

Developing Innovation and Creativity for Business Advantage

Week – 9

Summary of Creativity & Innovation

Amare Desta

[PhD, MEd, MSc, LCGI, BSc (Hons)]

Professor of Information & Knowledge Management

Email: a.desta@uwtsd.ac.uk

Innovation and creativity

- **creativity** is manifested in the production of a creative work (for example, a new work of art or a scientific hypothesis) that is both *original* and *useful*
- **innovation** begins with creative ideas,
 - creativity by individuals and teams *is a starting point for innovation*; the first is a necessary *but not sufficient* condition for the second

- creativity results:
 - in producing or bringing about something partly or wholly new;
 - in investing an existing object with new properties or characteristics;
 - in imagining new possibilities that were not conceived of before;
 - and in seeing or performing something in a manner different from what was thought possible or normal previously.

- Many creative ideas are generated when somebody discards preconceived assumptions and decides on a new approach or method that might seem to others unthinkable
- Serendipity - effect by which one accidentally discovers something fortunate, especially while looking for something else entirely

BASIC CONCEPTS

- ***Creative thinking represents a combination of logic and intuitive approaches***
- Being creative means dealing with the aspects and possibilities of today and tomorrow
- That requires a person to be open to everything new, do not stick to things that we are all used to, do not adhere to yesterday so much
- Creativity does not mean dreaming, it means productive managing of specific tasks.
- Only a creative approach to the problem solution can be successful.

Creativity in organizations

- **Amabile:** to enhance creativity in business, three components are needed:
 - Expertise (technical, procedural & intellectual knowledge),
 - Creative thinking skills (how flexibly and imaginatively people approach problems),
 - and Motivation (especially intrinsic motivation).
- **Nonaka:** creativity and knowledge creation are important to the success of organizations. In particular, he emphasized the role that tacit knowledge has to play in the creative process.

Creativity and economics

- Joseph Schumpeter: ***creative destruction*** - the way in which old ways of doing things are endogenously destroyed and replaced by the new.
- Paul Romer: the recombination of elements to produce new technologies and products and, consequently, economic growth. Creativity leads to capital, creative products are protected by intellectual property laws.
- The ***creative class*** as important driver of modern economies. Richard Florida in *The Rise of the Creative Class*, 2002 popularized the notion that regions with "3 T's of economic development: Technology, Talent and Tolerance" also have high concentrations of creative professionals and tend to have a higher level of economic development.
- Important aspect to understanding **Entrepreneurship**.

Stages of creative process

- Orientation: Need identification, intention to create
- Preparation: Information collection, problem formulation
- Incubation: seeking solution, evaluation of variants, unconscious thinking
- Illumination (Eureka!): synthesis, creation of ideas
- Realization: transformation of the idea into reality
- Verification: evaluation, learning, improvement

Barriers to creativity - 1

- The value of getting things right time can induce a fear of mistakes and experimentation.
- So can a blame culture where people become afraid of making mistakes.
- Managers who are not as secure as they should be can resist or block ideas that are not their own or which they see as threatening.
- A culture that over emphasizes cost containment, processes, consistency or efficiency.
- A reward system that too exclusively celebrates getting things done fast with no mistakes.
- A general fear of risk taking, wanting to analyze everything to death, to wait and see what others do in the market before acting.

Barriers to creativity - 2

- A lack of explicit funding for experimentation.
- A strict requirement to demonstrate the value of an idea before it has a chance to prove itself.
- A tendency to shoot down novel ideas as a way of scoring points.
- An over allegiance to past successes, proven experience and tried and tested methods.
- A suspicion of novelty, a fear of the unproven.
- A resistance to learning from mistakes or trial and error, a tendency to blame external factors or other people for failures rather than to learn from them.
- Short termism - a drive to meet short term financial goals rather than to invest in the future.

CREATIVITY STIMULATION

- Keep in touch with creative people
- Accommodate the effort to the targets
- Evaluate and appreciate the effort
- Protect creative employees
- Leave them peace and time
- Provide them with security
- Tolerate failures
- Maintain creative atmosphere
- Evaluate the creative ideas quickly
- Be persistent - nothing comes for free

Fostering creativity

- Establishing purpose and intention
- Building basic skills
- Encouraging acquisitions of domain-specific knowledge
- Stimulating and rewarding curiosity and exploration
- Building motivation, especially internal motivation
- Encouraging confidence and a willingness to take risks
- Focusing on mastery and self-competition
- Promoting supportable beliefs about creativity
- Providing opportunities for choice and discovery
- Developing self-management (metacognitive skills)
- Teaching techniques and strategies for facilitating creative performance
- Providing balance

METHODS OF CREATIVE ACTIVITY

- increasing the individual's or team's creative potential
- contributing to the improvement of the creative work conditions
- facilitating the problem solution

Creative Process

- ***Problem Definition*** - including problem analysis, redefinition, and all aspects associated with defining the problem clearly.
- ***Idea Generation*** - The divergent process of coming up with ideas.
- ***Idea Selection*** - The convergent process of reducing all the many ideas into realistic solutions
- ***Idea Implementation*** - Turning the refined ideas in reality.
- Processes - Schemes and techniques which look at the overall process from start to finish (or at least 3 of the above 4 areas)..

Convergent vs. divergent thinking

- Convergent thinking involves aiming for a single, correct solution to a problem
- Divergent thinking involves creative generation of multiple answers to a set problem.

CREATIVITY TECHNIQUES

- trial and error
- brainstorming
- Inspirational questions
- psychological-cognitive, such as:
 - Osborn-Parnes Creative problem solving (CPS)
 - Synectics;
 - Lateral thinking (courtesy of Edward de Bono),
- the highly-structured, such as:
 - TRIZ (the Theory of Inventive Problem-Solving);
 - ARIZ (the Algorithm of Inventive Problem-Solving), both developed by the Russian scientist Genrich Altshuller; and
 - Computer-Aided Morphological analysis.

