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PHYSICAL AND TECHNICAL ENERGY PROBLEMS

INNOVATION RISK MANAGEMENT IN THE RATIONAL ENERGY USE (Part 2)

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The paper (written in two parts) is a continuation in the series of works devoted to the acute problems of risk management in various areas associated with energy and environment conservation. While in Part 1 the authors developed general conceptions of risk management as related to the rational energy use, Part 2 presents a closer examination of specific problems arising in this sphere when innovations are involved.

The relevant methodical approaches have mostly been elaborated at the International Center for Energy and Environmental Policy (ICEEP).

1. INTRODUCTION

In developing the general conceptions of risk management in the scope of rational energy use, we proceeded from the fact that the energy conservation problems are closely linked to the realisation of concrete aims of concrete socially-economic entities. The world's scale overpopulation and massive migration, the civilisation disproportions, etc. − all these factors have resulted in a protracted crisis which, in turn, results in an enhanced environment degradation, threats of climate changes and shortage of energy for the necessary economic development.

In this situation, the relevant management under crisis conditions implies the capability of dealing with uncertainties and risk. Therefore, risk management has become of crucial importance, especially as concerns the innovation sphere (preparation and realisation of innovations, etc.).

2. BASIC NOTIONS OF THE INNOVATION MANAGEMENT

According to the research into the risk management in the scope of energy use (see, e.g. [5, 30]), the innovation management appeared as the instrument for considering the implications stemming from parameter deviations in a concrete process and achieving its stable conditions.

The basic idea underlying management of the kind is that innovations not only participate in the formation of a proper vision but also in its economical realisation, and therefore, are often used for shaping the conception "invention" in an idea-creation process. Consequently, the innovation is to be treated as realisation of an invention whose specific qualities are:

- "newness", which means the degree of deviation from a routine manner of realising a concrete process,
- uncertainty − being an inseparable result of the newness,
- occurrence of conflicts, since newness meets "difficulties" in realising a new product or service from the so-called "routinists".

Therefore, in the analysis of a phenomenon connected with introduction of newness (innovation) into a concrete process we distinguish:

- subjective innovation (newness for the innovator),
- objective innovation (what is new?),
- innovation efficiency (the degree of newness).

In the sphere of the rational energy consumption the most important is efficiency of innovations.

Also, the aims of innovations should be clearly defined, the following included:

- to give more attention to clients' wishes concerning new products or services (with respect to those currently realised),
- to increase dimensions of the technological innovation in a new product or service with respect to the degree of existing technological newness for actually realised products or services.

As a result, two alternative types of behaviour have become common as to realisation of a concrete innovation:

- technology-related activities:
  fundamental research → development → realisation → marketing → sale
- market-related activities:
  client needs → development → realisation → sale

A commonly accepted definition for innovation is as follows [15, 30].

The innovation is a process whose basic elements are:

method of idea generation →idea evaluation and acceptance →idea realisation

Therefore, of great importance becomes appropriate modelling of this process, especially in identification and valuation of the uncertainty sources [15, 22, 24–26].

In modelling of the kind, it should be taken into account that each conception or idea of a concrete innovation has specific quality resulted from local implications.

As a result, the necessity exists for valuation of the relative importance of each potential local implication as well as its surroundings, with parameters and couplings needed for keeping the quality of a real process of the kind (production or service) [6, 12, 27, 30].

In this connection, of importance are the methods helpful for:

- development of employee creativity, which would result in a steeply increasing number of new conceptions and ideas, and

- gaining knowledge for efficient application of conceptions and ideas in the economic reality.

Unfortunately, still existing at the present time is non-systematic thinking (which means non-network thinking); instead, widely spread up to now are deterministic descriptions of concrete systems (processes), ignoring the stochastic and fuzzy parameters & couplings (even implications from commonly existing uncertainty sources) often met in reality [12, 27].

As has been stressed in Part 1 of the work, in all analyses of innovation processes we should take into account (in the most aggregated form) the time functions of discussed process elements:

- technological materials,
- technical materials,
- energy carriers,
- information needed for the process as well as for the future user,
- appropriately trained staff,
- environment pollution and uncertainty of its sources.

