Revitalisation in control of business

Revitalizace v podnikovém řízení

J. Hron

Czech University of Life Sciences, Prague, Czech Republic

Abstract: This paper deals with the design of information architecture for the revitalisation of business processes. The proposal of a control system for a formalised decision-making process of revitalisation is in accordance with this information architecture. The entire methodology proposed relates to the application of consumer's value renewal of the product. Experts' standpoints are utilised in the procedural knowledge base which includes the information about the time sequence of starting and leaving some developmental activities. The product revitalisation control subsystem originates from this procedural knowledge base. The control subsystem converts this information into a binary format to enable detection of whether a consumer's quality lies below/above the reference value and at that the procedural knowledge base also receives this reference value. The control process is based on a synthesis of sequential (logical) function, the self-control mechanism of experts' decision-making (for the product value resumption regulation) is achieved via a reset-set (RS) flip-flop.

Key words: revitalisation, expert system, base of knowledge, product value, consumer's utility, control mechanism, set-reset flip-flop

Abstrakt: V tomto příspěvku je navržena architektura informací pro revitalizaci podnikových procesů, na kterou bezprostředně navazuje návrh řídícího systému pro formalizaci rozhodování o účelném časovém průběhu obnovovacích aktivit. Celá navržená metodika je prezentována na aplikaci regulace průběhu obnovy spotřebitelské hodnoty produktu. Expertní stanoviska jsou využita v bázi procedurálních znalostí o účelné časové sekvenci v zahajování a zanechávání určitých skupin vývojových aktivit. Z báze procedurálních znalostí následně čerpá řídící subsystém produktové revitalizace. Ten tyto znalosti převádí do binární formy ve smyslu zjišťování, zda-li určitá spotřebitelská kvalita leží pod/nad referenční hodnotovou hladinou – přitom kvantifikaci úrovně těchto referenčních hodnot poskytuje báze deklarovaných a procedurálních znalostí. K vytvoření řídících procedur je poté využito metodiky pro vytváření (syntézu) sekvenčních logických funkcí, vlastní řízení expertního rozhodování v rámci regulace produktové obnovy je realizováno prostřednictvím RS klopného obvodu.

Klíčová slova: revitalizace, expertní systém, báze znalostí, hodnota produktu, spotřebitelský užitek, řídící mechanismus, RS klopný obvod

INTRODUCTION AND PRESENTATION OF OBJECTIVE

This paper is closely related to the paper entitled "Diagnostics of Management and Organisational Systems", published in the Agrarian Perspectives 12/2006. The paper derives from the working and publication activities from the research project of the Ministry of Agriculture 1140/2. There were several themes solved and published in terms of this research project (besides those in the Agrarian Perspective scientific magazine). As the paper refers to some previous papers (it has even the same starting methodology as the paper Agrarian Perspectives 11/2006), I will take the liberty of briefly reviewing its background. The initial work was regarding the classification of agrarian entrepreneurs (represented by the paper "New economy and manager behaviour changes" Agric. Econ. 2004 (1)) in terms of the above-mentioned project, and the factor analysis influencing the generation of the business structures (represented by the paper "Strategy related factors of business entity structure and behaviour" Agric. Econ. 2004 (11)). The claims of the development of a new contemporary

Supported by the Ministry of Agriculture of the Czech Republic (Grant No. 1140/2).

process were implicit from that initial classification. These new processes concentrate on the optimisation of the structural parameters (analytical and set forms) – "The Organisational Equilibrium" Agric. Econ. 2006 (4)). At present control systems or managerial systems, it is necessary to consider a common attribute of a typical real system – although its output is not always reliably obtained. This was published in a paper regarding formalised organisational and control diagnostics – "Diagnostics of Management and Organisational Systems", Agric. Econ. 2006 (12) which was based on the aforementioned fact.

