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Innovative management techniques in the field of environmental education

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Abstract

Nowadays the global trend of transition to a knowledge economy is promoted. Establishment of such an economy is necessarily connected with the creation of an efficient innovation system of the labor force. Educational role that can transform the growing volume of information into an effective knowledge, which they can subsequently apply. The support process of innovation has become the most important part of science, development and application of knowledge-based society. Advanced economies consider science, research and innovation for the most important tools of technology independence and of long-term economic growth. An essential rule of any economy is therefore to support the creation of knowledge and innovation. To support the managing process formed has been a set of innovation management techniques (IMTs), are invariably considered to be effective tools for boosting competitiveness.

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1. Introduction

The need to enhance, using IMTs, follows from the existing shortages in innovations managing. **Major barriers to managing innovations are outlined below:** Absence of transparent methodology: managers are often confusingly taking innovations for purely technical or economical methods of developing a new product; Innovative culture is being absent throughout the entire organization; Absence of the model of processes and activities flows:

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despite the host of innovations supporting methods at hand the road to realizing and organizing the innovation remains obscured; Knowledge management is absent: 70 % – 80 % of the knowledge generated at searching for an innovative solution are lost and remain unprocessed; Quantification of results is missing: this important step is often neglected; Absence of complex innovation management: in majority of cases, the functions are common.

2. Defining the IMTS

IMTs may be conceived as a broad palette of tools, techniques and methods that help institution to systematically adapt to conditions on and challenges of the market. IMTs are the methodology or the tool that allow coping with institution innovations management with more ease.

Undisputable benefits of IMTs for institution, as they: Enhance flexibility and efficiency; Allow to be knowledge management more effective; Step-up productivity and reduce the time of introducing an innovation; Facilitate team-wise cooperation; Allow collecting on-line acquired marketing information; Improve mutual relations; Integrate information acquired from a variety of sources; Facilitate more effective relations and cooperation with customers; Eliminate redundant processes; Reduce costs applying ICT based solutions; Lower the administrative task share (i. e. eliminate value-not-adding activities); Support e-learning and e-commerce; Improve mutual relations among employees within the enterprise culture framework.

3. Origination of innovation management techniques

Development of innovation management techniques derives from diversity of innovative procedures. Resulting from each theory are relevant techniques: *Science and research supporting techniques* – innovations derived from science and research. Innovation opportunities are based on applying results and conclusions of research; *Market survey techniques* – innovations resulting from demands and needs of the market; market-driven innovations. The theory expands the research leading position by market factor; *Innovative cooperation techniques* – innovations based on the relations existing among innovation designing players. Connections between the research, engineering, production, marketing and the customers and suppliers, respectively; *Communications, support of design, etc. techniques* – innovations following from changes in the technology. The theory of innovation emphasises importance of information technologies; *Human resource managing techniques* – on social networks based innovations. Important is to emphasise the knowledge as driving force of information through education and creative environment.

3.1. Integrating innovation management techniques

IMTs are resolving, provided that they enjoy support of an innovative environment, identified problems and barriers to innovations. Their source and tool at a time are creativity, research and development. Whereas they are employed in all kinds of innovation projects they subscribe to enhance competitiveness.

Existent presently is an enormous set of tools, methods and techniques supporting the innovation managing. They differ by their situating in the innovation process, by degree of their fragmenting, universality and other features. Their basic models systemise iMTs.

Creators and users of IMTs – The innovative management players can be included in the following teams: **IMTs promoters:** *Organisations that are spreading information and create awareness on these techniques; in question are counselling companies that follow the government policy creators;* **Creators or developers of the innovative management techniques:** *These are proposing new innovation managing techniques; such are academic centres, consulting and counselling companies and operating companies.*

Major users of the innovative management techniques: Consulting and counselling companies; Entrepreneurial educational academies; Higher education centres; Business-making supporting organizations; Industrial companies; Financial organisations; Governments and state administration institutions.

IMTs for Knowledge-Based Economy – The review of identified techniques reflects their potential for knowledge-based economy.

Tab. 1 Typology of the innovation management key techniques for knowledge economy

IMTs Typology		Methods and tools
1	Knowledge managing techniques	Automatic classification tools; Balance scorecard; bibliographic methods; brainstorming; intelligence information systems; cluster cooperation techniques analysis; practice communities; management of the content; creativity supporting software; CRM system; data acquisition; decision-making supporting systems; platforms; environment condition scanning; internal and external benchmarking; knowledge and skills audit; projects managing; web monitoring; process maps
2	Market survey techniques	Technological observations; patents analyses; entrepreneurial intelligence; web monitoring; geo-marketing; customers management; virtual community
3	Cooperation and networking collaboration techniques	Marketing interfaces; creation of teams; reverse engineering; QFD methodology; TQM systems; JIT systems; continual improvements; videoconferencing tools; supply networks managing; clusters; ecosystem networks; partnerships of companies and universities; virtual commerce
4	Human resources management techniques	Needs mapping processes; on-line recruitment of personnel; competences assessment; leadership models; communication practices; outsourcing
5	Interfaces managing techniques	Marketing of interfaces; virtual models of companies; production portfolio management
6	Creativity developing techniques	Brainstorming; lateral thinking; TRIZ: creative problems solving; thought maps
7	Processes improving techniques	Benchmarking; workflow; lean production; redesign and reengineering; Kaizen; JIT; SMED
8	Innovation projects managing techniques	Project managing; projects evaluation; projects portfolio management
9	Management designing techniques	CAD systems; Rapid Prototyping; knowledge sharing; value analysis
10	Companies forming techniques	Virtual incubators; spin-offs from market surveys; best business practices; simulation of business making