In the preparation phase of a concrete innovation it is necessary to consider the following activities:

- definition of a concrete process (system) structure, in which the concrete innovation and the structure of appropriate energy using sub-process will be realised,
- elaboration of the preliminary assumptions in order to prepare a realisation project for the discussed innovation,
- preparation of the realisation project for the discussed innovation in the following scope:
  - preparation (accompanying) work:
    - inside the process in which the innovation is realised,
    - in surroundings of the process;
  - realisation work:
    - by own services,
    - by external services;
  - appropriate measures, after completion of the discussed innovation, for defining:
    - innovation effects,
    - security conditions for the personnel attending to the innovation,
  - preparation of a realisation timescale as referred to:
    - preparation works,
    - realisation works,
    - measures after completion of the works,
    - material, machines and equipment supply,
    - personnel (appropriately qualified) for attending to the innovation,
    - financial measures.

All the elements listed are intended for shaping the basic notions of the innovation risk management.

3. DETAILED ANALYSIS OF SOME PROBLEMS ASSOCIATED WITH INNOVATION RISK MANAGEMENT

At the beginning of search for an appropriate innovation model it is necessary to carry out a detailed analysis of an economic entity's aims (often called over-process of the innovation discussed), with a special attention given to [4, 24, 27]:

- methods for realising a concrete activity;
- characteristic of the object on which a concrete activity is realised;
- decision (relative importance) on or realisation of a concrete activity (degrees);
- realisation place and its surroundings;
- phases of realising a concrete activity (planning, realisation and control);
- dynamic problems, especially in the continuous and periodical phases;
- equipment needed for realisation of concrete activity tools.

Based on the knowledge of the mentioned problems it is possible to formulate the tasks for a concrete economic entity through aggregation of the partial analyses performed.

As a result, the possibility is raised for creation of an organisational structure and its functions as well as of the related objects and dynamics of their changes [24–27].

In the management of dynamic problems we should take into account conflicts arising between the innovation management and the risk management (since decrease in risk decreases chances) as related to a concrete economic entity.

Therefore, in the tension field between the stabilisation and the elasticity, it is impossible to expect that there will be an absolutely reliable method but instead rather a cluster of methods that would allow the scope of stable and possible activities to be described.

This means that such discrepancies are to be analysed via the balance of their effects [15–19, 24, 28].

Among the tasks of innovation management is systematisation of the mentioned problems through definition of the process that would promote concrete innovations with the highest probability.

All the said above about innovations stresses that it is difficult to describe the innovation management activities structurally, since it is necessary to take into account essential and very diversified couplings in all phases of a concrete innovation: the selection of ideas, the preparation of realisation, and the realisation as such.

This is important because up to now in planning the development of a concrete enterprise only "routine" problems have been taken into account, whereas the fact that innovations impart dynamism to the development processes of enterprises is often ignored.

Meanwhile, the research into the innovation management tries to analyse the implications of such a simplified approach, which "produces" additional uncertainty sources.

The relevant analysis is to take into account the common attitude to uncertainty sources in general, and especially to those resulted from the development dynamics of a concrete enterprise.

Therefore, to raise the importance of the issue, it is necessary to create closer links between both the management kinds: those of the innovation and risk as related to the whole cluster of risk problems of a concrete enterprise [2, 3, 5, 6, 20, 21, 29].

In the existing enterprising practice in the so-called stable realisation phase of enterprise aims the risk management is often limited only to uncertainty sources.

Meanwhile, the risk management development in general illustrates − to ever increasing extent − the necessity to consider not only the sources of risk from dynamic phenomena along with other deterministic fluctuations, but also those from such dynamic phenomena as changes and fluctuations having probabilistic and fuzzy character.

Such necessity exists also in relation to the implications from non-knowledge in a concrete economic process (including implications from its surroundings).

4. INNOVATION RISK MANAGEMENT IN VIEW OF RATIONAL ENERGY CONSUMPTION

The innovations, as considered in the scope of rational energy consumption, are directed to achieving specific and partial aims of an enterprise, with the main one being the most efficient use of energy carriers it has at disposal.

As concerns specific aims, the fact should be taken into account that innovations related to the rational energy use can produce not only energy gain, but also other effects (e.g. impact on the product output, saving of technical or technological material, decrease in the transport congestion and in the environmental pollution, etc.); therefore, it is necessary to estimate its economic efficiency [22, 25, 30].

One more specific feature of innovation management is the necessity to take into account the time functions of energy carrier streams, which call for innovations of its own.

The majority of innovations related to the rational energy consumption are dependent on the external supply and the activity of other enterprises (sometimes those from foreign countries) [3, 8, 15, 17, 21, 30]. Therefore, it is necessary to take into account the most probable sources of risk for a concrete innovation (also in foreign countries).

