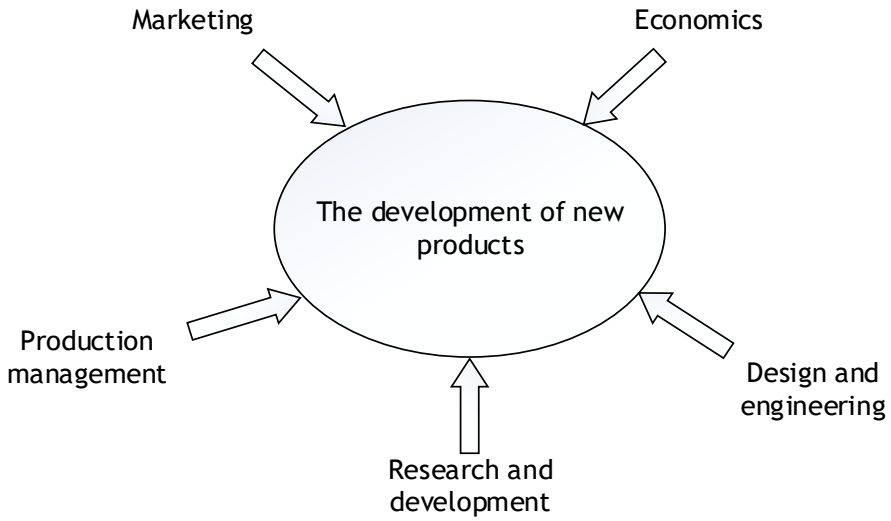
7 NEW PRODUCT DEVELOPMENT

New product development concerns the management of the disciplines involved, in the development of new products (NPD). These disciplines have developed their perspectives on the subject of NPD. These are largely based on their experiences of involvement in the process. Hence, production management examines the development of new products from a manufacturing perspective, that is, how can we most effectively manufacture the product in question? Marketing, on the other hand, would take a slightly different perspective and would be concerned with trying to understand the needs of the customer and how the business could best meet these needs. However, producing what the customer wants may or may not be either possible or profitable. The lack of a common approach to the development of new products is due to this multiple perspective. This is illustrated in Image 3. The variety of views presented on the subject is not a weakness. Indeed, it should be viewed as a strength, for these different perspectives illuminate the areas that are left in the dark by other perspectives.

Image 3: A variety of perspectives from which to analyze the development of new products



Source: Trott, 2012

Usually, competition between companies is assessed using financial measures such as return on capital employed (ROCE), profits and market share. Non-financial measures such as design, innovativeness and technological supremacy may also be used.

Theoretically it is possible for a firm to survive without any significant developments to its products, but such firms are exceptions to the norm. Where long-term success is dependent on the ability to compete with others, this is almost always achieved by ensuring that your company's products are superior to the competition (Trott, 2012).

The basic decisions need to be discussed (Krishnan and Uldrich, 2001):

- What are the target values of the product attributes?
- What will the product concept be?
- What variants of the product will be offered?
- What is the product architecture?
- What will be the overall physical form and industrial design of the product?

Krishnan and Uldrich (2001) also defined key questions to be managed:

- Which components will be designed specifically for the product?
- Who will design and produce the product?
- What is the configuration of the physical supply chain?
- What type of process will be used to assemble the product?
- Who will develop and supply the process equipment?

7.1 Case study: the repositioning of the BMW´s Mini

This case study was presented by Trott (2012) in the book of "*Innovation management and new product development*". The study is based on Arlidge (2006) and Simms and Trott (2006).

The Mini is one of the most established and successful product brands in the automotive industry. It has been in existence for over 45 years and had sold over 4 million units before its highly successful relaunch in 2001. The Mini was designed and manufactured in Britain; the car was launched in 1959 by the British Leyland Motor Corporation. The Mini remained under British ownership until 1994 when BMW acquired the Rover Group; though it later sold off much of the group, BMW kept the Mini. In 1999 the Mini celebrated its 40th birthday and *Autocar* named it the car of the century. The Mini itself remained relatively unchanged from its original launch until it was completely withdrawn from production in 2000. A new Mini and Mini. Cooper (designed and manufactured by BMW) were launched in 2001. It has been a very successful project with sales growing from 25,000 units in 2001 to over 200,000 units in 2006 (Arlidge, 2006).

7.2 Models of product innovation and its management

The numerous models of new product development can be classified (Trott, 2012):

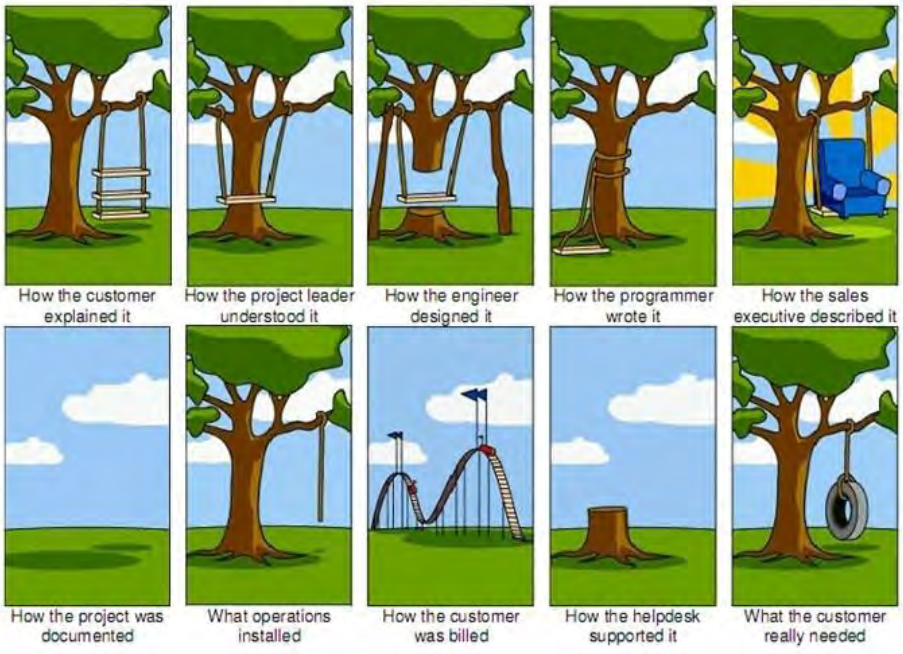
- departmental-stage models,
- activity-stage models and concurrent engineering,
- cross-functional models (teams),
- stage-gate process of new product development,
- conversion-process models,
- response models.

