

INNOVATION PROCESS MODELLING

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ABSTRACT: *Modelling phenomena in accordance with the structural approach enables one to simplify the observed relations and to present the classification grounds. An example may be a model of organisational structure identifying the logical relations between particular units and presenting the division of authority, work.*

KEY WORDS: *innovation; modelling; economic development.*

JEL CLASSIFICATION: *O31; O33.*

1. INTRODUCTION

The competitive advantage is the result of full adaptation actions for the changing demands of external and internal environments. It may be assumed that the process of shaping the basic success factors is determined by corporate activity in research and development, production, distribution and customer service. Integration of these actions demands constant market analyses as well as flexibility and organisational efficiency.

The process of constant change is the success factor in reaching the desired speed of products, processes and organisations development and thus in improving corporate potential (technical, organizational, informational, economic and social). Modelling phenomena in accordance with the structural approach enables one to simplify the observed relations and to present the classification grounds. An example may be a model of organisational structure identifying the logical relations between particular units and presenting the division of authority, work, etc.

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Functional modelling is widely applied in organisation and management as it offers the possibility to present phenomena in a way facilitating their evaluation on the basis of the data introduced to the model.

2. INNOVATION PROCESS

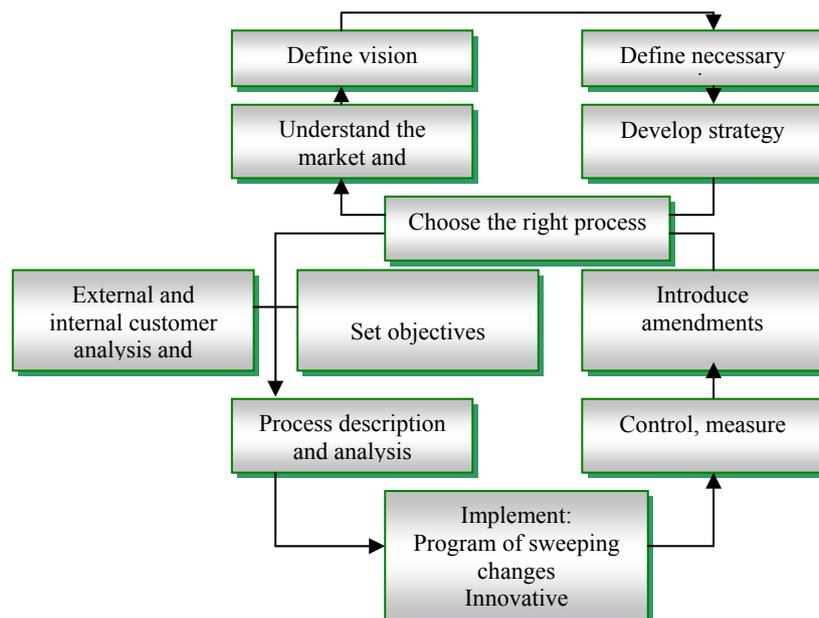
The problem of technological innovations has not been considered a priority by the classic theorists (Okoń-Horodyńska, 2002, pp.37-38). Due to the fact, no special importance is ascribed to the innovation development theory, in spite of the fact that Smith, Ricardo, Marks, Marshall, Keyns and Solow are almost unanimous, stating that long-term efficiency growth is inextricably related with introduction and diffusion of technological and organisational innovations. Joseph Schumpeter has stressed the role of innovation by pointing to the special interdependence between economic development and innovation development observed in the process of qualitative and quantitative application of innovations in business practice. However, the neoclassical theory does not identify any special role of innovation development, as it focuses on removing market imperfections and return of price and wage flexibility (Okoń-Horodyńska, 2002, p.39). Subsequent development of institutionalism has resulted in research on the existence, power and character of the correlation between economic development and innovation development. Interest in the process of learning in the light of economic results has changed the perception of the role of innovation. This approach has enabled deep understanding of the sources and determinants of technological changes, thus enriching the classical approach focused on the impact of technology on economy (Okoń-Horodyńska, 2002, p.41). Since that time, innovations have been considered to have major importance on socio – economic development. Researchers are now of the opinion that economy development does not depend on material, capital or human resources but mostly on modern technologies (Sollov, 1988, p.315).

Nowadays, research and development lay at the basis of economic power and social welfare (Mujżel, 1997, p.234). Innovative activity, especially in the field of goods and technology, may be considered a must in the global market conditions. Increased instability of the external environment influences the number and frequency of scientific and technical discoveries.

Moreover, innovation is considered a special business tool, applied in order to introduce new business solutions or new services (Durlík, 1998b, p.16).