Trial and error

- select a possible answer, apply it to the problem and, if not successful, select (or generate) another possibility that is subsequently tried. The process ends when a possibility yields a solution.
- more successful with simple problems, often resorted to when no apparent rule applies.
- the approach need not be careless, for an individual can be methodical in manipulating the variables in an attempt to sort through possibilities that may result in success. Nevertheless, this method is often used by people who have little knowledge in the problem area

Trial and error - features

- solution-oriented: trial and error makes no attempt to discover *why* a solution works, merely that it *is* a solution.
- problem-specific: trial and error makes no attempt to generalise a solution to other problems.
- non-optimal: trial and error is an attempt to find *a* solution, not *all* solutions, and not the *best* solution.
- needs little knowledge: trials and error can proceed where there is little or no knowledge of the subject.

CHARACTERISTICS OF SUCCESSFUL INNOVATING COMPANIES - 1

- Systematic collection of all impulses that could lead to innovation
- Creativity of employees
- Ability to evaluate the possibility of the innovation idea
- Good team work
- Project-based approach and ability to manage projects

CHARACTERISTICS OF SUCCESSFUL INNOVATING COMPANIES - 2

- Cooperation with external experts (universities, research laboratories...)
- Proper rate of risk-taking
- Employees' motivation (the employees are willing to improve the product and the operation of the whole company)
- Continued education of employees
- Ability to finance the innovation activities

Definition of innovation - 1

- “Technological innovations are defined as new products and processes and major technological modifications to products and processes. An innovation is considered performed if it is introduced to the market (**product innovation**) or implemented in the production process (**process innovation**). Innovation includes many research, technological, organizational, financial and commercial activities.

Definition of innovation - 2

- R&D represents only one of these activities and can take place during various stages of the innovation process. It can play not only the role of the original source of the innovation ideas but also the role of problem solution framework, which can be turned to at any stage of the implementation.,,

OECD, Frascati Manual 1992

- Technological innovations – based on specific technology, invention, discovery,
- Social innovations – in critical historic periods more important than technological ones (mail, educational system, social system, health care, ...)

DEGREE OF NOVELTY

- **Incremental innovations**
- **Radical innovations**
- **Systemic innovations**

Classification of innovations

SYSTEM	New series of cars, planes, computers, TV	New generation (MP3 and download as substitution of CD)	Steam engine, ICT, biotechnology, nanotechnology
	Improvement of components	New components for existing systems	Advanced materials improving component properties
COMPONENT			
	INCREMENTAL		RADICAL
	„do better what we already do“	„new for the company“	„new for the world“

INNOVATION PROCESS

- **Research and development (R&D)**
- **Production**
- **Marketing**

Innovation is an opportunity for something new, different. It is always based on change.

Innovators do not view any change as a threat but as an opportunity

FOCUS

- Use the limited resources in the most effective manner; focus on one of the following:
 - **Operational output**
 - **Top-quality products**
 - **Perfect knowledge of customers**

RECOMMENDATIONS

- Solve the correct problem correctly – be effective and efficient
- Manage innovation as a project
- Analyze risks
- Use models, scenarios, computer simulation
- Study examples of successful and unsuccessful innovation projects

WHAT TO DO

1. Start with analysis and study of opportunities.
2. Go among people, ask questions, listen
3. Effective innovations are surprisingly simple. They must be focused on specific needs and on specific final products.
4. Effective innovation start on a small scale.
5. A successful innovation always tries to win a leading position, otherwise you create opportunities for your competitors.

WHAT TO AVOID

1. Don't try to be too "clever". All that is too sophisticated will almost certainly go wrong.
2. Don't try to do too many things at once. Focus on the core of the problem.
3. Don't try to make innovations for the future but for today. An innovation can have a long-term impact but there must be an immediate need for it.

Three conditions for innovations

1. Innovation means work, hard, concentrated and thorough work. If these qualities are lacking then there is no use for the big talent, cleverness or knowledge.
2. Successful innovations must build on your strong points. The innovation must be important to the innovator.
3. Innovation must focus on a market, must be controlled by the market (market-pull).

No comment ...

1990



2005



TOSHULIN

Development of new machines:

- 1. Customized – the machines developed for the specific customer according to its requirements – market pull**
- 2. Prototypes – there is no specific customer – market push**

THREE

Pillars of Success

- 1. Maximum attainable quality**
- 2. Sharing expenses with customers**
- 3. Development of original products**

Disruptive and open innovations

Innovation categories

- **sustaining** – better products that can be sold with higher margin to demanding customers; incumbents win
- **disruptive** – commercialization of simpler, more user-friendly products, which are cheaper and targeted to new or less demanding customers; new entrants win