7.2.1 Departmental-stage models

Departmental-stage models represent the early form of new product development models. These can, shown to be based around the linear model of innovation, where each depart is responsible for certain tasks. R&D provides the interesting technical ideas; the engineering department will then take the ideas and develop possible prototypes; the manufacturing department will explore possible

ways to produce a viable product capable of mass manufacture; the marketing department will then be brought in to plan and conduct the launch. Such models are also referred to as 'over-the-wall' models, so called because departments would carry out their tasks before throwing the project over the wall to the next department.

Image 4: How to design a new product



Source: Fleming, 2018

It is now widely accepted that this insular departmental view of the process hinders the development of new products. The process is usually characterized by a great deal of reworking and consultation between functions. In addition, market research provides continual inputs to the process. Furthermore, control of the project changes on a departmental basis depending on which department is currently engaged in it.

7.2.2 Activity-stage models and concurrent engineering

Trott (2012) describes these models similar to departmental-stage models but because they emphasize activities conducted they provide a better representation

of reality. They also facilitate iteration of the activities through the use of feedback loops, something that the departmental-stage models do not. Activity-stage models, however, have also received fierce criticism for perpetuating the 'over-the-wall' phenomenon. More recent activity-stage models (Crawford, 1997) have highlighted the simultaneous nature of the activities within the NPD process, hence emphasizing the need for a cross-functional approach.

In the late 1980s, in an attempt to address some of these problems, many factoring companies adopted a concurrent engineering or simultaneous engineering approach. The term was first coined by the Institute for the Defense Analyses (IDA) in 1986 (Winner et al., 1988) to explain the systematic method of concurrently designing both the product and its downstream production and support processes. The idea is to focus attention on the project as a whole rather than the individual stages primarily by involving all functions from the outset of the project. This requires a major change in philosophy from functional orientation to project orientation. Furthermore, technology-intensive businesses with very specialist knowledge inputs are more difficult to manage. Such an approach introduces the need for project teams.

7.2.3 Cross-functional models

Common problems that occur within the product development process revolve around communications between different departments. In addition, projects would frequently be passed back and forth between functions. Moreover, at each interface the project would undergo increased changes, hence lengthening the product development process. The cross-functional teams approach removes many of these limitations by having a dedicated project team representing people from a variety of functions. The use of cross- functional teams requires a fundamental modification to an organization’s structure. In particular, it places emphasis on the use of project management and interdisciplinary teams.

7.2.4 Stage-gate process of new product development

Stage-gate model was developed by Edgett and Cooper as a standard for new product development.

Cooper and Edgett explain the model in the book “Lean, Rapid and Profitable New Product Development” (2005) as a machine where you put your ideas in, and after the machine prioritizes and processes them, it delivers a steady stream of successful new products into the marketplace. The machine epitomizes the ideal. In its simplest form, that's what Stage-Gate is — a product innovation machine.

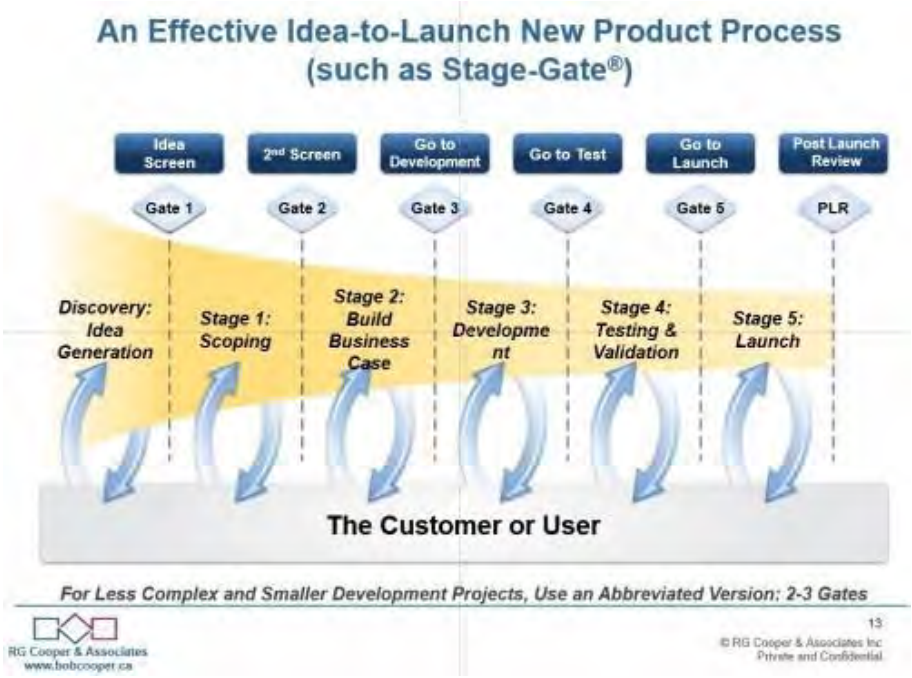
Stage-Gate is the original new product process, and has become the standard methodology for product innovation in many companies around the world (Cooper, 1988, 1990). Stage-Gate has its roots in academic research. Beginning in the late 1970s, we observed and studied thousands of project teams in hundreds of different companies as they conceived, developed and launched new products. It was almost like watching video replays of football games on Monday morning, and analyzing the game play by play - what went wrong, what was done well, and so on. Most of this academic research was widely published in refereed and learned journals, hence stood the test of the peer review process.