Inside a turbulent corporate environment, it is not possible to rigidly stay with old-tested structures and formalized procedures, no matter if it is concerned with managerial methods, data management or product configuration. It is only the companies, that are ready and able to receive and sequentially to implement organisational, cooperative and revitalisation processes at the right time, which have the chance to survive and successfully evolve (under fully competitive conditions). The revitalisation (recovery) processes are not the exclusive domain of the business activities. These processes are also applicable when renovating old houses (especially prefabricated apartment buildings), or in activities surrounding the regeneration of a landscape, and elsewhere. One example from the Czech Republic is the creation of a methodology to manage the river network according to world-class standards. This was done with the objective of renovating the retentive capability of the landscape (retentiveness of water), and also to reclaim the poor quality agricultural land by restoring the natural function of watercourses.

It is possible to divide the methods and forms of business performance revitalisation into two basic categories – according to the renewal needs level, or level of company crisis. The first category is represented by a flexible company, which has sufficient assets for making the changeover from an unprofitable condition. The second revitalisation category represents the company which has no chance to achieve profitability, because the debts are not covered by the value of the appropriate assets. Optimal bankruptcy processes are proposed for these "high-debts" companies in order to minimize financial loss.

Revitalisation processes usually start after a detailed analysis of the economic indicators of the company to be revitalised, and a preliminary analysis of the causes of poor business performance (low profitability). The revitalisation plan is based on the result of these analyses. The revitalisation plan concerns the list of sub-optimised procedures to achieve the efficient recovery transformation processes. The pre-requisite analysis is made by qualified specialists in economics and management, and also, ideally, specialists in other fields of science – according to the specific requirements.

There is an important aspect of the implementation of an efficiency revitalisation programme from the financial aspect. After implementation of the basic revitalisation activities (utilizing of assets and a debit reduction programme), a new business strategy is created – which includes elements to inhibit repetition of the situation. The methodology of the following text is based on a more abstracted basis than the financial point of view – this paper is based on the value point of view. The value point of view is less preventive and less measurable than the financial point of view, but it is more general, and so very suitable for making a methodology for product revivalism. At this point in the paper, it is necessary to note, that many existing managers have had an unpleasant association connected to solving of the liabilities (in terms of "dummy stockholder" or dummy "white horse", i.e.: the closing-down of a business because of bankruptcy). This managers' image is called out of low-culture of the surrounding entrepreneurial environment where some companies camouflage an illegal method – so-called "white horse" placement to statutory body of the companies.

The first objective of the paper is to contribute to the reclamation of the seriousness of entrepreneurial efficiency revitalisation perception of professionals. Nevertheless, the first objective can be achieved through the second objective of the paper: the expert system creation for control planning of renewal of product value. The motivation to make an assessment of the second objective has resulted from the fact that the preservation of entrepreneurial efficiency in an existing organisation is necessary to develop a competitive product, which can generate profits for a long time from the appropriate market segment.

METHODS AND PRESENTATION OF RESULTS

The term "innovation" is used universally for any change in the internal structure of an organisation, of a product or of an industrial production capacity (one author actually noted some negative changes (e.g. abrasive wear) for the innovation (see Valenta 2001). This author has carried out a diagnosis of the innovations in a style of innovation orders. These orders of innovation then form two set of innovations:

The first set of innovations is presented by analysing the current situation through a process of rationalisa-

tion, which (according to Valenta 2001) creates the following five positive levels of innovation:

0 Regeneration (renewal of some product's characteristics)
1 Change of amount – (it means: an increase of the industrial production capacity in order to cover an increasing demand for the quality of the product outputs),
2 Intensity (increased speed of operations),
3 Reorganisation (displacement of the operations),
4 Qualitative adaptation (technological improvements).

The second set of innovations are achieved by qualitative innovation (from the customer's aspect of utility of the offered product, qualitative innovation is connected to revitalisation of the competitive advantage of the product). The revitalisation of product competitive advantage covers four consequential levels:

5 Variety (product modernising by a change of one or several functions),
6 Generation (a change of all significant functions by using an old design concept),
7 Differentia – it means: a change of the design concept by using an original, authentic principle,
8 Generic difference (a change of the principle, on which the production conceptis is based).

Because it is necessary during the product life cycle to hold on the acceptable competitive advantage and marketability, it is necessary to react continuously to this continual obsolescence. It is not possible to implement both sets of innovation at the same time over the period of the product life cycle (it is caused by limited sources, but also by the disproportionate developmental and test costs compared with the product usefulness).