Among specific innovations belonging to the scope of rational energy consumption are also exchange of energy carriers and their conversion.

Choice of the appropriate innovation for rationalising the energy consumption in a concrete process needs that there be analysed other potential innovations in this scope so that it is possible to find the most efficient (optimal) solution.

For realising a good choice, the knowledge (in relation to a concrete economic entity) is needed on:

- potential of rational energy consumption, which means possibility to achieve energy saving and other effects by considering implications of the basic couplings − both internal and external,

- financial measures that are indispensable for realisation of potential activities in the scope of rational energy consumption.

To summarise, it should be stressed that so far the methodical approach to the risk management problems in the sphere of rational energy use has been ignored because of:

- a common practice to resort to numerous simplifications at modelling the real processes and phenomena,
- poor knowledge of the methods that would allow appropriate (i.e. of reduced complexity) modelling of real processes and phenomena,
- rarely used sustained and efficient improvement of the processes and, similarly, of the before mentioned risk management.

The causes of such an arrested development of methodical approaches in the mentioned sphere in full measure relate to the problems of innovation risk management.

5. INNOVATION RISK MANAGEMENT OF THE PROCESSES USING PRIMARY ENERGY

The discussed development tendencies have caused noticeable increase in importance of the process management, the risk management, and management of the related changes, especially in the sphere of innovation activities [9, 12, 30, 31]. As a result, also in the scope of rational energy use it is advisable to employ up-to-date methodical approaches to management of the kind.

This particularly refers to rationalisation of the energy using processes, which in a synthetic manner can be described as follows.

5.1. Rationalisation of the energy use resulted from:

5.1.1. Improvement of exploitation as related to:

- technological installations,
- heating installations based on: electricity and fuels (solid, liquid, gaseous, steam, warm water, etc.),
- light (individually used, jointly used, of general use, etc.),
- telecommunication installations,
- computer technique,
- consumption of drinking water and industrial water,
- sewage installations.

5.1.2. Improvement of energy equipment efficiency:

- furnaces and kilns,
- electric motors,
- transformers,
- pumps,
- ventilators,
- compressors,
- energy nets (sewage, aqueous, gaseous, liquid, electrical, telecommunication).

5.1.3. Improvement of organisational efficiency:

- operation of equipment,
- technological,

- accessorial (recondition, energy related, environmental, automatics, informatics, social issues)
- transport (internal, external).

5.1.4. Improvement of the process continuity (less interruptions):
- planned,
- not planned,
- resulting from changes in the process organisation, in the cooperation with sub-performers and clients.

5.1.5. Improvement of the energy using process management related to:
- employee team,
- production and service processes,
- enterprises,
- external cooperation processes.

5.1.6. Improvement of industrial branch efficiency at the level of:
- towns and communities,
- regions,
- country.

5.2. Rationalisation of the energy use through introduction of new energy-efficient production and service technologies:
5.2.1. modernisation of the existing processes,
5.2.2. building of new objects.

5.3. Rationalisation of the energy use through structural changes in economies as to:
5.3.1. production,
5.3.2. services.

5.4. Rationalisation of the energy use through structural changes of the energy carriers used.

Each of the above mentioned energy using elements has certain specific attributes resulted from the local conditions. Therefore, as concerns innovations related to the rational energy use under constant control should the sensitivity of a concrete innovation to the influence of these attributes and resulting new risk sources for a discussed process [24, 26, 27, 30, 31].

Currently, ever increasing number of enterprises are doing permanent and complex risk management research, taking into account also the implications of local attributes.

Advisable (even necessary) is: to organise at all enterprises competent teams for managing:
- innovations on the rational energy use,
- relevant risk.

The research in this scope (see, e.g. [1, 9, 12, 17, 18, 27]) provides proofs that the existing in reality risk sources hinder to a significant degree the decision-making processes in all spheres of our life (which fact is illustrated by the popular statement: one is certain that all is uncertain).

Nowadays, the following issues are acquiring ever increasing importance − also as related to creative activities:
- experience gained from similar problems realised by other institutions or persons,

- confidence in appropriate institutions (persons), especially if they possess reputation [3].

Possession of reputation gives the certainty that an appropriate institution (a person) has realised and is still realising distinguished and stable professional attainments in a definite scope [3, 31, 34, 37], and therefore is helpful in making choices (e.g. the innovation performer and the co-operator of a concrete innovation) and preventing formation of new risk sources.