Today, innovation is understood as: introduction of new products or improvement of the already offered ones; introduction of new implementation methods or improvement of business processes (primary, auxiliary and management); introduction or improvement of a production system, including the production and management subsystems; introduction of a new organisational structure or improvement of the already existing one, with special stress put on hierarchical relations and dependencies in the sphere of information, competence, responsibility and decisions; introduction of new organisational and management culture or improving the already existing one.

It is commonly believed that the character and intensity of the process of implementing innovations in the field of goods, processes or organisational structure depend on both corporate research and development initiatives and on transfer of technology and know-how from the external environment of the particular organisation. The complexity of business processes, focused primarily on managing knowledge, information, technology, staff, finance and marketing, results in the fact that contemporary companies notice the necessity to transform the present business priority sectors (Figure 1).



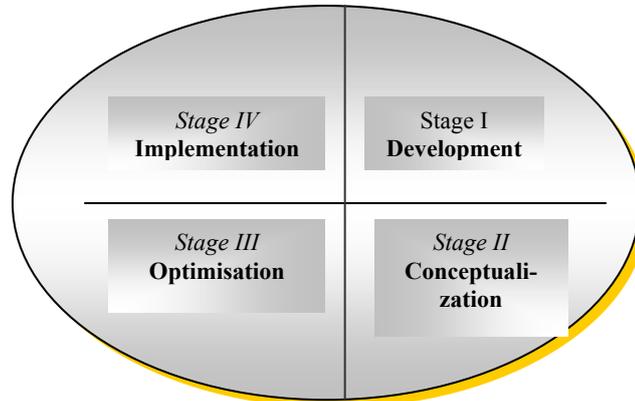
Source: Adair Ch.B., Murray B.A., *Breakthrough process redesign: new pathways to customer value*, Wydawnictwo Naukowe PWN, Warszawa 2002, p.40

Figure 1. Process facilitation model

One may thus state that management, including change management, applying the total organisational (social, material and financial) potential is the basic development paradigm. Customer value is conditioned by the synergy of process complexity and speed of innovative changes. Thorough reconstruction of processes aiming at restructuring an organisation may be achieved thanks to the application of the process approach and focus on continuous innovation introduction. One-time change aimed at the introduction of a new concept in the process of organisation management is frequently not sufficient to reach the desired objectives and implement strategic goals of a company of the future. Special importance is ascribed to the ability to identify the main processes - *megaprocesses*, taking into account resource limitations and reorganisation possibilities.

It is most frequently observed that changes aimed at development or innovation should prevail in a well-managed enterprise. Innovation introduction is

identified with the process of generating new solutions, conceptualization of projects, their optimisation and implementation (Figure 2). The basic objective of actions undertaken in this respect is better organisation and efficiency of an organisation, especially in the sphere of market service (Penc, 1999).



Source: Basadur M., *The Power of Innovation. How to Make Innovation a Way of Life and Put Creative Solutions to Work*, Pitman Publishing, 1995, p.34

Figure 2. Stages of innovation development

Complex approach to innovativeness enables one to compare innovative activity to the search for innovative ideas and solutions covering a complex process originating in research and finding its end in complete implementation of the particular innovation (Jasiński, 1992).

3. MODELLING OF INNOVATION PROCESS

Developmental cycle of an innovation, especially its scope, time and efficiency in reaching corporate goals influences directly not only the degree of innovativeness of the goods produced or services rendered but also of the whole company. Contemporary technological progress results in shortening development cycles and thus faster implementation of innovative solutions into business practice.

From the point of view of retrospective analysis, the character of innovation processes has changed considerably, starting from the linear model up to network integration approach. There are five basic generations of innovation process models (Table 1).

In case of the four generations, the innovation process took the form of subsequent linear stages (Generation I / II). In Generation III, interactive relations between different factors (including feedback) were identified. The fourth Generation of the innovation process is a parallel model, taking into account the importance of key suppliers, customers and numerous interdependencies. "For most of the 20th century, the 'closed innovation' model worked well – internal R&D focus, product innovation orientation, self-reliance, tight control and generation of own ideas to develop, manufacture, market, distribute and service new products (Davenport, et al., 2006,

p.131). Another, fifth generation of the innovation process is characterised by erosion of the “closed innovation” phenomenon. Networks are created, tests and experiments are very popular in the sphere of new technological and organisational solutions.