We have to specify when it is appropriate to concentrate an innovative potential on increasing the qualitative characteristics by using the original concept (focus on the first set of innovation levels) and when it is necessary to modify the concept for revitalising the competitive advantage of the product (concentration on factors of the second set of innovative levels). Nevertheless, it is necessary to concentrate attention on both sets of factors when the competitive advantage of the product is decreasing. This necessity of double-focus concentration is based on the fact that, for successful achievement of a definite level of innovations from the second set, we must achieve a definite level of innovations from the first set (innovations of the second set depend on the innovations of the first set). For example: the quality of an original concept forms the technological point of view, limits the innovated concept because production and technical documentation with the level of component unification of the product body represent a "zero-level" of the innovated conception.

An expert system design for control of revitalisation of the product value

The term "expert system" was used for the first time during the 1970's and 80's, as a result of knowledge that the quality of a particular system depends more on the knowledge qualities than the qualities of the control mechanism. The expert systems have been known as systems based on the unique knowledge takeover from experts - specialists. According to Feigenbaumen (Feigenbaum, McCorduck 1998), an expert system is the programme procedure simulating some decision-making activities of the expert for solving complex problems, and it uses a suitable cryptic and explicit form of special knowledge, which has been obtained from the expert(s) for achieving the same level of decision-making as the expert in a specific branch. This definition implies an important fact, so expert systems contrast from conventional programs (for scientific and engineering calculations) in character, architecture and method of data processing. It is therefore appropriate to show some fundamental attributes of these systems before we make a design of the expert system for the control of product value.

As in a conventional program, knowledge of specialist(s) is broken down into separate program instructions to determine the operating sequence, but in expert systems, the expert's knowledge is absolutely and explicitly expressed in the form of a "knowledge base". As well, a strategy of control of knowledge is also available in the knowledge base, i.e. a control mechanism. A strict separation between knowledge and control strategy of their exploitation is typical just for the architecture of expert systems.

This characteristic makes it possible to achieve a high level of re-application of the developed and tested control mechanism. The base of knowledge includes an expert's knowledge which is necessary for solving the defined decision-making problem.

The base holds a large amount of knowledge (from the most general to closely specific, from highly conformal to cleanly private – i.e., that the specialist should not be allowed to publish, and from exact to uncertain heuristics). The result of an empirical investigation provides us with the information that expert differences inform an average employee by

the range of special (or private) knowledge of their significant functions.

The basic and contemporary partition of expert systems (from the point of view of its' characteristics) is according (Mařík, Štěpánková 2003) to:

– an expert system for diagnosis;
– expert systems for planning;
– hybrid expert systems (inclusive of diagnostic and planning functions).

The reader can find an introduction to the expert system for diagnostics of some organisational disturbances in modern companies in literature (Hron 2006). In the following text, we will describe a design of the planning-expert system for the control of the product value revitalisation.

Organisational and knowledge subsystem for revitalisation of the product

According to Figure 1, a profitable product will be different from an unprofitable product by the size of its revitalisation cycle. An unprofitable product has its consumer's initial value too low, and is losing its competitive strength too quickly, therefore it will fall below the customer's limit of acceptance before the break-even point is reached .

We could also develop and produce the product, and sequentially handle a relevant segment market of the product, however, it is necessary to achieve some definite levels of initial quality and also to keep on its consumer's value within regulated limits. These limits are created by the initial level of consumer's quality and a minimum level of consumer's product value for demand above the point of stopping production. For it we can use the knowledge base and an estimation of the loss of competitive value over time.

It is obviously necessary to replace a functional yet out-of-date product by an improved product (includes fifth or higher innovative levels) to ensure the continual profitability.

It is advantageous to use the declarative represented knowledge integrated into the expert system for formalised control of such product revitalisation. The expert system would control the strategic management or the product manager to achieve a competitive advantage, thereby making control of the profitability of the product portfolio (via the procedural checks to innovative activities – to the qualitative adaptation and to the qualitative innovation). The organisation of the expert system for planning revitalisation is (in this case) based on engaging the declarative and procedurally represented knowledge to the common structure of the base of knowledge. Nevertheless, the declared knowledge must explain, what would be the cognition (understanding) or the derived, procedural knowledge then becomes less uncertain about the method of cognition (procedural knowledge is usually in the form of a rule).