Using the football analogy, after watching enough games, the coach finally takes out his own chalkboard and starts to map out how you will play the game — your own team's game plan or playbook. That's what we have done. Beginning in the early 1980s, the first versions of our new product process started to appear in test companies as a very crude and very early version of Stage-Gate. Since then, Stage-Gate has evolved to become a professional and world class system for driving new products to market used by leading companies worldwide. Stage-Gate is, thus, analogous to a playbook or game plan that a football team might use to drive the football from one end of the field down to the goal line and beyond - consistently, proficiently, quickly and game after game.

The Stage-Gate approach is a conceptual and operational model for moving a new product project from idea to launch. It is a blueprint for managing the product

innovation process to improve effectiveness and efficiency. Stage-Gate methods break the innovation process into a predetermined set of stages, each stage consisting of a set of prescribed, cross-functional and parallel activities. The entrance to each stage is a gate. These gates control the process and serve as the quality control and Go/Kill check points. This stage-and-gate format leads to the name "Stage-Gate" process.

Image 5: Stage-gate process of new product development



Source: Sopheon, 2015

7.2.4.1 The Stages

Stages are where the action occurs. They are analogous to the plays in a North American football game. The players on the project team undertake key tasks in order to gather information needed to advance the project to the next gate or decision-point.

Each stage begins at the exit of a gate. The team begins each stage with an approved Forward Plan and approved resources (a check -for people and dollars - is

cut at the gate). Also a date for the next gate is set, along with a list of required deliverables for the next gate - the expectations are clear.

The stages are defined by the activities within them, and there is usually a fairly standard ox prescribed list of actions for each stage. This list includes both recommended and mandatory actions, designed to be undertaken in parallel. The activity list is based on best practices that are proven discriminators between best performers and the rest.

A closer look at the activities in a typical stage reveals that they are information acquisition activities. That is, the activities in each stage are designed to gather and yield the information needed to make excellent decisions at the next gate. Thus, the entire Stage-Gate system is designed as a risk management process. In order to manage risk, the parallel activities in each stage must be designed to gather vital information - technical, market, financial, operations — in order to drive down both the technical and business risks of the project. Each stage costs more than the preceding one, so that the game plan is based on incremental commitments. As uncertainties decrease, expenditures are allowed to mount, and risk is managed.

Throughout each stage, the emphasis is on quality of execution — doing it right — as well as rapid and efficient execution. The team also relies on sound project management methods, for example, using milestone and status meetings for updates and input, and keeping senior people engaged and informed.

Stages are also cross-functional. There is no R&D or Marketing stage; rather, each stage consists of a set of parallel activities undertaken by people from different functional areas within the firm, working together as a team and led by a project team leader. And these actions within each stage occur rapidly and in parallel.

Stage 0 - Discovery: Pre-work designed to discover opportunities and to generate new product ideas.

Stage 1 - Scoping: A quick, preliminary investigation and scoping of the project. This stage provides inexpensive information — based largely on desk research - to enable the field of projects to be narrowed before Stage 2.

Stage 2 - Build the Business Case: A much more detailed investigation involving primary research - both market and technical - leading to a business case. This is where the bulk of the vital homework is done, and most of the market studies are carried out. The result is a business case that includes the product definition, the project justification, and a project plan.

Stage 3 - Development: The actual detailed design and development of the new product, along with some product testing work. The deliverable at the end of Stage 3 is an "alpha-tested" or "lab-tested product". Full production and market launch plans are also developed in this potentially lengthy stage.

Stage 4 - Testing and Validation: Tests or trials in the marketplace, lab, and plant to verify and validate the proposed new product, its marketing and manufacturing/production — field trails or beta tests; test market or trial sell; and operations/production trials.

Stage 5 — Launch: Commercialization and the beginning of full manufacturing or production, marketing, and selling. Here the market launch, production/operations, distribution, quality assurance and post-launch monitoring plans are executed.

7.2.4.2 The Gates

Preceding each stage is an entry gate or a Go/Kill decision point. The gates are the huddles on the football field. They are the points during the game where the team converges and where all new information is brought together. Gates are the decision points in the idea-to-launch framework - they ensure that only the right projects move forward.

Effective gates are central to the success of a fast-paced, product innovation process:

- Gates serve as quality control checkpoints: Is this project being executed in a quality fashion?
- Gates also serve as Go/Kill and prioritization decisions points: Gates provide the funnels, where mediocre projects are culled out at each successive gate.
- Finally, gates are where the action plan for the next stage is approved, along with resource commitments.

Gates have a common format:

- A set of required deliverables: What the project leader and team must bring to the gate decision point (for example, the results of a set of completed activities). These deliverables are visible, are based on a standard menu for each gate, and are decided at the output of the previous gate. Management's expectations for project teams are made very clear;
- Criteria against which the project is judged in order to make the Go/Kill and prioritization decisions;
- Defined outputs: a decision (Go/Kill/Hold/Recycle), an approved action plan for the next stage (complete with people required, money, person-days committed, and an agreed timeline), a list of deliverables, and a date for the next gate.

Gate meetings are usually staffed by senior managers from different functions — the gatekeepers — who own the resources required by the project leader and team for the next stage. Thus, the gatekeepers are usually the leadership team of the business ion major projects at Gates 3, 4, 5 and the Post Launch Review).

7.2.5 Conversion-process models

As the name suggests, conversion-process models view new product development as numerous inputs into a 'black box' where they are converted into an output (Schon, 1967). For example, the inputs could be customer requirements, technical ideas and manufacturing capability and the output would be the product. The

concept of a variety of information inputs leading to a new product is difficult to criticize, but the lack of detail elsewhere is the biggest limitation of such models.