Key elements of disruption

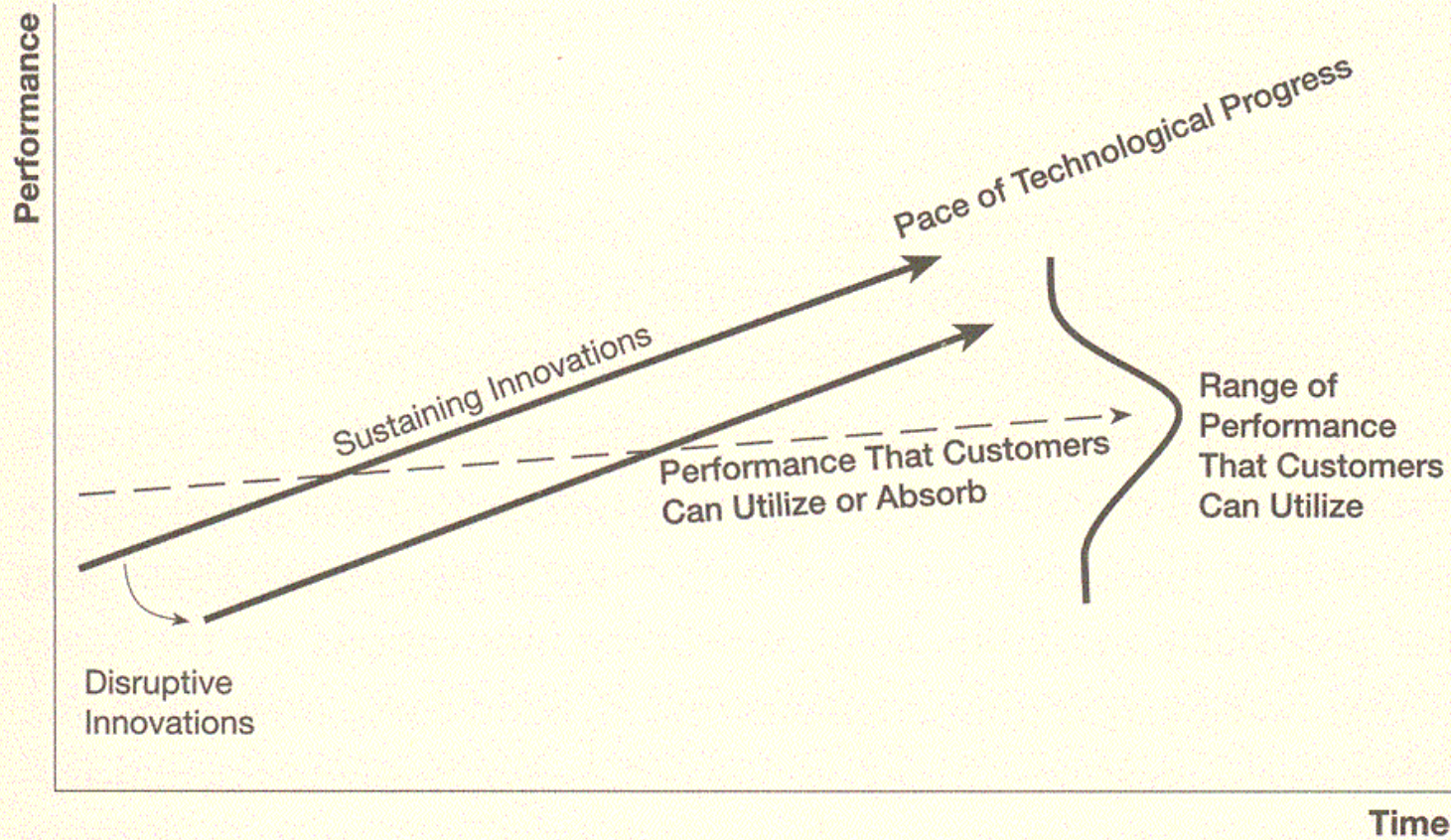
- Customers at each market has limited absorption capacity
- Technological progress usually is faster than the ability of the market to employ it. Companies focus on better products to be sold with higher margin to unsatisfied customers.

Sustaining vs. disruptive

- **Sustaining**: focused on demanding customers; both incremental and radical. Incumbents have resources and motivation.
- **Disruptive**: introduce products and services not as advanced as existing ones, but offering other advantages (simpler, cheaper, more user friendly, ...) and focus on new or less demanding customers.

FIGURE 2 - 1

The Disruptive Innovation Model



Clayton M. Christensen: The Innovator's Solution, Harvard Business Press, 2003

- Due to technological progress the trajectory of the disruptive innovation after some time crosses the trajectory of demands of more demanding customers and starts to replace incumbents who are not principally ready to react adequately, as they are motivated to succeed at „better“ markets, not to defend themselves on „inferior“ ones.

Conditions of success - 1

- Disruption is successful, as it is easier to defeat competition that tries to escape than the competition who fights
- Innovation must be disruptive for all companies in the industry
- Ex. Internet – for Dell sustaining, they sold computers formerly by mail, phone, etc.

Conditions of success - 2

- Following the trajectory upwards to market tiers where it is possible to attain higher margins is what good manager is expected to do.
- Each company therefore prepares its own disruption. This is the innovator's dilemma, but also the start of innovator's solution.
- The advice to new, growing firms: focus on products and markets ignored or neglected by incumbents.

Two types of disruption

- New markets: compete with non-consumption: simpler, more user friendly, can be used by less sophisticated customers (PC, transistor radio, desk copiers).
- Low-end: focus on lower tiers of main markets (minimills, discount stores, Korean auto-makers); motivate incumbents to leave the market

OPEN INNOVATION

- Chesbrough, H., “*Open Innovation*”, Harvard Business School Publishing, Boston MA, 2003
- ***Closed innovation*** - requires control
- ***Open innovation***
 - companies use external as well as internal ideas and both external and internal ways to market
 - internal ideas can be taken to the market through external channels to generate additional value

Closed innovation	Open innovation
All the best people are working for us	Not all the best people are working for us . We must work with clever people within and outside our company.
R&D creates profit only when we invent, develop and market everything ourselves.	External R&D can create remarkable value; to employ it, we need absorption capacity, often as internal R&D.
If we develop the product ourselves, we will be the first on the market.	R&D can create profit even if we do not initialize and perform it ourselves.
Winner is who gets the innovation to the market first.	To develop better business model is more important than to be the first in the market.
We will win if we develop most of the ideas (an the best of them).	We will win if we make best use of internal and external ideas.
We must have our intellectual property under control so that our competitors can make advantage of it.	We must be able to profit from others using our intellectual property and we must license the intellectual property if it supports our business model.

Closed innovation	Open innovation
Examples: nuclear industry, mainframe computers	Examples : PC, movies
Mostly internal ideas	Many external ideas
Low workforce mobility	High workforce mobility
Low role of the venture capital	Active venture capital
Few new businesses, weak ones	Many new businesses
Universities are not important as the sources of ideas	Universities are not important as the sources of ideas and people

Business model

- Formulate ***value proposition***, i.e. the value delivered to the customer by the product based on specific technology.
- Identify ***market segment***, ie. users to whom the technology brings value and performs the job to be done.
- Define structure of the ***value chain***, required for the product creation and distribution. Value creation is necessary, however not sufficient condition of profitability; value creation is conditioned by:
 - balance of forces among our business, suppliers and competitors
 - presence of complementary assets (e.g. in production, distribution, etc.) necessary for supporting the company position in the value chain.

Business model– cont'd

- Specify the mechanism of profit creation and evaluate product ***cost structure*** and ***target margin***
- Describe the company position in the ***value network*** that connects suppliers and customers, including identification of potential alternative producers and competitors.
- Formulate ***competitive strategy*** enabling to the innovative company to gain and keep competitive advantage.

Assessment of company innovation potential

COMPANY INNOVATION POTENTIAL

A company with high innovation potential scores high in the following areas:

- Strategy and planning
- Marketing
- Technological process
- Quality management
- Logistics
- Human resources

INNOVATION POTENTIAL ASSESSMENT

- For a company, it is important to know its innovation potential. It can use the questionnaire
- For every of the six areas, there are six question, each with four possible answers. The answers are formulated so that they reflect the existing situation in the company.