Table 1. Five generation of innovation process models

Generation		Key features
I / II	1960's +	simple linear models – need pull, technology push
III	1970's +	coupling model, recognizing interaction between different elements and feedback loops between them
IV	1990's +	parallel model, integration within the firm, upstream with key suppliers and downstream with demanding and active customers, emphasis on linkages and alliances
V	2000 +	systems integration and extensive networking, flexible and customized response, continuous experimentation and testing

Source: Davenport T.H., Leibold M., Voelpel S., *Strategic Management in the Innovation Economy. Strategy Approaches and Tools for Dynamic Innovation Capabilities*, WILEY, Germany 2006, p.131

A model is commonly defined as a graphical, mathematic or physical representation of a particular phenomenon or action. In case of organisation and management, a model is a logical construct playing an instrumental role in organisation theory and practice. There may be two approaches distinguished: a structural approach, in which a model is defined as a construct reflecting the real object with the use of abstraction and a functional approach, in which a model is a construct substituting the real, original object in cognitive and empirical operations (Jerzak, 1994, p.140).

Modelling phenomena in accordance with the structural approach enables one to simplify the observed relations and to present the classification grounds. An example may be a model of organisational structure identifying the logical relations between particular units and presenting the division of authority, work, etc.

Functional modelling is widely applied in organisation and management as it offers the possibility to present phenomena in a way facilitating their evaluation on the basis of the data introduced to the model.

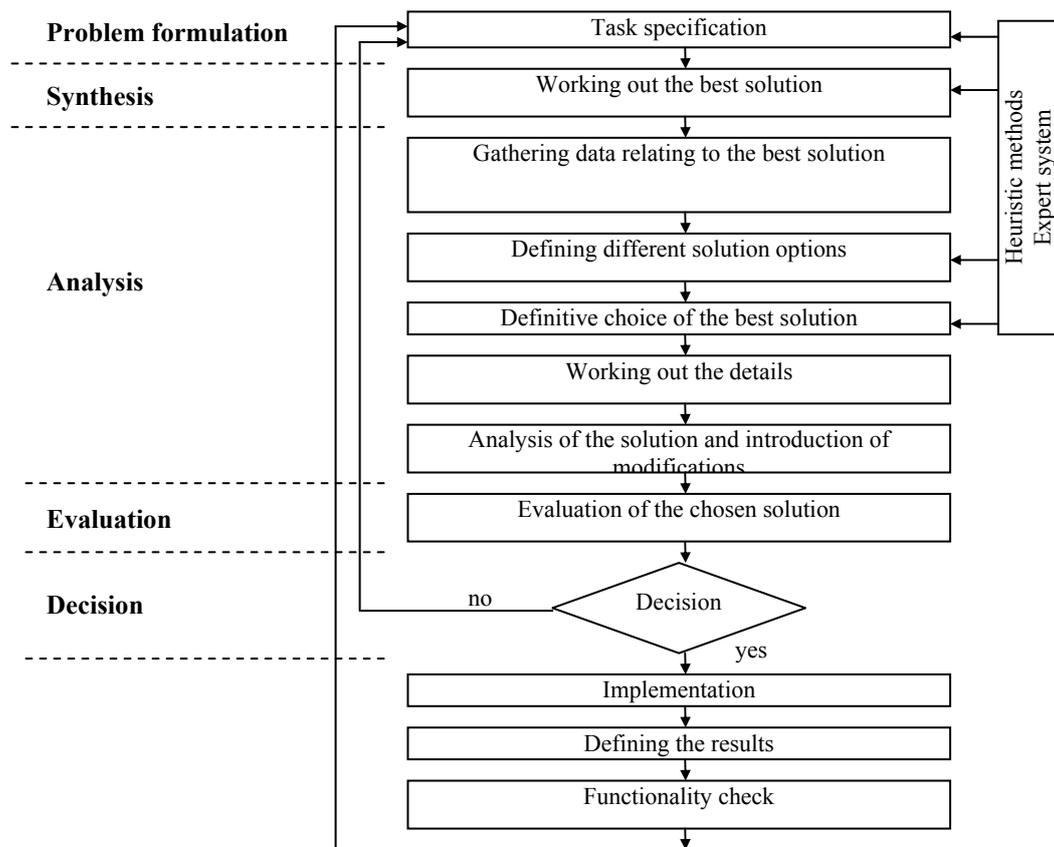
The degree of materialisation of the phenomena presented by a model, understood as a degree to which it reflects reality is most frequently dependent on the character and complexity of the described phenomenon and is a resultant of demands and competences of business entities.

In organisation and management processes, modelling often takes the form of a research procedure characterised by various types of methodology of study. The following models are frequently enumerated among the discussed approaches: G. Nadler's models (Fig. 3), models based on Altszuler's deduction and models developed on the basis of the D. Buschardt's block method.