7.2.6 Response models

Response models are based on the work of Becker and Whistler (1967) who used a behaviorist approach to analyze change. In particular, these models focus on the individual's or organization's response to a new project proposal or new idea. This approach has revealed additional factors that influence the decision to accept or reject new product proposals, especially at the screening stage.

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8 BUILDING A BUSINESS CASE

The term “Business Case” has been already used in a project methodology development based on the Prince2 standard, presented in a book of Hinde (2012).

The Business Case is developed both before the project starts and during the initiation stage. Before the project starts, corporate or programme management creates a Project Mandate. The mandate contains the reasons for the project. The Project Mandate can be either high-level or detailed. Whatever form it takes, it should at least have some valid reasons for the project.

Once the Project Mandate has been created, the Starting Up a Project process begins. This is a pre-project process with a set of activities focused on determining whether the project idea is worthwhile and viable. The Executive role (the main decision maker and the representative of the business perspective on the project) creates an outline Business Case based on the information in the Project Mandate.

The purpose of the Business Case is to set out the justification for the project. It provides a compelling argument to show why the project represents value for money and will give a good return on investment. In order to do this, the Business Case balances out the benefits that can be expected from the project against the cost of the initial project and any ongoing costs of operating the project's products. It also takes into account any risks that the project or the organization will be exposed to as a result of the project.

The Business Case is used to drive decision making in the project. For example, when Project Board members are considering whether to authorize the project to start, go on to the next stage, or close, they use the Business Case as an input into their decision. It is also used when the team is deciding whether to implement a change to the project's products. In this case, they want to check that the change doesn't have adverse effects on the Business Case.

8.1 The Contents of the Business Case

The Business Case consists of the following sections:

- Executive summary;
- Reasons;
- Business options;
- Expected Benefits;
- Expected Dis-benefits;
- Timescales;
- Costs;
- Major Risks;
- Investment Appraisal.

8.2 Case study – Building a Business Case

Business Case				
Project Name:				
Date:		Release:		Draft/Final
Authors:				
Owner:				
Client:				
Document Number:				

Revision History			
Revision Date	Previous Revison Date	Summary of Changes	Changes Marked

Approvals				
Name	Signature	Title	Date of Issue	Version

Distribution	
Name:	
Title:	
Date of Issue:	
Version:	

Overview	
Executive Summary:	
Reasons:	
Business Options:	
Expected Benefits:	
Expected Dis-Benefits:	
Timescale:	
Costs:	
Investment Appraisal:	
Major Risks:	

Source: Hinde, 2012

References:

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9 SOCIAL ENTREPRENEURSHIP AND INNOVATION

Bessant and Tidd (2011) consider innovation not as a simple flash of inspiration but an extended and organized process of turning bright ideas into successful realities - changing the offering (product/service), the ways in which it is created and delivered (process innovation), the context and the ways in which it is introduced to that context (position innovation) and the overall mental models for thinking about what we are doing (business model or 'paradigm' innovation).

Getting innovation to happen depends on a focused and determined drive - a passion to change things which Bessant and Tidd call 'entrepreneurship'. Essentially this is about being prepared to challenge and change, to take (calculated) risks and put energy and enthusiasm into the venture, picking up and enthusing other supporters along the way.

Successful entrepreneurs they are typically ambitious, mission driven, passionate, strategic (not just impulsive), resourceful and results oriented.

For example, Muhammad Yunus revolutionized economics by founding the Grameen Bank, or 'village bank', in Bangladesh in 1976 to offer 'micro-loans' to help impoverished people attain economic self-sufficiency through self-employment - a model that has now been replicated in 58 countries around the world. Or there's Dr Venkataswamy, founder of the Aravind clinics, whose passion for finding ways of giving eyesight back to people with cataracts in his home state of Tamil Nadu eventually led to the development of an eye care system which has helped thousands of people around the country (Esty, 2011).

These are people who undoubtedly fit our entrepreneur mould but target their efforts in a different, socially valuable direction. Wikipedia defines a social entrepreneur as “someone who recognizes a social problem and uses traditional entrepreneurial principles to organize, create, and manage a venture to make social change”. Whereas business entrepreneurs typically measure performance in profit and return, social entrepreneurs often start nonprofits and citizen groups.'

9.1 Characteristics of social entrepreneurs

Characteristics of social entrepreneurs defined by Bessant and Tidd (2011):

- ambitious: social entrepreneurs tackle major social issues - poverty, healthcare, equal opportunities, etc. - with the underlying desire - passion even - to make a change. They may work alone or from within a wide range of existing organizations including those which mix elements of non-profit and for-profit activity
- mission driven: their primary concern is generating social value rather than wealth - wealth creation may be part of the process but it is not an end in itself. Just like business entrepreneurs, social entrepreneurs are intensely focused and hard-driving - even relentless - in their pursuit of a social vision.
- strategic: like business entrepreneurs, social entrepreneurs see and act upon what others miss: opportunities to improve systems, create solutions and invent new approaches that create social value.
- resourceful: social entrepreneurs often work in contexts where they have limited access to capital and traditional market support systems. As a result, they must be exceptionally skilled at mustering and mobilizing human, financial and political resources.
- results oriented: again, like business entrepreneurs, social entrepreneurs are motivated by a desire to see things change and to produce measurable returns. The results they seek are essentially linked to 'making the world a better place' - for example, through improving quality of life, access to basic resources, supporting disadvantaged groups, etc.

9.2 Case Study: Healthcare in South Africa

The case study presented on Ashoka Foundation website in a book of Holender (2006).

Veronica Khosa was frustrated with the system of healthcare in South Africa. A nurse by trade, she saw sick people getting sicker, elderly people unable to get to a doctor and hospitals with empty beds that would not admit patients with HIV. So Veronica started Tateni Home Care Nursing Services and instituted the concept of 'home care' in her country. Beginning with practically nothing, her team took to the streets providing care to people in a way they had never received it - in the comfort and security of their homes. Just years later, the government had adopted her plan and through the recognition of leading health organizations the idea is spreading beyond South Africa.

