Crisis Impact Simulation on Value Added Production in the Organizations

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Abstract: - Paper aim is the crisis situation impact investigation, simulation and modelling on Value Added production via the computerised assistance in the organizations of critical infrastructure especially. Every weighty crisis situation has an origin in the disruptive event or incident occurrence and always brings discontinuity of organization´s processes. Unexpected and sudden disruptive event of critical infrastructure organization will be tested in Czech Republic and European environments. The DYVELOP (Dynamic Vector Logistics of Processes) method is used for the modelling and mathematical relations expression of crisis situation impact analysis in dependence between real time and Value Added production. It provides the methodology for the functions and relationships investigation of business continuity management in operational coping of the crisis in the organizations. The results of this paper are in new introduction of feasible procedure for remedial and recovering processes of the business, according blazonry expressed crisis scenarios. They are able to identify problematic critical zones and functions, displaying critical interface among actors and other entities of crisis situations and in the conclusions; they are able to propose remedial processes, utilizing effective business continuity management. Regenerated organization´s Value Added is decisive indicator of crisis situations mitigation. This paper conclusive provides special use case, which is necessary for successful coping of the crisis. Uninterrupted and continuous processes bring fruitfulness for crisis management and they are good indicators and controlling actors of organizational continuity and its sustainable development advanced possibilities.

Key-Words: - crisis, organization, impact analysis, simulation, modelling, Value Added

1 Introduction

Simultaneous and future security situations need better methods for emergency planning & preparedness and for crisis situations investigation & modelling within the organizations of Czech or European critical infrastructure (further only Organizations). In European union context [1] the critical infrastructure is defined as the assets, systems and their sections, situated in EU member state that are important for a preservation of the most important social functions, for the health, security, economic and social conditions ensuring of the population, whose the disturbance or destruction would have weighty impact for member state in a consequence of these function´s malfunction.

Every crisis situation has an origin in the accident or incident occurrence, arising from relevant threats and perils of disruptive events in certain systems, processes, environments and circumstances of real Organization [2]. Its crisis management needs operational coping of crisis situation according crisis scenarios in advance prepared by Organization´s security unit, which is necessary participant on business continuity management. The forms, characteristics, behaviour and utilization of these crisis scenarios [3] have various qualities, depending on real Organization. These scenarios will be modelled by means of DYVELOP method (Dynamic Vector Logistics of Processes) complex figures, which will be named as a “blazons” [4] (“one picture is better than hundreds words…”). The blazons contain three types of modelled entities: Environments (ENV), Process Systems (PrS) and Cases. They serve to crisis scenario´s models, using investigative, analytic, evaluative, modelling and simulative tools and procedures. They show here that crisis situation must be generally modelled, operated and coped in continual threats/ peril life cycles. Uninterrupted continuity is good indicator and controlling actor of

Organization´s survival in their crisis towards sustainable development advanced possibilities. The continuity has several phases, formally classified as the cases. The continuity of these cases is a condition for the encompassment of disruptive event by efficient business continuity management finally. It brings new possibility for a displaying and exact evaluation of organizational security awareness. Special accent is put on computerised assistance for the both the crisis situation modelling and the situational estimation in real time as the first parameter of the blazons. Second parameter has information character as the detachedly ascertainable economic value in each Organization. Such an economic value is Value Added. On our next modelled and simulated blazons, the real time will flow from page top to the bottom. Here, the Value Added will be grown from the left to right side of the page on our next blazons. Controlling is generalized capability to have control over situational policy. Controlling actor is an executor of controlling functions.

2 Problem Formulation

The objectives of our current research work reflect a requirement for exact evaluation of Organization production abilities before, in and after crisis situation. The method of Mind Maps [5] are good for it and as a inspire source can be used the Unified Modelling Language [6] also. But they are not enough for complex and exact reflexion of full problem. Here is necessary to use DYVELOP method [4], using common and well known computer software MS Word: Power Point[MS], Excell[MS], SmartArt[MS] and Project[MS]. They are able to model and simulate the majority of the systems & processes of qualitative and quantitative research by means of mutual relations in simple record. The aim is successful coping of crisis situations.

2.1 Value Added for single product

The Fig.1 blazonry displays the production scene for ***Case of the Value Added (VA) producing in the „Funnel“.*** This use case includes meta processor **PrS ProductionVA**, which has three-dimensional (real time / space / information) “Funnel” shape on defined **ENV XYZ** according ⟨**τ**⟩´s controlling. Here the **VA** is produced in the proportion to activity batches (cases) ***Incoming batch ⟨a/b⟩*** and/or ***Outcoming batch ⟨c/d⟩***. This proportion is represented by a relation of the batches

a/b ≠ c/d (1)