The knowledge of organisation of the expert system for planning and product revitalisation control will influence the second distinguishing level – i.e. the component level of the system and its structure.

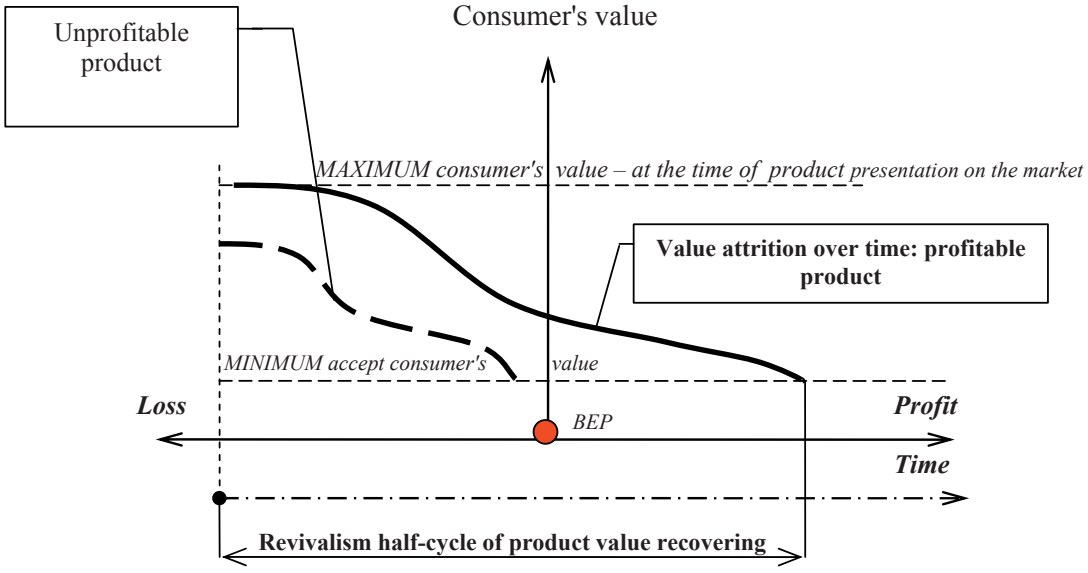

Figure 1. Process product value losing in the time of the revitalisation phase (half-cycle)

Base of the declared knowledge

We have two groups of notational activities I_1, I_2 which are initialised by two signals (stimuli) y_1, y_2, in order to maintain consumer's product values adequately during the revitalisation cycle.

The innovation activity I_1 indicates the processes which are necessary for covering of the qualitative adaptation (usually in this sequence: change of quantity, intensity, reorganisation, adaptation), innovation activity I_2 then covers the processes leading to realisation of the qualitative innovation (usually in this sequence: variation, generation, specific difference, generic difference).

Base of the procedural knowledge

- Both groups of the innovative I_1, I_2 activities have to be achieved concurrently, if the consumer's value decreases below the level of point *C*, which indicates a progressive reduction of the consumer's value of the product, incurred by product obsolescence (Figure 2).
- The group of innovative activities I_1 will be initiated by the reduction of the consumer's values below the level of point *B*, representing the inflexion point at the time of losing the consumer's values of the product.
- The group of innovative activities I_2 will be initiated by the reduction of the consumer's values below the level of point *C*, representing the moment of the next acceleration of consumer's values of the product degradation.
- The group of innovative activities I_1 will be finished if the consumer's value of the product reaches the level of point *A* – the maximum currently attainable consumer's values.
- The group of innovative activities I_2 will be finished if the consumer's value of the product reaches the level of point *B* (the level of point *B* then operates as an on/switch, switching off stimulation for activities I_2).

The inflexion point *B* represents the fact that after a specific time of identification with a new product, the scarcities of loading quality will quickly appear over time.