A. STRATEGY AND PLANNING

- 1. Idea about the company future**
- 2. Vision and employees**
- 3. Company innovation programs**
- 4. Plan modifications**
- 5. Financial indicators of the plan**
- 6. Project management**

B. MARKETING

- 1. Monitoring of current market trends**
- 2. Evaluation of the market competition position**
- 3. Customer-orientation**
- 4. Monitoring of customers' attitudes to the company product**
- 5. Market information flow inside the company**
- 6. Marketing and financial control**

C. TECHNOLOGICAL PROCESS

- 1. Future company's competitiveness in the industry**
- 2. Changes of technologies**
- 3. Collection of impulses for implementation of technology changes**
- 4. Evaluation of the return on investment**
- 5. Calculation of production costs and their monitoring**
- 6. Creation of resources for development**

D. QUALITY, ENVIRONMENT

1. Monitoring of changes conditioning the quality management in the company
2. Employees' personal contribution to the quality system
3. External quality audit in the company
4. Monitoring of the environmental impact
5. Impact of quality monitoring on the company processes
6. Covering of costs resulting from modifications of standards, regulations and legislation in the sphere of quality and environment

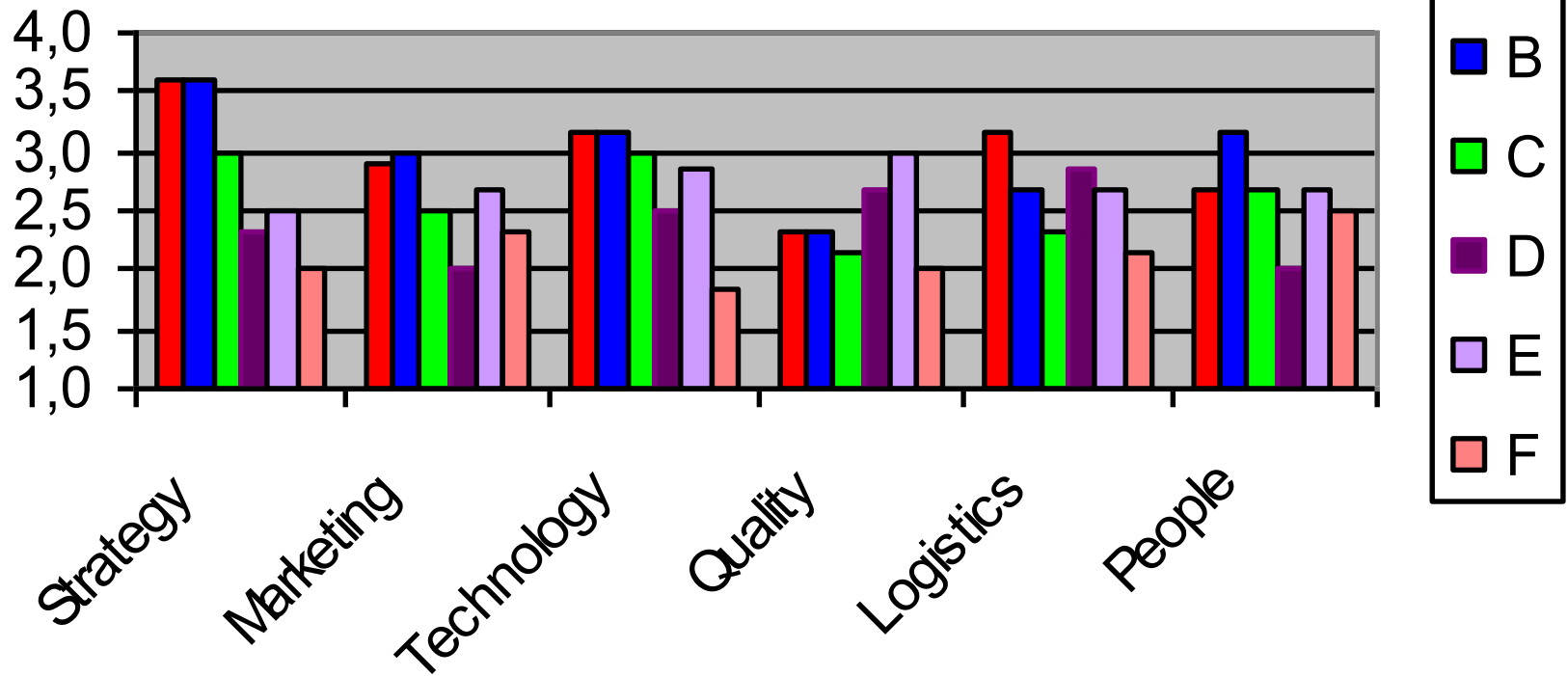
E. LOGISTICS

1. Organization of purchase and distribution channels in the company
2. Optimization of the company logistics
3. Information and communication flows between the company and its partners
4. Flexibility of logistics processes
5. Introduction of innovations in logistics
6. Logistics and financial control

