2. INNOVATION

ENGR4901

Introduction to Design Projects

In many fields, technical or economic as well as personal, problems may arise which require solutions that go beyond commonly acknowledged experience.

Such problems need innovative solutions which can only be found by creative thinking. Many people believe that creativity is a personal talent but, in fact, it can be learned and trained successively.

CREATIVITY

- Creativity can be defined as the **ability to generate new ideas** in order to find the most practicable solution for problems.
- Creativity **is not limited to a few**. Each person has a more or less high creative potential.
- Every innovation requires a creative strategy which, in turn, uses **creative thinking**.
- Creative solutions involve **not necessarily entirely new** inventions but often **combine already known**, but not yet linked elements.
- Creativity thus summarizes and **restructures knowledge** by establishing **new relations and connections**.

Surveys have established that about 75% of all new ideas are generated externally and not in the company.

Individual	Organizational
Personality	Hierarchy
Age	Autonomy
Qualification	Management Style
Motivation	Information/Communication
Stress	Working Environment
Willingness to take risks	Uniformity of procedures

Factors affecting creativity

INNOVATION

First of all, Innovation is not a single action but a total process of interrelated sub processes.

- It is not just the conception of a new idea,
- nor the invention of a new device,
- nor the development of a new market.
- Innovation process is **all these things** acting **in an integrated fashion.**

Some common definitions of INNOVATION:

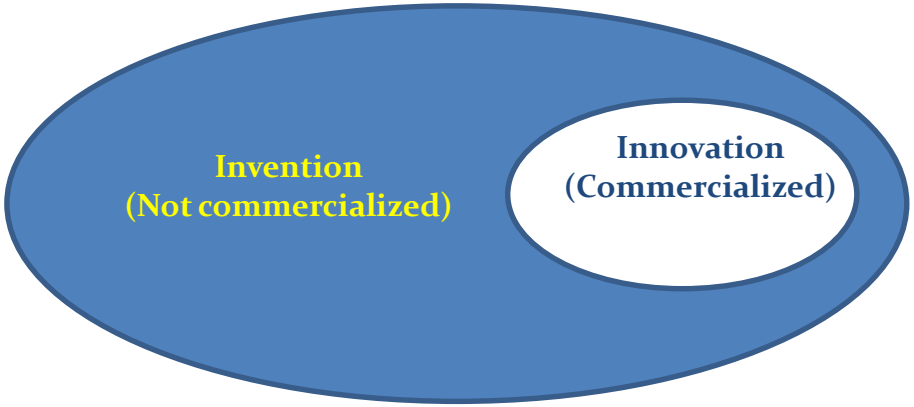
- Process of turning opportunities into new ideas,
- Adoption of new ideas within the organizations,
- Successful applications of the resulting novelties; such that they provide value to the organization.

The most important aspects of innovation are:

- New
- Changes
- Opportunities
- Creative ideas (inventions)
- Adoption of organization
- Value creation

Invention is a detailed design or model of a process or product that can be distinguished as compared to existing ones.

Innovation is the actual use of a nontrivial change and improvement in a process, product or system that is specific to the institution developing the change.



For invention to become an innovation, the organization needs to be introduced to the invention and invention should add value to the organization in some way. Only the economic implementation of an idea can be called innovation.