During this time, it is not profitable to make extensive changes to the quality of the product, it is better to wait until the *B* point of inflexion, where there will be the change of rate of the value attrition. After obtaining a full understanding of the loading weaknesses of the product, it is systematically possible to rationalise the production capacities, so that it is not very likely that we will get a significant problem with the product quality in the near future, or that we would have to reorganise the production capacity. A digressive process of the product value loss up to point *C* verifies this fact.

Point *C* represents the moment of the next increase of rate declining product value, there is already an adequate quality of implementation, but the concept of the product becomes out-of-date as compared to the latest knowledge about the developed product. An initialisation of activities I_1 is already done, because we have achieved the *B* point of inflexion. An initialisation of activities I_2 is here, therefore, we need

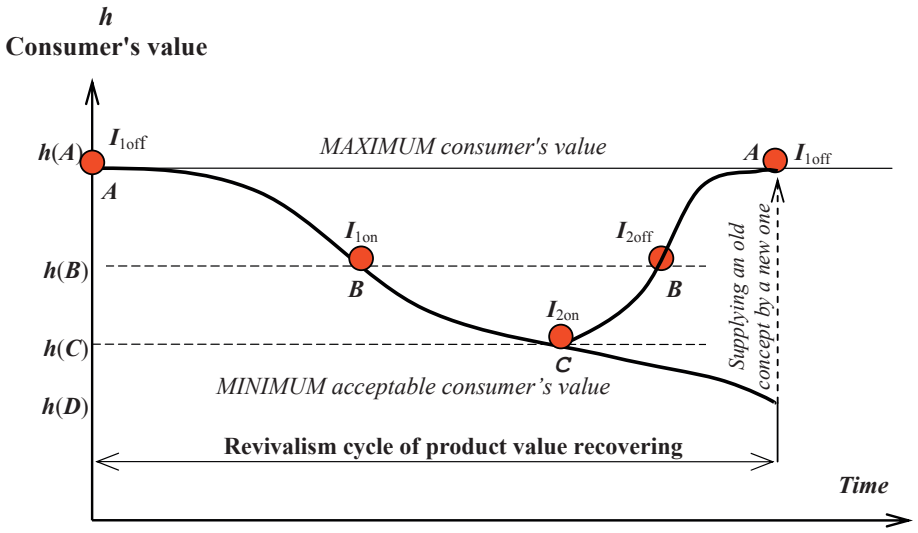

Figure 2. Organisation of the procedural knowledge about the structure of the revitalisation cycle

to develop a new concept even before achieving the low-limit of the consumer's utility. We have not, however, enough information to prevent the conceptual weaknesses before the complete time-verification of the weaknesses of the present concept.

Point A represents the shut-off contact for the group of activities I_1, then the differences, or even the generic differences of the product are possibly the only activities focused on qualitative innovations running on the adequate time (in this case one revitalisation cycle).

Because the quality of a new concept will not be criticised from only the point of view of level of sophistication, but also according to the levels of quality of the completed product, it is necessary to start improving the product before its appearance on the market. This time-moment is signalled by the switch-on/switch-off point B for the innovation activities I_2 (Figure 2).

Control subsystem of product revitalisation

If we know an organisation of the declared and procedural knowledge about the characteristics of the controlled object (here about the renewal of the consumer's product value), we can suggest the control system to it. In this case, we will utilise the methodology from an earlier paper "Diagnostics of Management and Organisational Systems" (Hron et al. 2006).

That diagnostic system (Hron et al. 2006) used the methodology based on the minimisation of the logical function in the all-combinatorial form. In the diagnostics formulated problem, the static formalised approach to solving a foundation is used, because in the case of malfunction of any definite system its activity will shut-down and we will separate it from some time-change of the influence of an active system.

In the case of the revitalisation cycle control, time is the input-variable, therefore the output value provides via combinational function can not be a static (time independent) relationship. Because the combination function operates with only the contemporary value of the inputs, no dynamic (in the time variable) characteristics of control can be affected, that is (of course) the characteristic of the control of the revitalisation cycle. We must therefore approach the control system in a different way.