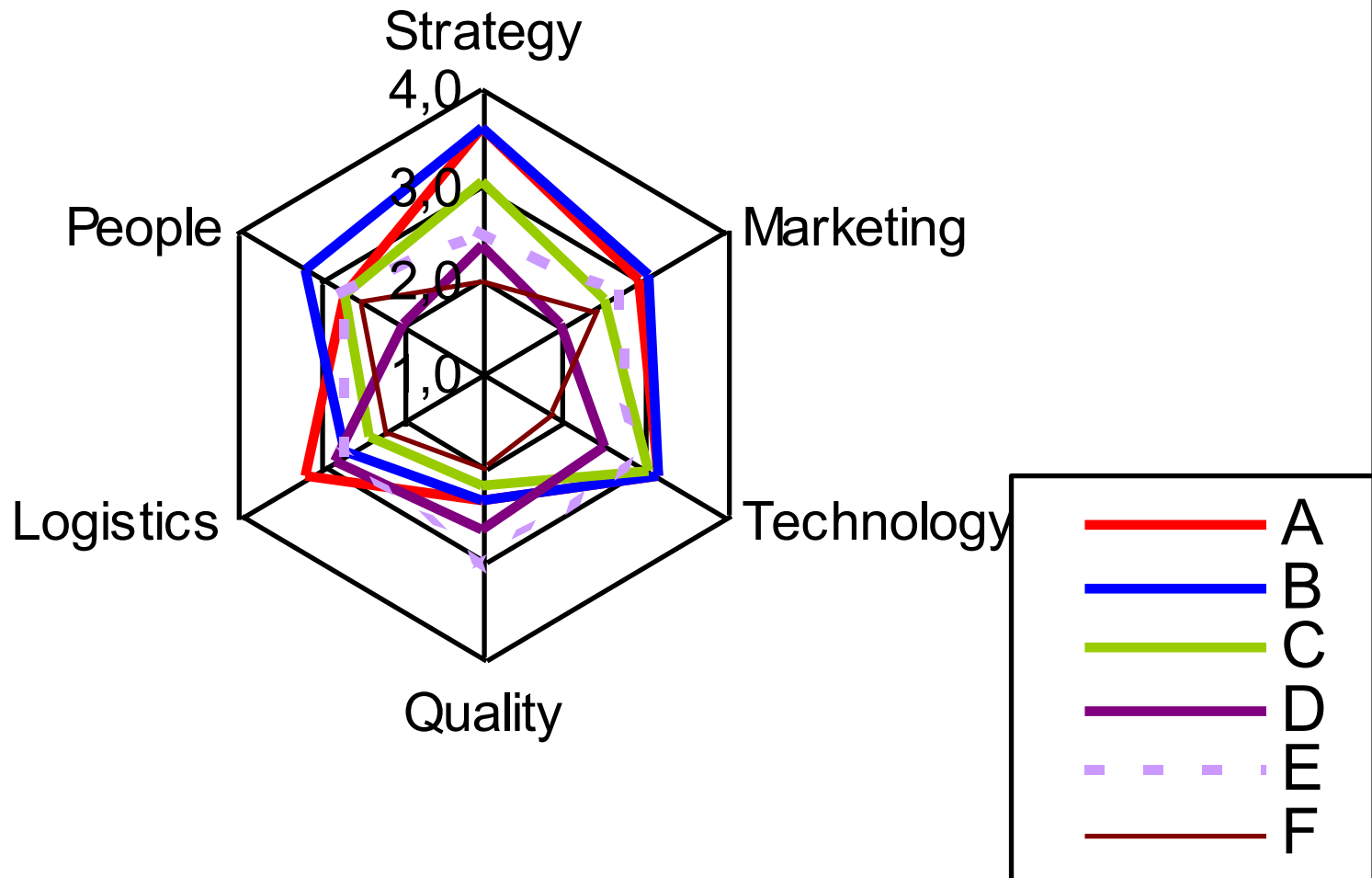
F. ORGANIZATION AND HUMAN RESOURCES

- 1. Employees satisfaction**
- 2. Employees motivation**
- 3. Management and communication**
- 4. Conflict resolution**
- 5. Company information system**
- 6. Company culture**

Innovation potential assessment



Innovation potential assessment

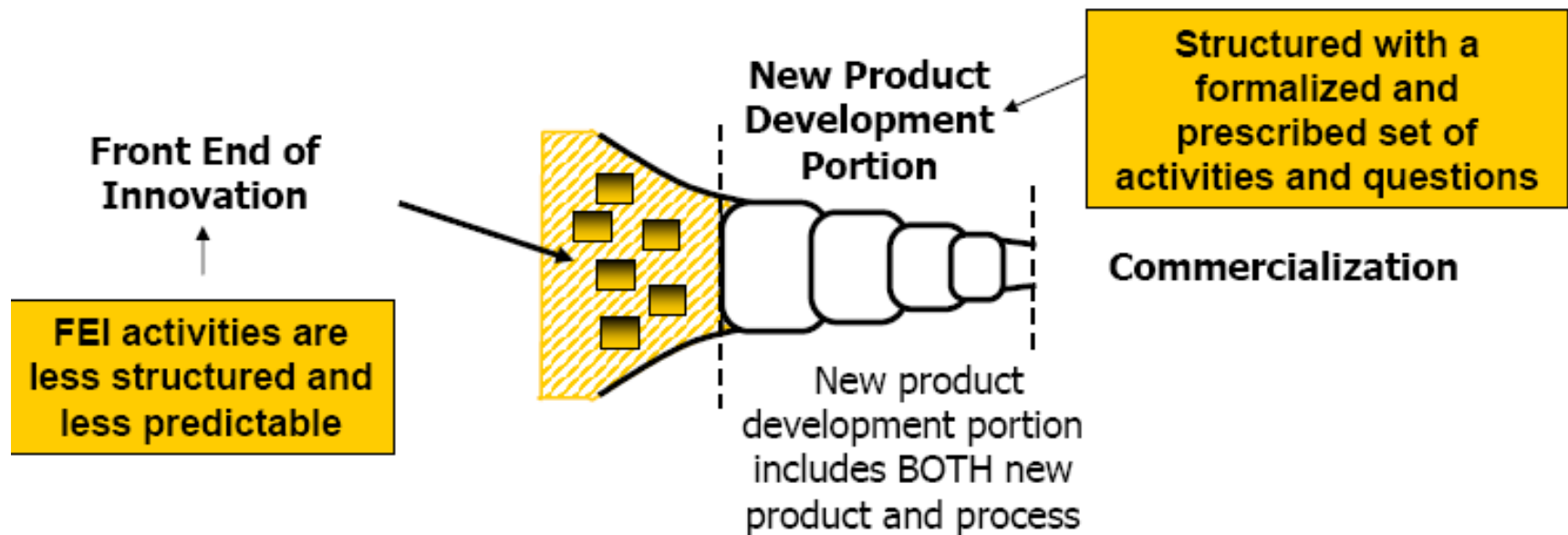


Incremental vs. radical innovations

- Koen: systematic approaches using process models can be successful in the case of incremental innovations, where both business and technical uncertainty is rather low
- whenever at least one of those uncertainties is high, we need more flexible approaches with iterations and parallelization of activities
- successful radical innovations often use rapid or virtual prototyping even in the 0-th or 1-st phase, as it allows better visualization and communication of the product concept.