G. Nadler's method of ideal concept, identical with the IDEALS (Ideal Design of Effective and Logical Systems) concept consists in (Jerzak, 1994, p.141): considering the designed (improved) object as a system whose constituents are: system functions: input and output, sequence of steps between input and output, system

environment, physical catalysts and human beings; application of a design procedure consisting in the search for the ideal solution and idea materialisation during the implementation stage; dependence of the design procedure on the people involved in the process.

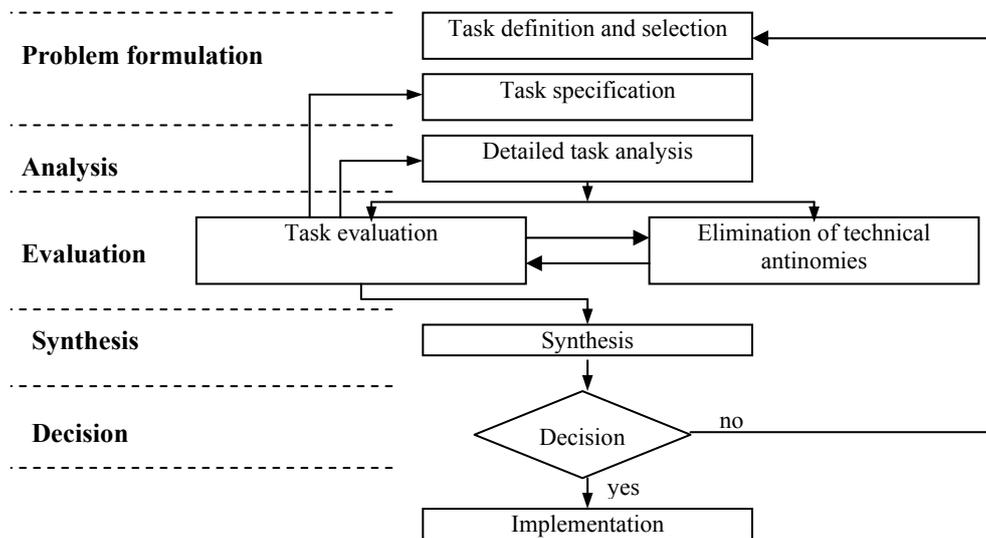
This approach necessitates the adoption of a prognostic strategy in the process of problem solving. The concept of search for the ideal is primarily focused on the synthesis of the best solution, working out the details of the one to be implemented and search for possible implementation problems (Figure 3).



Source: Durlik I., *Restructuring Business Processes. Reengineering, Theory and Practice*, Agencja Wydawnicza Placet, Warszawa 1998, p. 96.

Figure 3. Nadler' algorithm (prognostic problem solving method)

The process of modelling based on the Altszuler's concept approach identifies the necessity of problem definition. According to the above discussed procedure, a problem is identified and working hypotheses concerning its solution possibilities are tested. The Altszuler's implementation procedure covers the following stages (Fig. 4): problem formulation, search for potential solutions, evaluation of particular options, solution selection, and implementation decision.



Source: Durlik I., *Restructuring Business Processes. Reengineering, Theory and Practice*, Agencja Wydawnicza Placet, Warszawa 1998, p. 95.

Figure 4. Altszuler's invention algorithm (diagnostic method of problem solving)

D. Buschardt's organisation method consists in the following stages (Jerzak, 1994, pp.142-143): arbitrary isolation of model subsystems and definition of relations between them; definition of tasks performed by subsystems and their local objectives; definition of agendas responsible for the implementation of particular tasks; graphic design of the model achieved by drafting a scheme of the designed subsystem elements; verification of the model's internal compatibility with regard to e.g. occurrence of all necessary blocks, supplies and carriers of information, solution correctness, etc.; definition of the aspects differing the designed model from the present state; practical implementation and verification.

Complexity and variety of problems observed in enterprises, necessitate frequent application of prognostic methods of their solution. The demands of competitive markets and the possibilities offered by modern information technology necessitate transformations of the already existing structures and procedures. Due to the fact, one of the transformation option seems to be the application of methods consisting in creating ideal solutions.

4. SUMMARY

Theoretical studies on innovations confirm the interest in the problem of innovative activity both among theorists and practitioners of organisation and management sciences. Comparative approach to the innovation theory in classicism, neoclassicism and institutionalism may be the basis for considerations on the importance of innovative activity in the contemporary global economy. Implementation of organisational innovations conditions better coordination of actions

undertaken by different elements of the organisational structure and is thus a factor facilitating efficient management. In contemporary business practice change is most frequently observed in the sphere of goods, processes, systems, organisational structures and recently in organisational culture and social capital. The question of innovation process modelling in practical business activities is important scientific challenge.

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