Now it is necessary to equip the control system with a memory member, because the control signals depend on their inputs condition and also on the time influence (we need to consider the previous control condition). The control system can be considered to be analogous to the diagnostic system of the organisational disturbances, so we can base it on logical functions, but it is also necessary to make possible the implementation of several-defined connections between the inputs and their outputs. For this purpose, we can use the sequential functions as a standard functional unit – so-called: *set-reset flip-flop.* In the control unit, the input marked S (set) comes back (sets) the output equal to 1 and second input R (reset) vice versa cancels this output, therefore it has a deep-seated mark for S input as accessing (setting), and for R as erasing (resetting). A control output then has a memory function at $R = S = 0$, i.e. the control instruction stays at its last value.

The status of the user's value of the product provides us (according to Figure 2) with binary data in the form of measuring of the reference levels of the offered product consumer's value ($h(A)$, $h(B)$, $h(C)$, $h(D)$ – levels) where the values 0 and 1 mean:

$$A,B,C,D = \prec \begin{matrix} 0 \\ 1 \end{matrix} \succ \text{consumer's value} \prec$$

$$\prec \begin{matrix} h < h(A), \text{alternativ.}\, h(B), \text{alter.}\, h(C), \text{alter.}\, h(D) \\ h \geq h(A), \text{alternativ.}\, h(B), \text{alter.}\, h(C), \text{ alter.}\, h(D) \end{matrix}$$

The control stimuli y_1, y_2 for the innovation activities I_1, I_2 initiation will be achieved by binary measurements:

$$y_1, y_2 = \prec \begin{matrix} 0 \\ 1 \end{matrix} \succ \text{the concerned innovation} \quad I_1, I_2 \prec$$

$$, \prec \begin{matrix} \text{has not been proceeding in this time} \\ \text{has been proceeding in this time} \end{matrix}$$

Now we can summarise into the table of requirements the verbally described control of the revitalisation cycle of the product value (Figure 3). It is evident that the control of revitalisation has to use the sequential functions, because e.g.: in the second and in the sixth lines the inputs have the same combination, but the outputs for innovation control I_2 (i.e. control decisions y_2) *are not equivalent*.

If we express the output of the first group of innovation activities of the control system as a combinational function with a feedback, then it is necessary to express it as a function containing the four variables:

$$y_1 = f(A,B,C,y_{1P})$$

where y_{1P} is the output value delayed at one period of the control position.

By using the synthesis of the combinational function in the form "product of sum" we will get (from Figure 3):

info-inputs / situation	A	B	C	output command	
				y_1	y_2
1	0	0	0	1	1
2	0	0	1	1	1
3	0	1	1	1	0
4	1	1	1	0	0
5	0	1	1	0	0
6	0	0	1	1	0
7	0	0	0	1	1

R → 1 (row 2, y_2); R → 1 (row 3, y_1); S → 0 (row 5, y_1); S → 0 (row 6, y_2)

Figure 3. The requirements for the control system of renewal of the product value

$$y_1 = \left(\overline{A} + \overline{B} + \overline{C} + \overline{y_{1P}}\right) \times \left(A + \overline{B} + \overline{C} + y_{1P}\right) =$$
$$= \overline{B} + \overline{C} + A \times \overline{y_{1P}} + \overline{A} \times y_{1P}$$

We can compile the output combination function for activities y_1 analogous to y_2 activities. From the outputting "ones", we can make a combination function via "sum of product":

$$y_2 = \overline{A} \times \overline{B} \times \overline{C} + \overline{A} \times \overline{B} \times C \times y_{2P} = \overline{A} \times \overline{B} \times \left(\overline{C} + y_{2P}\right)$$

We can find the formulation set and reset functions on behalf of the qualitative innovation group y_2 according to the Figure 4:

$$s_2 = \overline{C}\,;\; r_2 = B$$

The diagram of realisation of the control system for product revitalisation (represented by Figure 4) provides us better understanding of the interactions between the inputs *A, B, C* and outputs y_1, y_2 and we can use this diagram for programming the expert