New concept development model

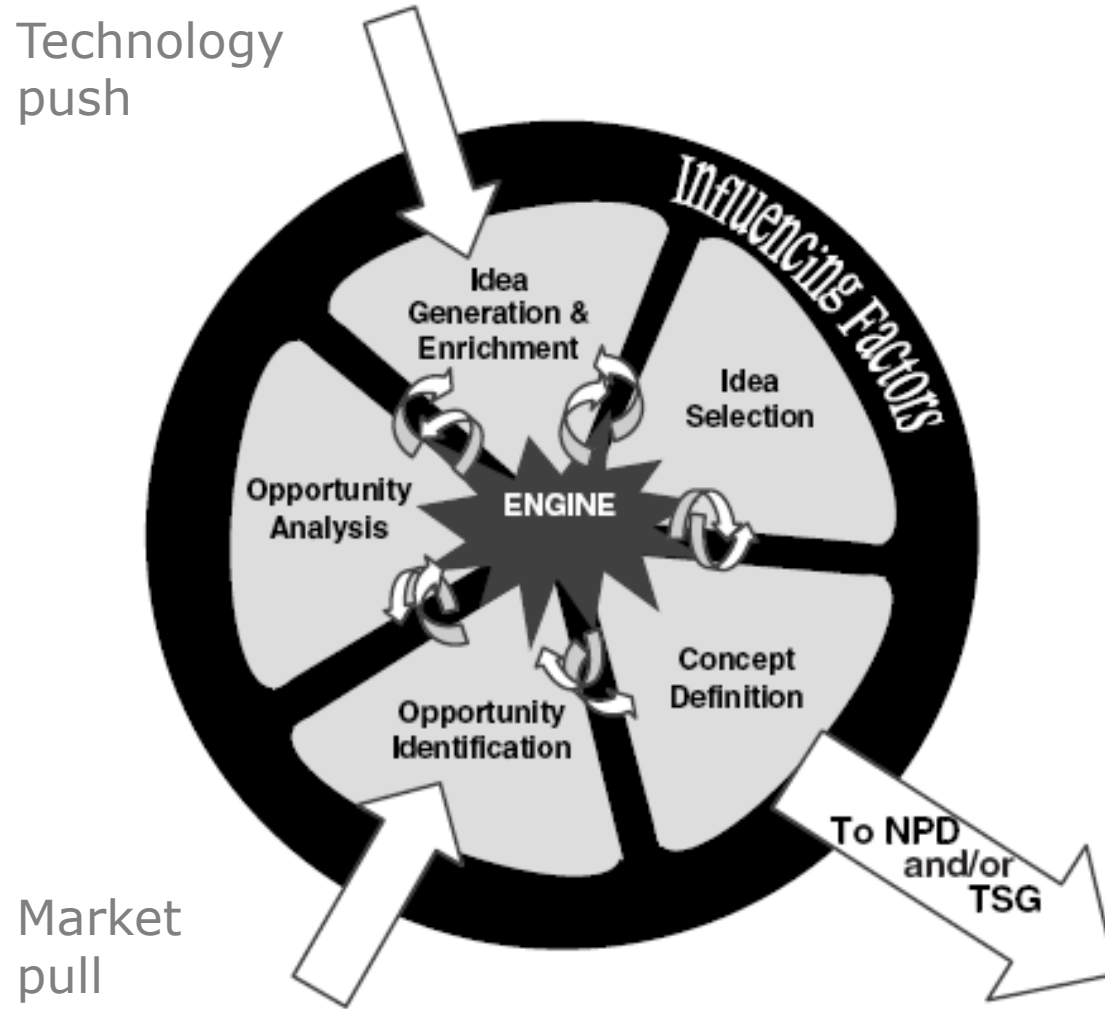
- in the early phases it is not suitable to use the same approaches as in the later, more structured process phases



Difference Between FFE and NPD

	Fuzzy Front End (FFE)	New Product Development (NPD)
Nature of Work	Experimental, often chaotic. “Eureka” moments. Can schedule work—but not invention.	Disciplined and goal-oriented with a project plan.
Commercialization Date	Unpredictable or uncertain.	High degree of certainty.
Funding	Variable	Budgeted.
Revenue Expectations	Often uncertain, with a great deal of speculation.	Predictable, with increasing certainty, analysis, and documentation as the product release date gets closer.
Activity	minimize risk and optimize potential	Multifunction product and/or process development team
Measures of Progress	Strengthened concepts.	Milestone achievement.

New concept development model (NCD)