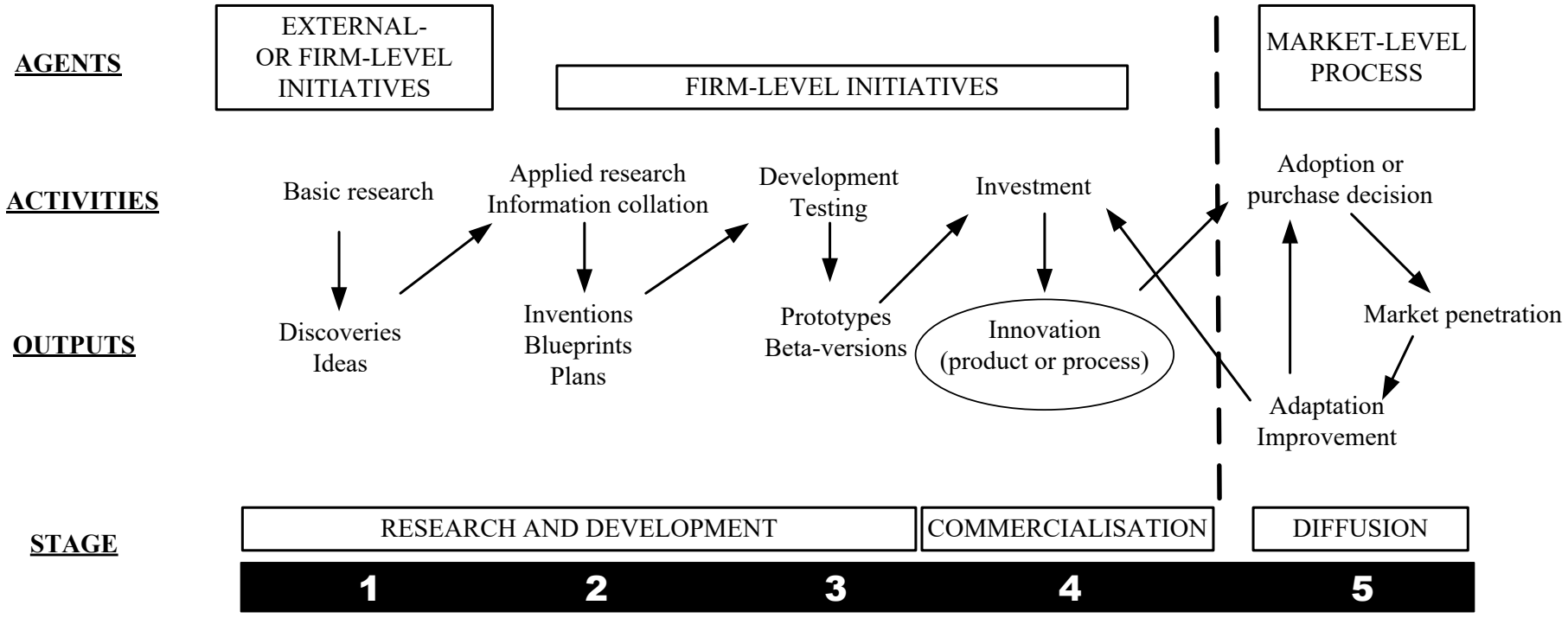
Innovation can be described as the result of:

- Some amount of time and effort into *researching* (R) an idea,
- Some larger amount of time and effort into *developing* (D) this idea,
- Some very large amount of time and effort into *commercializing* (C) this idea into a market.

Innovation is closely linked with ***competitiveness***

- Innovation has deep impact on both "*Differentiation*" or "*Cost Leadership*"
- The uniqueness of the products/services increases the level of "*satisfaction of the client*"
- Innovation in value chain may result in "*time and cost savings*"

Innovation Characteristics	Strategic Advantages
Novelty	Offers something no one has done before
Complexity	Keeps entry barriers high
Robustness	Improves basic model by extending life and/or reducing overall cost
Radical Nature	Carries competitiveness into a new dimension
Continuous Innovation	Results continuouıs improvement in performance



- INNOVATION PROCESS -

Innovation process has three stages:

1. Generation of an idea (Stage-1),
2. Acceptance (decision) of the idea (Stages-2 & 3),
3. Realization (implementation) (Stages-4 & 5) of the idea.

Types of Innovation

There are many different types of innovation with the two most popular types amongst innovation specialists usually being incremental innovation and radical innovation.

a. Incremental Innovation

Incremental innovation uses existing products, processes or technologies by improving on what currently existed. Incremental innovation is all about doing what you have to do in order to keep a product up to date.

Enhancing products so as to be more effective or improving operability, reducing costs, improving quality, etc. By making incremental improvements to the product customers must be engaged.

b. Radical Innovation

Radical innovation wipes away existing markets by providing something completely new to the world.

Radical innovations are fundamental changes to a product, service or activity. Something entirely new or a significant transformation of what existed prior to the innovation.

- ***Product Innovation:*** Change in end product/ service or their quality
- ***Process Innovation:*** Change in products/services delivery methods
- ***Market Innovation:*** Opening of new markets
- ***Resource Innovation:*** Change in sources of raw material supply
- ***Organizational Innovation:*** Change in characteristics of organization structure

Why do we need Innovation?