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Basics of Firm Innovation Policy

(Innovation Management)

Case studies

Eva Jurickova

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1 CASE STUDY: THINKING ABOUT INNOVATION

The case study was published in the book “Innovation and Entrepreneurship” written by Bessant and Tidd (2011).

The Aravind Eye Care System has become the largest eye care facility in the world with its head-quarters in Madurai, India. Its doctors perform over 200,000 cataract operations every year - and with such experience they have developed state-of-the-art techniques to match their excellent facilities. The cost of these operations runs from $50 to $300, with over 60% of patients being treated free. Despite only 40% of customers paying, the company is highly profitable and the average cost per operation (across free and paying patients) at $25 is the envy of most hospitals around the world.

Aravind was founded by Dr G. Venkataswamy back in 1976 on his retirement from the Government Medical College and represents the result of a passionate concern to eradicate needless blindness in the population. Within India there are an estimated 9 million (and worldwide 45 million) people who suffer from needless blindness which could be cured via corrective glasses and simple cataract or other surgery. Building on his experience in organizing rural eye camps to deal with diagnosis and treatment he set about developing a low-cost high quality solution to the problem, originally aiming at its treatment in his home state of Tamil Nadu.

One of the key building blocks in developing the Aravind system has been transferring the ideas of another industry concerned with low cost, high and consistent quality provision -the hamburger business pioneered by Ray Croc and underpinning McDonald's. By applying the same process innovation approaches to standardization, workflow and tailoring tasks to skills, he created a system which not only delivered high quality but was also reproducible. The model has now diffused widely - there are now five hospitals within Tamil Nadu offering nearly 4000 beds, the majority of which are free. It has moved beyond cataract surgery to education, lens manufacturing, research and development and other linked activities around the theme of improving sight and access to treatment.

In making this vision come alive Dr V has not only demonstrated considerable entrepreneurial flair - he has created a template which others, including health providers in the advanced industrial economies, are now looking at very closely.

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2 CASE STUDY: INNOVATION IN GLASS INDUSTRY

The case study was published in the book “Innovation and Entrepreneurship” presented by Bessant and Tidd (2011).

It's particularly important to understand that change doesn't come in standard sized jumps. For much of the time it is essentially incremental, a process of gradual improvement over time on dimensions like price, quality, choice, etc. For long periods of time nothing much shifts in either product offering or the way in which this is delivered (product and process innovation is incremental). But sooner or later someone somewhere will come up with a radical change which upsets the apple cart.

For example, the glass window business has been around for at least 600 years and is - since most houses, offices, hotels and shops have plenty of windows - a very profitable business to be in. But for most of those 600 years the basic process for making window glass hadn't changed. Glass was made in approximately flat sheets which were then ground down to a state where they were flat enough for people to see through them. The ways in which the grinding took place improved - what used to be a labor-intensive process became increasingly mechanized and even automated, and the tools and abrasives became progressively more sophisticated and effective. But underneath the same core process of grinding down to flatness was going on.

Then in 1952 Alastair Pilkington, working in the UK firm of the same name, began working on a process which revolutionized glass making for the next 50 years. He got the idea whilst washing up when he noticed that the fat and grease from the plates floated on the top of the water - and he began thinking about producing glass in such a way that it could be cast to float on the surface of some other liquid and then allowed to set. If this could be accomplished it might be possible to create a perfectly flat surface without the need for grinding and polishing.

Five years, millions of pounds and over 100,000 tons of scrapped glass later the company achieved a working pilot plant and a further two years on began selling

glass made by the float glass process. The process advantages included around 80% labor and 50% energy savings plus those which came because of the lack of need for abrasives, grinding equipment, etc. Factories could be made smaller and the overall time to produce glass dramatically cut. So successful was the process that it became - and still is - the dominant method for making flat glass around the world.

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3 CASE STUDY: INNOVATION BEHAVIOR

This case study was presented in the book of Mckeown (2014) “The Innovation Book: How to manage ideas and execution for outstanding results“.

- Assess your existing blend of sameness and difference. Think about the efforts your organization (or company) make to increase 'consistency' or 'alignment'. Consider how recruitment, review and reward systems may lead to standardized world views.
- Identify sources of dissent: who is doing any active disagreement? identify deviance: who is travelling in a different direction? Identify difference: who has different opinions or behavior? Identify sources of defiance: who is openly standing up against prevailing views?
- Compare levels of creative diversity in your organization with those that are more innovative. Look at how organizations that have lost their innovative edge have previously become over-standardized. If you are facing a crisis of standardization, you may have to respond with an injection of rebelliousness - and look after it so it contributes.
- Introduce the rebel, maverick, soldier, conformer concepts to your team. Discuss the value of each of them to the success of the group - particularly in shaping a better future. The evidence is that people more easily value diversity when they see how it helps them.
- Think about the difference between breaking rules and rejecting traditions. Most people find it simpler to deal with those who break rules because it is more straightforward to punish or rehabilitate. Yet open rejection of traditions challenges the beliefs of the group.
- Help people to share dissenting opinions in ways likely to help innovation. Different or new people are valuable but less likely to be accepted. You need a particular blend of novelty and credibility for ideas to change circumstances and change minds.

Freeing your inner rebel, artist or maverick can be as important as releasing those around you. Justin Bieber, despite criticism, has that impulse to create and share. He seems happier when able to share his creations, regardless of the people who say they hate his music, whether covers of R&B stars or songs he has written. After two albums, he released a series of 10 musical experiments. More personal and less commercial, they were announced each week to his 46 million Twitter followers. According to his manager, sharing directly is part of showing Bieber can play the game differently (Mckeown, 2014).

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4 CASE STUDY: XEROX

Carayannis et al. (2015) published a XEROX case study introducing an innovation and competitiveness in this company in the book named “Innovation and entrepreneurship”.