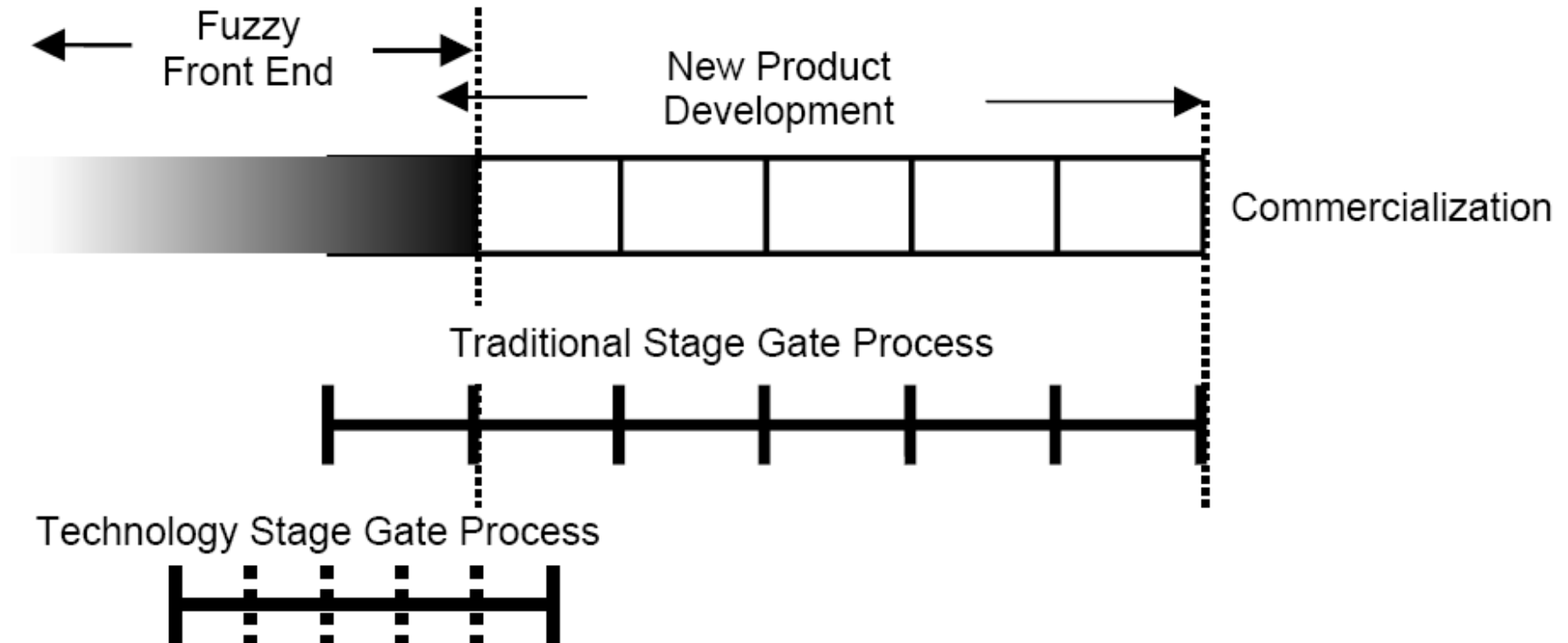
NCD components

- Engine: represents management support
- Engine powers the five elements of the NCD model
- The engine and the five elements are placed on top of the influencing factors.

Technology stage-gate process (TSG)

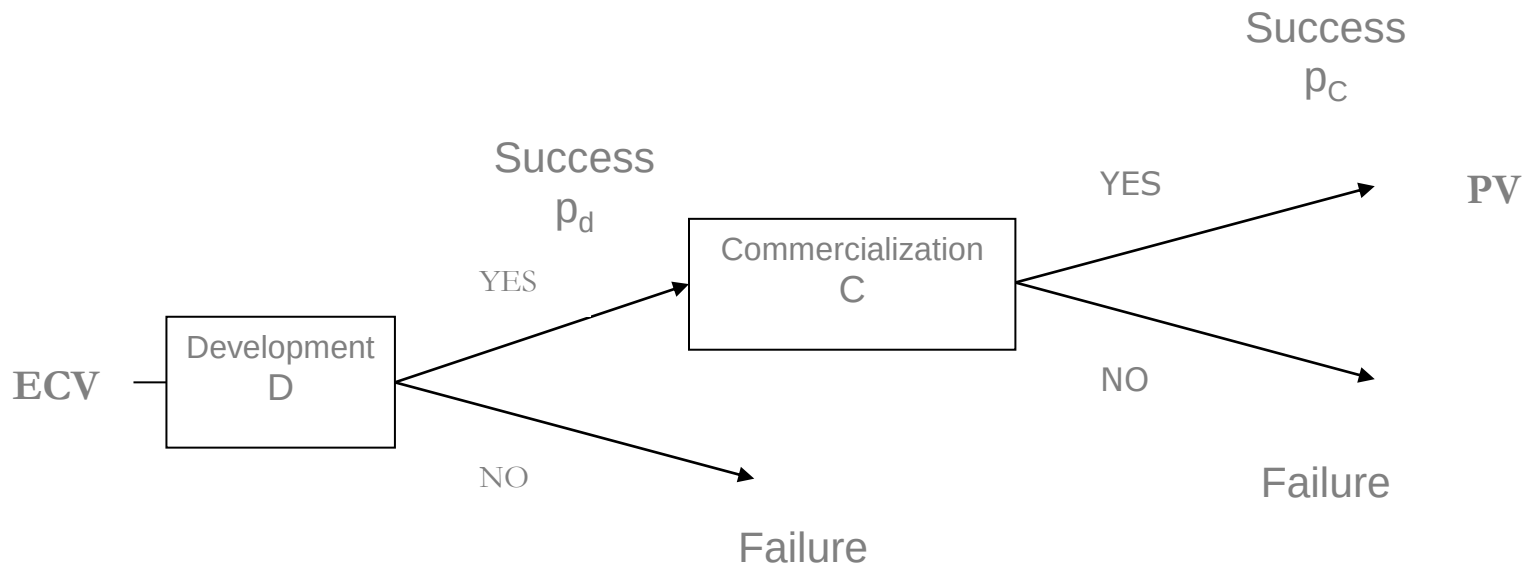
- Management of high-risk projects within and at the transition between the fuzzy front end and new product development
- traditional SG: gates are transparent, the product development team can "see" all the deliverables at the gates
- TSG: gates are opaque, the team can only "see" to the next gate and understands that the deliverable may change as the technology is developed

Traditional and technology stage-gate processes



Project Expected Commercial Value (ECV)

- Takes into consideration all three important characteristics of each phase – its cost, duration and probability of success
- The project is modeled by the probability tree.
- The stage duration, together with the discount rate, is reflected in the net present value calculation.
- Illustration: project with only two stages – development and commercialization



ECV = project expected commercial value
 p_d = probability of successful development
 p_c = probability of successful commercialization
 D = development costs
 C = commercialization costs
 PV = net present value of expected project earnings

$$ECV = [(PV * p_c - C) * p_d] - D$$

according to [Cooper 2001]