Recently, it has been also possible to observe that potential clients are ready to pay more for realisation of a set task if the performer possesses good reputation (which is also properly remunerated in the stock-market). Remarkable in this scope is therefore:

- on the one hand, to acquire good reputation is possible by demonstrating unusual and constant attainments in a concrete field and during a relatively long time;
- on the other hand, the risk of reputation loss is great − sometimes only one published example of deviated behaviour could result in the loss of reputation.

For this reason, socially-economic entities having a proper reputation organise a special team (often in co-operation with a team working on "early warning' before entering in a risk situation or with a "risk controlling" team), whose aim is prevention of the mentioned above situation.

Such a specially organised team should become (in a very short time) responsible for reduction in still inflicted damages.

To summarise, it should be stressed once more that already now there exist enterprises (also persons) having reputation in the scope of rational energy use problems (e.g. efficient realisation of concrete innovation, guidance of research, cooperation with research institutions, realisation of creative teams, etc.).

6. INNOVATION RISK IN THE POLICY OF RATIONAL ENERGY USE

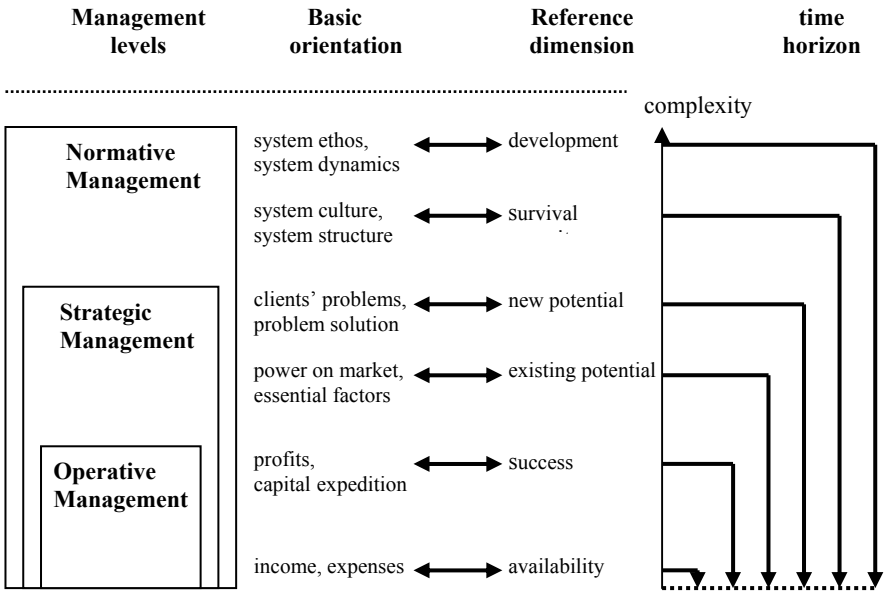
In modern management systems (processes) three logical management levels are distinguished [12, 27, 30] (Fig. 1):

1. operative management,
2. strategic management,
3. normative (regulation) management,

which are referred to as progressive time-horizons whose aims are:

- achievement of production and service success,
- possession of financial liquidity,
- identification of the current innovation potential,
- estimation of new success potential,
- development of enterprises (socially-economic entities),
- assurance of survival ability for a concrete enterprise (socially-economic entity).

Therefore, important in the management of rational energy use innovations are also appropriate regulations and standards as well as principles of the governmental policy where the rational energy use issues should be mandatory.



Source: [20]

Fig.1. Reference values and basic reorientations at three logical levels of management.

Such regulations and standards are elements of normative management at the levels of government, regions, towns and enterprises, with the influence characterised by the greatest time-horizons (see, e.g. [4, 13, 20–27, 42].

The research done in the framework of European UNDP/UNIDO project "Energy Conservation in Industry" has stressed that the scope of the rational energy use policy (or the energy conservation policy) should contain the following issues:

- organisation of central and accessory institutions responsible for the rational energy use and definition of their competence,
- provision of prognoses on:
  - probable development of the energy carrier consumption,
  - potential of the rational energy use for a concrete country, region and town,
- provision of the conditions for acceptance of concrete rational energy use projects,
- defining financial support for preparation, realisation and dissemination of the investment and innovation projects on the rational energy use proposed by enterprises and other socially-economic entities,
- defining and developing pro-efficiency activities of the state in the scope of rational energy use by the following methods:
  - stimulation of the rational energy use by economic, organisational, management, controlling, and propagation measures,
  - basic or additional financing of scientific research on the rational energy use in the scope of appropriate basic (methodical) research, development research, operative research, etc., for revealing new creative activities,
  - organisation of appropriate bilateral foreign cooperation on the rational energy use with a foreign institution having reputation in the

discussed scope, by attracting appropriate international organisations and agreements, exchange of experts,

- organisation and management of appropriate institutions responsible for support of the rational energy use activities (especially innovative).