4.1.1 The history and background

XEROX numbers many successes and failures in its history with regard to innovation. The successes are obvious at present in the office environment. Photocopy machineries, laser printers and network services are all around us, due to XEROX successful innovation. It is not only office equipment that made XEROX a success. Service provision (maintenance of photocopy machines) and consumables (ink cartridges, paper etc.) is very successful-similarly to support services and document processing services (solutions). XEROX innovations multiply; according to data, more than 7,000 active patents belong to its intellectual property. However, in the course of time, there were some unsuccessful innovations too.

The invention of a personal computer with a graphic imaging environment, a desktop, a mouse, Ethernet and the first document processor WYSIWYG has never been a XEROX innovation. The same is true for the first laser printer. In both cases, XEROX invented but did not innovate. It took the control of other companies and acquired their inventions to reach the stage of innovation. There are, however, three basic questions raised:

- What criteria drove to success?
- What criteria drove to failure?
- What are the lessons to be drawn?

These are very important questions. The answers could help us define the criteria of success, allowing for the elaboration of methodologies which would enable the creation and preservation of better innovation practices. When studying innovation, it is better to start analyzing successes and failures. This way of analysis is followed below for the example of innovation in Xerox.

On October 22, 1938, in Astoria, a suburb of New York City, Chester Carlson invented what was later called a photocopy. He considered the photocopy a revolution in the evolution of office but later he would realize that people did not view this invention in the same mood as he did. Carlson, born in 1906 and during the first steps of his career, worked as a pressman assistant; he even published a small newspaper in his hometown.

This early experience impressed him and particularly his difficulty to place words on paper and share the knowledge. He later obtained a physics diploma from the Institute of Technology of California and began to work as a researcher engineer at Bell laboratories. In an era of work slowdown, he obtained a Law diploma that led him to a second career as private practicing lawyer. As a lawyer he often faced the problem of not having enough carbon papers.

The only alternatives were to use an accurate photographic processing or to try broad patent applications. In his free time, he explored alternative technologies finding finally the study by the Hungarian physicist Paul Selenyi on photoconductivity. He made experiments in his kitchen, copying finally the image "10-22-38 ASTORIA" on a tin plate coated with sulfur. He finally concluded that innovation was not an easy process. He looked for a company that would be interested in further financing a research on his invention. For 10 years he was not successful at all.

The market was not ready for alternative solutions—the common view that prevailed was that current technology, the photocopy carbons, were sufficient and there was no need for a new technology. In 1944, the Battelle Memorial Institute, a nonprofit research institute, was interested in helping Carlson to further develop his invention. In Battelle times, selenium was introduced as an improved photoconductor and a shade of dry ink was developed. Finally, in 1947, the company Haloid, a photographic paper manufacturer, obtained a license to manufacture a photocopies machine. In a year's time, the first Xerox photocopy machines began operating, heralding the era of photocopy.

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The first photocopy machine had a complex operation but found a place in the production of satisfactory mechanisms with the method of printing negative film. We should remember that the printing technology at that time was with 'a printing press', printing separately images of cast metal. This was a very costly procedure. Finally, the method of negative film was utilized in printing, in cheap printing environments.

Up until 1959, Haloid improved the equipment and circulated the copy machine #914—the first real photocopy office machine. #914 was a revolutionary innovation. The competitors, the 3 M Thermo-Fax polygraph by the company AB Dick and the Kodak Verifax were outstripped in a relatively short period of time. The machine #914 was so successful that spearheaded technology and dominated the market up until 1972.

The photocopy was discovered in 1938, but it was only in 1959 that the initial discovery was applied and became an innovation. The 19-year journey from discovery to innovation was wasted in finding a financial partner to further develop the idea (1938-1947) and later in trying to determine a market (1948-1959). From the '30s to the '50s, the office technology was characterized by the carbon paper and the upcoming offset printing method.

The carbon paper allowed for the copying of a document in real time in probably more than 8 copies but the cost for 8 500 copies was prohibitive. What Chester Carlson and Haloid initially found in the market research was that there was no need for innovation. The challenge for Haloid was to develop a market.

The first reproduction machine of copies through the photocopy was presented in 1949. The market gained was in between the developing offset printing technology. In particular, the first photocopy machine by Xerox fixed as direct target to manufacture document reproduction mechanisms with the offset method (conversion). The mechanisms would be used successively in the reproduction process of identical documents, making therefore photocopies. The copies' creation mechanism by Xerox for the reproduction with the offset method was expensive and

complex to operate and soon would be replaced by another one, based on photography and being less costly. As long as Haloid Company was being focused again on substituting the carbon paper technology, it fared well with the introduction in 1959 of the photocopy machine #914. This combination of market pull and technology push would generate revenue and profit in the '70s. Since the early days of Haloid unregulated innovation, Xerox has elaborated a culture for innovation organization. At the same time, in the organizational chart of Xerox, the Innovation Group refers directly to the chief executive officer. This stresses the primordial role of innovation for an organization.

Xerox kept on innovating throughout its history although it was not always successful. In 1973 the first desktop computer was presented driving the revolution of PCs. Xerox, due to its marketing strategies, to be discussed further down, did not profit from this development. For a second time in 1977, it developed the laser printer but did not move quickly to dominate the early laser printer market, as did the competitive company Hewlett-Packard.

Xerox corrected its innovation strategy when it introduced in 1990 the black-and-white high intensity printer system, DocuTech, creating thus a digital revolution in placing words on a piece of paper. Later in 2002, it introduced iGen3, a colored version of DocuTech technology, hoping that this would mark the launch of another revolution, that of digital color, and would bring Xerox the economic reward of innovation.

To fully understand Xerox, we should have a picture of the entire raft of products and services and the market share it holds. Therefore, the two main categories - products and services could be classified further:

- the products encompass office maintenance, production, equipment;
- the required support services;
- the services consist in resources, reverse engineering process, solutions;
- (embedded services) and software applications.