Example

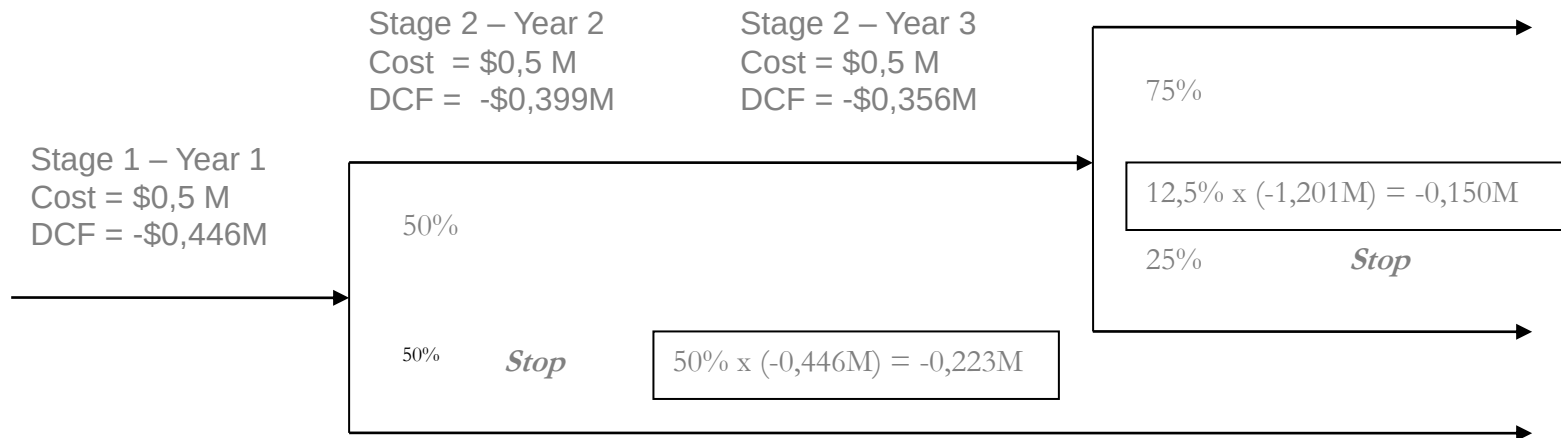
- The first stage (1 year): laboratory tests; success probability 50%.
- The second stage (2 years): field tests; success probability 75%.
- If tests are successful, the necessary investment into the technology is \$5M, expected earnings \$8M $\Rightarrow$ project net present value \$3M.
- Financial data are discounted, assuming the weighted capital costs WACC = 12%, risk-free discount rate 5%.
- Development costs and specific project risk are high $\Rightarrow$ resulting ECV negative (-\$109 000)
- according to this criterion, project should be rejected.

Probability tree in project evaluation

$$ECV = 0,265 - 0,150 - 0,223 = -0,109M$$

$$\begin{aligned} & 37,5\% \times \\ & (1,907 - (0,356 + 0,399 + 0,446)) = \\ & = 37,5\% \times (1,907 - 1,201) = \\ & = 37,5\% \times 0,706M = 0,265M \end{aligned}$$

Stage 3 – Year 4
NPV = \$3,0 M
DCF = \$1,907M



according to [Boer 2003]

Real options

- The concept of real options is closely related to financial options that found their place in financial markets in recent decades. Real options relate to company opportunities and emphasize the basic idea that risk can bring the competitive advantage and as such it should be rewarded.
- The application of the real options theory is briefly described in [Boer 2003], the related website contains further information and references to more detailed resources. Here we will give only a brief account of basic concepts and terminology.

SOURCES OF INNOVATION IMPULSES

Internal environment

- Own R&D
- Technical divisions – design, technology
- Production divisions (production, provision of services)
- Marketing and sales
- Logistics (purchase and supplies)
- Guarantee and post-guarantee service
- Owners

SOURCES OF INNOVATION IMPULSES

External environment

- Customers
- Suppliers
- Competitors
- Consultants, R&D institutions
- Schools, universities
- Professional publications, Internet
- Exhibitions, fairs, specialized seminars and conferences
- Advertising agencies
- Investors
- Media
- Authorized testing laboratories, certification agencies
- State institutions, public sector
- Legislation
- Globalization

MARKET PULL - R&D PUSH

- **Market pull**
 - looking for the best way of satisfying a newly emerging customer demand
 - improvement of the existing products, extension of the existing offer or decrease of price
 - impulses for continuous, incremental innovations or for process innovations
- **Research and development push**
 - looking for commercial use of new impulses resulting from the R&D results
 - generating of new markets for conceptually different products

7 SOURCES OF INNOVATION IMPULSES

(Drucker)

INTERNAL

1. *unexpected event*
2. *contradiction*
3. *change of work process*
4. *change in the structure of industry or market*

EXTERNAL

5. *Demographic changes*
6. *Changes in the world view*
7. *New knowledge*

1. Unexpected event

- *Unexpected success*
 - 1. What will the use of the offered opportunity mean to us?
 - 2. Where will its introduction take us?
 - 3. What do we need to do for its implementation?
 - 4. How can we achieve that?
- *Unexpected failure*
- *Unexpected external event*

2. Contradiction

- *Non-compliance with economic reality*
- *Contradiction between reality and anticipations about it*
- *Contradiction between the anticipated and real behavior of customers and their values*

3. Change of process

- realize the necessity of change, identify the weak point of the chain
- be convinced that if something does not work the way it should, then it is necessary to attempt a change
- the solution must be convenient for those who will implement it. It must place moderate and feasible requirements

4. Change in the structure of industry and market

- Rapid growth of the industry
- Identification of new market segments
- Convergence of technologies (e.g. use of computers in telecommunications)
- Rapid change of the industry and resulting need of a structural change

5. Demography

- easiest to describe and to predict
- influence what will be bought, who and in which amounts will purchase

6. Change of attitudes

- change in the approach to health: health-care, food, spending the leisure time
- “upper-middle class”: a chance to offer non-standard services at non-standard prices
- increasing migration, feminism, regionalism etc
- Timing is essential - to be the first

7. New knowledge

- Based on convergence or synergy of various kinds of knowledge, their success requires, high rate of risk
 - Thorough analysis of all factors. identify the “missing elements” of the chain and possibilities of their supplementing or substitution;
 - Focus on winning the strategic position at the market. the second chance usually does not come;
 - Entrepreneurial management style. Quality is not what is technically perfect but what adds the product its value for the end user

IMPULSES FROM THE MARKET ENVIRONMENT

- **Customers**
 - product presentation**
 - realistic
 - simple, demonstrative and precise
 - moderate
 - representative sample of customers
- **Suppliers**
- **Competitors**

INNOVATION IMPULSES OF THE R&D

- **identification research:** to monitor the scientific, technical and economic information and identify innovation impulses applicable in the company
- **basic research**
- **applied research:** acquire knowledge and means applicable for the meeting of specific, beforehand-defined goals
- **development:** systemic use of knowledge and means acquired in the applied research for the creation of a new or improvement of the existing product or for the creation or modification of processes

INTERNAL IMPULSES

- usually combined with external sources
- supported by
 - creative techniques
 - innovation tools
- REGISTER OF IMPULSES

**End of
Developing Innovation
and
Creativity for Business Advantage**