An expanded analysis of the issue is given in Fig. 2.

Prognosis	**Realization**	**Support**
Socially-economic development scenarios	**Executive basis of energy and environment conservation activities**	**Pro-efficient activities on energy and environment conservation**
Energy conservation potential: - energy: - existing, - of the future, - environment: - existing, - of the future	financial measures materials and equipments executive services	scientific research stimulation methods foreign co-operation institutional support
Foreign experience in: - state, - development energy and environment conservation activities		

Sources: [17, 21, 26].

Fig. 2. Scope of the energy conservation policy.

The mentioned research has also stressed the main actual problems resulted from:

- implications of newly arising diverse risk sources as related to the international policy of innovation risk management in the field of rational energy use,
- still existing sources of specific risk stemming from the conditions of post-transformation countries (the CEE countries) mainly associated with the following problems:
  - price policy on the fuel and other energy carriers,
  - restructuring of a country's economy,
  - state policy with respect to foreign countries,
  - unprecedented methodical impediments in these countries,
  - efficient use of other CEE countries' experience, and
  - those being subjects of planned future international research [12, 25, 26].

As concerns the rational energy use innovations, a very great diversity in this sphere is observed, which makes advisable to adopt also experience of other innovators, especially as related to the identification and valuation of the corresponding risk.

8. CONCLUSIONS

The conclusions to be inferred from the overview are as follows.

Of particular value is now becoming elaboration of efficient risk management methods at the international organisations dealing with innovations, which would take into account dynamic and sometimes chaotic behaviour of systems (processes) under the conditions of various deterministic, probabilistic, fuzzy and non-knowledge impediments, with involvement of the notions borrowed from other spheres.

The up-to-date innovation risk management approaches should take into consideration the following:

- sensitivity of a concrete innovation to the potential influence of internal factors (processes, enterprises) and external ones (appropriate surroundings),
- forecasts of appropriate systems' operation under real conditions for achieving the most adequate identification of potential risk sources that might be hidden in innovations, and of chances to create more innovations.

Therefore, especially as related to the CEE and developing countries, of essential importance is comparative research into the efficiency of innovations and their certainty degree. Such research is organised at the ICEEP (International Center of Energy and Environment Policy). It is aimed at the efficiency improvement of presented methodical problems, giving primary attention to the risk management efficiency in the scope of innovations.

Based on the research works carried out under the ICEEP supervision, world-scale regulations should be worked out which would be helpful in overcoming the global financial crisis. Of especial importance will be establishment of global duties as to organising the appropriate risk management in all the spheres of rational energy use, with particular emphasis on relevant innovations.

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ENERĢIJAS RACIONĀLAS IZMANTOŠANAS INOVATĪVA RISKA VADĪBA (2. daļa)

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K o p s a v i l k u m s

Raksts (sastāvošs no divām daļām) ir rakstu sērijas turpinājums, veltīts enerģijas un ekoloģijas saudzēšanas riska menedžmenta problēmām dažādās tās jomās.

Ja pirmajā daļā autori attīstīja vispārējo riska menedžmenta koncepciju saistītu ar enerģijas racionālu izmantošanu, 2. daļā atspoguļo specifisku problēmu analīzi jomās, kur inovācija darbojas.

Metodiskie pētījumi pamatā tiek attīstīti Centrālās un Austrumu Eiropas valstu Starptautiskā Enerģijas un ekoloģijas politikas centrā (ICEEP).

Balstoties uz pētījumiem, kas tiek veikti ICEEP vadībā pasaules mēroga menedžmenta regulēšanā, varētu palīdzēt pārvarēt globālo finansiālo krīzi. Svarīgi būtu veidot globālas organizācijas atbalstošas riska menedžmentam visās enerģijas racionālas izmantošanas jomās, sevišķi racionālas enerģijas izmantošanas jomās ar inovatīvām metodēm.

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