It is interesting to underline that searching for products and services on a diachronic basis revealed some interesting things, some of them being the heart of Xerox innovation portfolio—electronic typewriters, working mechanisms and computers. These do not figure in the current portfolio anymore.

Xerox sells its products through various channels in various ways including direct selling, telemarketing, after sales services, agencies, donations and through the web. These modes of selling are managed by various organizations—see the table below. The sales organization is global and is divided in regional departments. The largest sales organization is the one in USA and is covered by North American Solutions Group (NASG).

Almost 50 % of Xerox employees are working for Xerox Services, with most of them being placed in the customer-sales store. Business solutions are an area of understanding that many Xerox researchers found hard to grasp. Xerox defines 'Solutions' as an 'integrated proposal that includes materials, software and human-based services that solves a problem, improves a project, and creates a market or a competitive advantage'. Xerox has divided the provision of Solutions to 4 main business functions and focuses on market production (graphic arts companies), office market and services. The four groups are Documents Systems and Solutions Group (DSSG), Office Systems Group (OSG), Office Printing Business Group (OPBG) and Xerox Global Services (XGS).

4.1.2 Innovation: Sequence of Errors

In 1970, Xerox developed the Palo Alto Research Center (PARC), being famous as the center of computer revolution. PARC researchers were given the ease to conduct basic research from the beginning. This led, among other discoveries, to the first personal computer in 1973 and the first laser printer in 1977.

The personal computer was sophisticated for its era consisting of a software system, a text editor WISYWYG, a graphic environment for the user interconnected to a desktop surface, a mouse and an Ethernet connection. With this state-of-the-art discovery in its portfolio, Xerox would drive the computer revolution-but as

history shows us, Xerox did not profit from this unprecedented discovery letting others lead the genesis of a new market. The question addressed to researchers of innovation is why Xerox let this happen and what could be done to avoid this type of costly mistake in the future. In other words, what is the lesson to be taught from this?

In order to understand Xerox strategies, researchers are trying to find the solution exploring the history of innovation of Xerox and taking interviews from basic players of the era. In such an interview with Mr. RT, a Xerox veteran for 30 years and business executive connected with the control center of the business in West Coast for the largest part of his career, the following information was taken.

In '70s, besides PARC. Xerox held an important control center of the business in the West Coast. You should remember that the Xerox base is in Rochester of NY, where the largest labor force worldwide is placed (16,000). The man who envisaged the 'office of the future' was Joe Wilson II, later President of Xerox. At that time, except for PARC, Xerox—West consisted of Versatec (regionally), XSoft (development of software applications), Xerox Network Services (Ethernet, networks), Sughart (construction of discs), Total Recall (scanning and retrieve applications) plus a construction capacity of photocopy machines and materials. This was a very advanced portfolio of technical capacity and technical power of those times.

PARC since the beginning of '70s was a central institution for arranging computer information. It developed a professional forum as a tool to give incentives to researchers. Every week it used to host a public event ("FORUM") to allow its researchers to present the results of their researches. "FORUM" was addressed to professionals from universities outside Xerox, engineers from the developing computer industry and others interested in research. This early contribution of knowledge helped to the birth of computer industry in the area of Silicon Valley.

When the personal computer was initially developed, Xerox strategy was to promote PC as a private tool of an enterprise. It was mostly a 'portable' computer than a “personal” computer. The computer would comprise a 32" broad portable

unit and a hard disc that could be transported and be moved from place to place, as required. The computer was placed in an interconnection terminal. The initial software, MESA, was unique. We should stress that MESA finally became the base of artificial intelligence systems of our time.

The PC was named with the code STAR and was soon introduced in the market as the mechanism 6085. Finally, a by-product was formed called Global View and the computer later became known as Global View System. Approximately 50 applications were developed, such as text editor, spreadsheets programs, graphics programs, specialized graphics (chemical and mathematical applications), messenger programs, hyperlinks, browsers, etc. It contained many particular characteristics, such as the application "CLEARINGHOUSE" (clearance application), giving users a knowledge distribution area. An application enabled users to create applications upon demand (a JAVA precursor). All applications were privately owned and could be used only in the Global View system.

In the same time, Xerox started staffing the West Coast administration with former IBM management executives, most of them with powerful activity.

It should become known that the upcoming PC market was influenced by three large players of the era, i.e. Xerox, IBM and WANG. As we may know from various IBM studies, the management's ability and experience (former IBM executives) could not be harmonized with the PC market developments. Introducing the power of experienced IBM management executives, Xerox probably made its biggest mistake. Former IBM executives did not fit in well in the existing Xerox culture and had a hard time to disseminate their ideas in Xerox management infrastructure. Xerox management executives had the right vision and lagged behind in the appropriate execution.

While Xerox nurtured the vision of 'the office of the future', it was not sure how to promote it in the market. Xerox was known for the selling of photocopy machines and it fared very well. The PC market was established-overwhelming-standardized and Xerox management had a hard time foreseeing the progress of the industry. It focused its strategy on the commercial axis 'business-to-business' (B2B)

disregarding the 'personal' or amateur market (B2C), as was known. As the market target was business to business, the selection of privately-owned systems showed it was the best strategy. It was later when it became known that the PC industry development was driven by amateurism that was the bridge between the offer of in depth knowledge and the computer usefulness for personal and business use.

The market was better delimited with the rise of Apple computer. It is interesting to highlight that the main attraction of Apple computer was the common graphic surface/desktop/mouse, an idea borrowed during a visit to PARC. Another point of discussion in Xerox, narrowing down the market strategy, was the alignment of sales power. Xerox possessed a well-trained and equipped sales team aligning the photocopy machines with the provision of material (H/W) and services of added value. For Xerox to capitalize on this novel innovation, the computer, a sales labor force was required which was aligned with a different fundamental product—the software (S/W) in the sense that it had the capacity and experience to sell services (software). Xerox strategy did not take into consideration the re-alignment of its sales labor force and in particular its remuneration objectives. Xerox had a successful sales team particularly because its remuneration objectives were very liberal.