Source: Original design

VERITE model – Virtual environment for management of innovation technologies

Project VERITE (Virtual Environment for Innovation Management Technologies) stands for a trans-regional network of the IMTs supporting, and it is primarily directed to the innovation management technology tools. Especially emphasised are the below outlined IMTs: *Industrial design; Human resources management; Technology centres; Planning of resources; Supply chains managing; Creativity techniques; Value analysis; Partners based cooperation; Logistics; Proprietary rights management; CAD modelling; Innovation cycles managing; E-business making; Applying patents; Rapid Prototyping; Virtual modelling; QFD, FMEA, SCM systems.*

3.2. Features of selected creativity techniques:

BRAINSTORMING – is kind of an upgrade to the trial and error methods. It does not eliminate confusion in searching for a solution but, quite to the contrary, utilises it for searching in multiple directions. Rules of brainstorming: Team of 8 to 12 members; Presenting the issue, not formulating a task; The session is managed by the organizer; Absence of evaluations at sessions – absolute freedom of ideas; Fear of assessing ideas as bad or faulty is eliminated; Ideas are written down (blackboard, large sheet of paper); Brainstorming is over once there are no more ideas.; pon completion, the themes are included into groups; Out of the theme ideas are excluded; Selected are ideas for further processing, evaluation or verification; Kept on brainstorming are records and the resulting solution is subject to opposing.

SYNECTICS – (synectis – from Greek – stands for “union of seemingly unrelated subject matters“). The objective is to disturb the habitual view of a problem and to attain an unusual, original solution. Synectic method is a form of controlled discussion the result of which are themes arrived at by linking seemingly unrelated

and differing elements resulting from analogy with use of free associations. The method is applied in the form of team meeting of professionally mixed participants and a head (Chair). Sessions of groups are held by adhering to the rules of brainstorming. When a suggestion is discussed within a group, used are four kinds of analogies: **Direct analogy; Personal analogy (empathy); Symbolic analogy; Fantasizing analogy.**

CAUSE AND EFFECT CHART – Problem-solving is based on identifying and defining relations between the cause and their effects. Analysis of the solution is visualized using the fishbone diagram. Procedure: Defining the problem through causes and effects using an arbitrary ideas generating technique (e.g. brainstorming); Defining major problematic areas (e.g. employees, logistics, technology, marketing, etc.) and their plotting in the chart as fish bones. Later on, the chart may be modified and problem areas can be subdivided or joined; Updating the chart by records of effects and their reasons based on creative ideas and on investigating of causalities; Solutions on the chart focused on determining principal causes, their joining, dividing, relocating and systemizing. It is expected that once the cause is identified found can be adequate means to eliminate their effects.

SCAMPER – The technique consists of a list of the questions that stimulate creation of ideas: **S: Substitute?** (Substitute things, places, times, processes, people, ideas...); **C: Combine?** (Combine themes, concepts, ideas, emotions...); **A: Adapt?** (Adapt ideas from various contexts, times, persons, styles...); **M: Modify?** (Modify, add something more into an idea or a product, and thus transform it.); **P: Put to another use?** (Apply to another use; extract hidden possibilities from products, ideas.); **E: Eliminate?** (Eliminate or decrease the number of elements to minimum; select concepts, parts and integral parts of the problem.); **R: Reverse?** (Reverse, reorganize or add elements, places, times, roles...);

THOUGHT MAPS – A technique that substitutes traditional (linear) wording of analyzing and solving by use of structural map. Procedure: The problem is entered into the middle of a sheet – this grants the possibility to proceed in any direction whilst solving the issue; Individual thoughts and ideas are entered around the middle, into “branches”; In the process of resolving, notes are entered randomly, in circles from whichever corner; Entered are only the most important ideas; When analysing, the problem becomes restructured and new relations surface; Used are various marks, symbols, drawings and colours.

CATWOE – A creativity technique titled to reflect first letters of individual aspects that are used at analysing and resolving a problem: **C – Customer** – The system receiver. Customer is the one to who are results of solving intended and the one benefiting from the system. Analysis is to find the one whom and how will be influenced by resolving the problem; **A – Actor** – Executor. Included here are any constituents that perform activities within the system and from activities of which is the system dependent; **T – Transformation process** – that reworks the system so that inputs become quality outputs; **W – World view** – General elements that act upon the system and influence it; **O – Owners** – System owners. Analysed are element that can start the system running or that can stop its running; **E – Environmental constraints** – Any elements of influence upon resulting quality of the system if they have connections with the environment within which is the system to be functioning.

THE TRIZ METHOD – Globally used TRIZ acronym derives from the Russian (теория решения изобретательских задач, *teoriya resheniya izobretatelskikh zadatch*) and means “theory of resolving patent assignments”. It was developed based on regularities in developing, determined by studies of tens of thousands patent files with the objective to find out what is common in them, and from the abstraction to derive generally usable theory for resolving research assignments to support engineering creativity. **TRIZ is based on two principles:** *Technical system are always developed through overcoming a technical or physical conflict; Formation and development of technical systems proceeds in harmony with general technology development trends.* **TRIZ methodology consists of two parts:** **Functional cost analysis (FNA)**, which helps to answer the question “what?” to improve and “why?”. Well thought-over answers to these questions are helpful at precise formulating the assignment – prerequisite of rational solution; **Inventive assignments resolving algorithm (ARIZ)**, which suggests to the solver how to **eliminate** – identify the problem and how to resolve technical and physical conflicts.

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