- Financial pressures to reduce costs, increase efficiency, do more with less, etc
- Increased competition
- Shorter product life cycles
- Changing standards and values
- Stricter regulations
- Industry and community needs for sustainable development
- Increased demand for accountability
- Demographic, social and maket changes
- Rising customer expectations regarding service and quality
- Changing economy
- Greater availability of potentially useful technologies

Evaluation and Feasibility of an Innovation

During innovation process alternative options for solution should be evaluated according to their technical, economic and environmental benefits.

The depth of the study depends on the type of project. Complex problems naturally require more attention than simple projects.

For some options it may be necessary to collect considerably more information. An important source of information are employees who are directly affected by the implementation.

The whole work is known as «**Evaluation and Feasibility**» Study.

Checklist for the Technical Evaluation

- Have you determined whether other companies have already gained experience with this option?
- Will this option maintain product quality?
- Will this option adversely (negatively) affect production?
- Will this option require additional staff?
- Will workers be able to run the process with the implemented option?
- Is extra training of workers needed?
- Are you certain that this option will generate less waste?
- Are you certain that this option will not generate additional waste or emission problems ?
- Is the plant layout and design suitable for the incorporation of this option?
- Will the provider guarantee this option?
- Have you determined whether this option will improve or maintain the workers' safety and health?
- Does this option reduce waste at the source?
- Are materials and parts readily available?
- Can this option be easily serviced?
- Does this option promote recycling?

Checklist for the Environmental Evaluation

- Does this option reduce the toxicity and volume of solid waste and sludge?
- Does this option reduce the toxicity and volume of wastewater?
- Does this option reduce the toxicity and volume of gaseous emissions?
- Does this option improve the health and safety conditions on the workfloor?
- Does this option reduce the use of raw materials (per unit of product)?
- Does this option reduce the use of process materials (per unit of product)?
- Does this option reduce the energy consumption (per unit of product)?
- Does this option generate new environmental impacts?
- Does this option increase the possibility of recycling waste streams?
- Does this option increase the possibility of product recycling?

Checklist for the Economic Evaluation

- Does this option reduce the cost of raw materials?
- Does this option reduce the cost of utilities?
- Does this option reduce material and waste storage costs?
- Does this option reduce compliance costs?
- Will this option reduce the costs associated with workers' injury or illness?
- Will this option reduce insurance premiums?
- Will this option reduce waste disposal costs?
- Does this option have an acceptable payback period?
- Is this option economically acceptable for the company (consider both capital and ongoing operations)?

Checklist for the Feasibility Study

- Did you carry out a technical evaluation of the prioritized options?
- Did you carry out an economic evaluation of the prioritized options?
- Did you carry out an environmental evaluation of the prioritized options?
- Did you determine the training method of the employees for the successful implementation of the selected options?
- Can you identify the barriers which can be encountered on the work floor and which hamper the implementation of cleaner production options?
- Did you take measures to facilitate the implementation of these options, such as workshops, meetings, briefings, etc.?
- Did you record the feasible options selected for implementation?
- Did you record the non-feasible options?
- Did you coordinate the planning and time schedule of the cleaner production assessment or audit?
- Did you inform the management and employees about the progress of the cleaner production assessment?
- Did you prepare before-and-after sheets for the implementation phase?
- Based on the expected “before-and-after” situation, did you calculate the expected payback period?

CONCLUSIONS

- Considering the definition of Innovation, the main components and outcomes of innovation are ***adding value*** to the organization and providing ***competitive advantage***
- ***Innovation strategies*** are main triggering factors for an organization to reach its ***targets*** in the presence of environmental *barriers/drivers* through using its *core organizational competencies*
- As environmental barriers are *out of the control* of the company, the company should improve its ***core capabilities*** for successful innovations

These course notes have been compiled from:

1. http://www.innovation-creativity.com/definition-of-creativity.html

2.http://www.unido.org/fileadmin/user_media/Services/Environmental_Management/CP_ToolKit_english/PR-Volume_05/PR-5-Textbook_inno.pdf