In order for the existing trade-off plans to benefit each salesperson separately, the only solution for computers' sale, being attractive from an off-setting point of view, was to sell a multi-million-dollar computer.

During '70s the only customers who were able to invest millions in computers were the current powerful computer customers of IBM, WANG, Digital and others. Therefore, the computer market based on B2B axis was not sustainable. Large companies were not ready to shift from high-power computers to personal computers even if they were networked. The results were obvious. Another barrier to success was the different corporate mindset or culture: Xerox was domiciled in Rochester of NY and the computer revolution rose in the West Coast of the USA; the mentality gap between East and West Coast is significant. The subsequent

clash of cultures led to a Not-Invented-Here Syndrome that worked as a hindrance to the successful transfer of technology and XEROX innovation promotion.

The new inventions originating from the West Coast were not immediately understood because the sources of knowledge and the management for innovation support were based in Rochester. A case in point is the development of network technologies by Xerox. The technology was developed in West Coast control centers and was then transferred to Rochester for further development—a clear case of cultural conflict, as Rochester owned a small infrastructure to support the upcoming internet technology. Funding and marketing decisions, being based in Rochester, lacked the strategy to be aligned with the perceptions of the upcoming market. Focus was placed on the marketing strategy of photocopy machines and the PC marketing was not aligned with the marketing strategies for photocopy machines. The object of marketing strategies for recently emerging markets was erroneously explained. Cultural differences had not been promptly identified and XEROX executives did not handle them appropriately.

Finally, XEROX traded Global View in non-privately owned environments, such as IBM 6000 and with compatible concepts in IBM/Microsoft (MS) ideas adopting the strategy of "competitive cooperation" (co-opetition) but the decision taken was delayed so it failed to ensure a share in the market of said technology. Commercial isolation was encumbered with technological inconsistencies. For example, the personal IBM computer, when it followed the MS platform, did not have sufficient memory to run the Global View of XEROX and because the sufficient memory cost was too high for the era, the overall installation cost was prohibitive.

There was an effort to utilize the products of technologically advanced organizations but organizationally cultural influences and oppositions got in the way. In the beginning of '90s, Xerox strategy showed that technological research centers in West Coast are about to shut down and to merge with the Rochester-based organizations in NY State. At present, PARC in Palo Alto of California and the research centers of Xerox in Ontario, Canada and in Grenoble. France are guided, directed and managed by Rochester technological administration, NT.

Another influence on Xerox innovation strategy was the anti-trust arrangement of 1975. According to this arrangement, Xerox agreed to open the dossier of its intellectual rights property and issue a license to use some of them previously considered technology of Xerox exclusive ownership. While the arrangement did not impact directly on Xerox culture, it finally influenced its innovation strategy, as proven, by the current Innovation Group organization.

Intellectual property became a source of revenue for Xerox. It took a generation to change this culture and become fully applicable.

As typically described in the Xerox example, the other side of success is a list of innovation's failures.

The failures of innovation are summarized as follows:

1. Management of intellectual property rights;
2. Patenting and taking advantage of strategically corporate secrets;
3. Influences of diverging mindsets and management strategies of technological and business risk;
4. Strategic development of markets.

One cannot accept the reasons of failure without making a valuation and assessment that would enable translating failures into successes in the future.

In the first failure, management of intellectual property rights - Patenting and taking advantage of strategically corporate secrets, the strategy used by PARC to recognize the production of researchers led to the disastrous result of exposing corporate secrets to competitors without managing exchange within certain legal boundaries - such as Credos (Cooperative Research and Development Agreement), i.e. licensing agreement or other arrangement to control the share of knowledge. Dissemination of technology needs to be safeguarded by suitable policies and practices for its protection. The creation of inventions and their commercialization via innovations is hard and should not be obstructed by uncontrolled flow of information undermining profit margins.

The second failure refers to the influences of diverging mindsets and management strategies of technological and business risk. This is a complex subject of discussion as the culture of an organization may not be directly obvious. In the case of Xerox, it can be considered that there are two distinct cultural influences.

Initially, the company was largely influenced by the aspect of creating a 'home office'. Rochester in NY was the operational center of Xerox with an employee concentration of more than 20 % of the total labor force. Rochester is also home to the historical influence of innovation up until the middle of '40s. In 1970, when the innovation center (PARC) was developed in West Coast, there was a natural reaction by Rochester group of employees against the fact that Rochester was not the innovation center's base. Moreover, the management of West Coast divisions mainly consisted of persons recently recruited by IBM. Xerox culture and IBM culture were not compatible resulting thus in an additional separation from Rochester.

The third failure, the market development strategy, is practically linked to the existing cultural influences. Since Rochester, home to the marketing department, was not culturally linked to the West Coast divisions, the marketing department failed to comprehend the essence of discoveries being made in PARC and in the West Coast divisions. This lack of understanding was deleterious for any marketing plans developed. Rochester was not grasping the real meaning of the discoveries, tending to challenge the place. The lack of understanding led to mistaken marketing plans and to underestimating market capabilities.

At the end of the day, what is the lesson drawn from XEROX case analysis study? Innovation can be considered as a coin with two different sides. On the one hand lies success - a history teeming with discoveries that can evolve into innovation. On the other hand, there is failure - either due to lack of discoveries or due to non-converting the discovery into innovation. Remember the definition of innovation given above, i.e. as a kind of implementation or application of a discovery for rendering new solutions or improving existing solutions, desires or needs of the market.

The case of Xerox provides us with examples of aspects of innovation, the rich history of successes and the disenchantment of failure. It also supports the definition given on innovation and the important criteria for the distinction between innovation and invention.

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