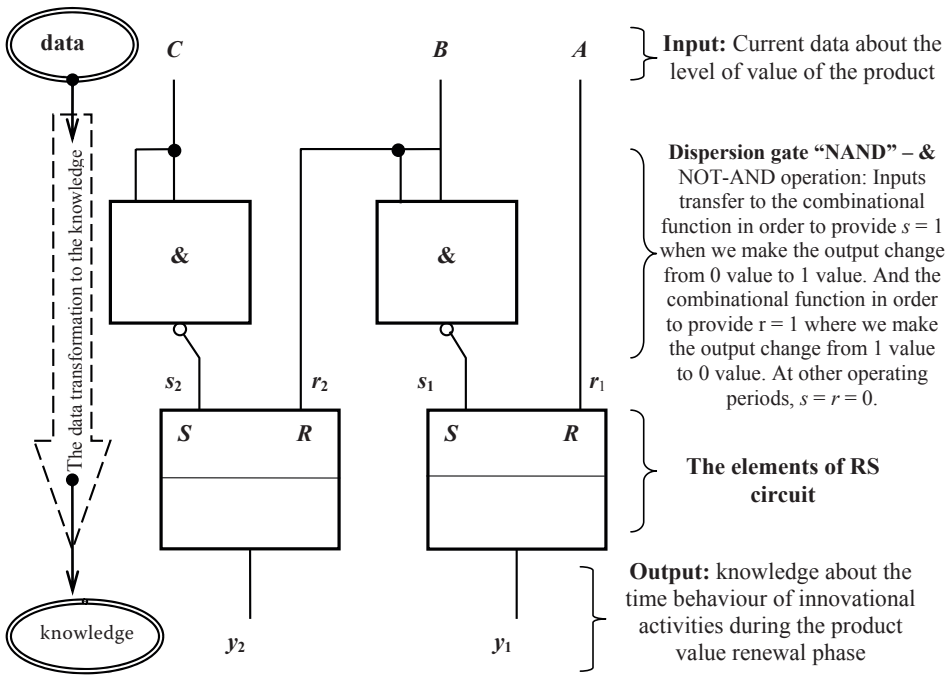

Figure 4. Control structure for decision-making formalisation during the revitalisation of product value

system for formalising decision making about innovative processes.

DISCUSSION – CONCLUSIONS

This paper deals with the design of an information architecture for revitalisation of business processes. The proposal of a control system for a formalized process of decision-making for revitalisation agrees with this information architecture. All the proposed methodology is presented to the application of consumer's value renewal of the product. The classification of some innovative activities (created by Valenta 2001) presents the basic element for creating the base of the declared knowledge. Experts' standpoints are utilised in the procedural knowledge base which includes information about the time sequence of starting and leaving some developmental activities. The product revitalisation control subsystem follows from this procedural knowledge base. The control subsystem converts this information into a binary form to enable detection of whether a consumer's quality lies below/above the reference value, and at that the procedural knowledge base also provides this reference value. The control procedure is based on a synthesis of a logical function, the self control mechanism of the experts' decision-making (for the product value resumption regulation) is achieved via an RS process (reset-set flip-flop).

From the previous introduction, it is evident that the control and organisational knowledge systems are informative compatible, also they can very closely cooperate and after their integration they will create valuable expert systems of the product renewal.

REFERENCES

Feigenbaum E.A., McCorduck P. (1988): The Rise of the Expert Copany. Times Book, London.

Hron J. (2006): Diagnostics of management and organisational systems. Agricultural Economics – Czech, 52 (12): 545–551.

Hron J., Lhotská B., Macák T. (2007): Kybernetika v řízení. Příklady a aplikace (Cybernetics in management. Examples and application). Vydavatelství ČZU, Praha; ISBN 978-80-213-1640-9.

Mařík V., Štěpánková O. (2003): Umělá inteligence (Artificial inteligence) (2). Academia, Praha; ISBN 80-200-0504-8.

Valenta F. (2001): Inovace v manažerské praxi (Innovation in managerial proffesion). Velryba, Praha; ISBN 80-7261-029-5.

Arrived on 31st October 2007

Contact address:

Jan Hron, Czech University of Life Sciences Prague, Kamýcká 129, 165 21 Prague-Suchdol, Czech Republic
tel.: +420 224 384 242, e-mail: hron@pef.czu.cz