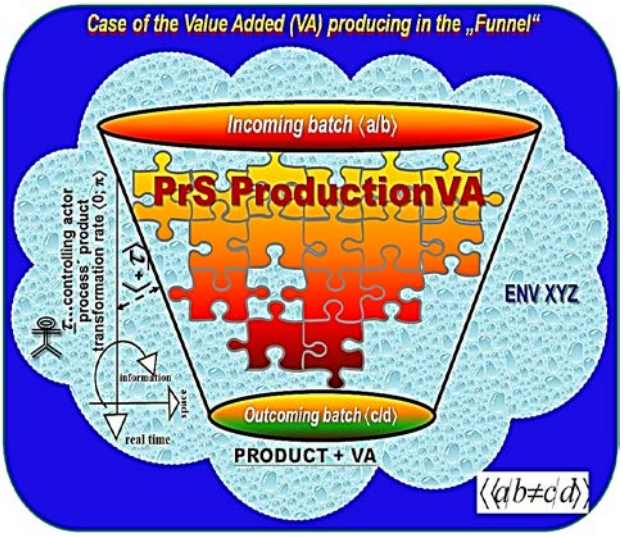

Fig.1 Funnel model for VA of single product

This proportion is depending on ***τ*** angle magnitude, which virtually quantifies process´ product transformation rate. Funnel model blazonry illustrates Value Added [7] image, but its mathematical deduction needs its projection to real time dependence at four (production/ distribution/ consumer/ recycling) phases of ´product life cycle´, which is developed at Fig.2 also in equations (2) and (3).

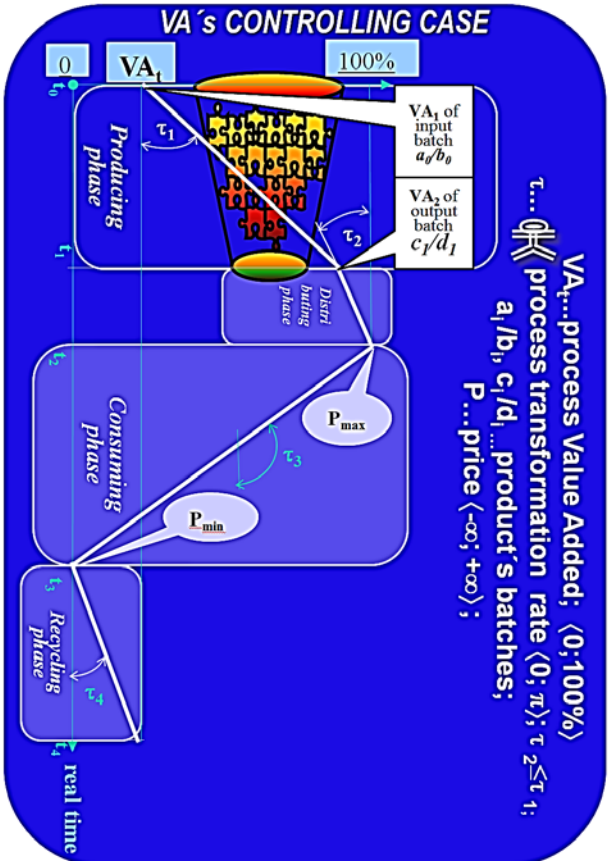

Fig.2 The Value Added at single Product Life Cycle

$$VA_t = \frac{P_t}{P_{\max} - P_{\min}} * 100 \cdots [\%] \quad (2)$$

$$tg\,\tau_i = \frac{dVA}{dt} = VA' \quad (3)$$

Here is: VA_t is single product Value Added, taking the value ⟨0; 100%⟩;

τ **is** process transformation rate, taking the value ⟨0; π⟩ and $\tau_2 \leq \tau_1$;

a_i / b_i, c_i / d_i are product´s batches; i = (0; 1; 2; 3; 4);

P is product´s price ⟨-∞; +∞⟩.

A significance of these equations consists in simple expression of single product (a thing) use case ***TRANSFORMATION CONTROLLING*** (see Fig.2) quantitative dependence as first (time incremental) derivation of Value Added.

3 Problem Solution

On the Fig.3 is formulated mathematic dependence of whole organization economic product – the VA on real-time. This VA forms in displayed logistic processional system (in pentagonal symbol „vector arrow"), accompanying stable and continuous flow of product batches - the "multiply funnels“ with a quantity x/y. It is happened within its case - ***Undisturbed Production Batching x/y Case***, which is enacted within the time period ⟨$t_{u\ start}$; $t_{u\ fin}$⟩. It is possible to derive that transformation angle (see Fig.1) $\tau_u = 0°$, containing the direction vector logistic flow batch quantity **x/y** with the real-time vector. This angle has zero value. So that on Fig.3 is displayed fair logistical process, which produces steady VA, otherwise it to do operating with [8] (maximum) **Operating Value Added** ⇒ **+OVA ≈ 100%**. In reality, the **OVA** presents then horizontal (from the left to right side of the page) increasing information vector about the process. Sudden Disruptive Event - DE enters unexpectedly to this process in time $t_{u\ fin} \equiv t_{d\ start}$, whose course is quick-acting and consequence is instantaneous, therefore it includes transformation minus angle with real-time vector in equation (4).

$$\tau_{de} \cong -90° \quad (4)$$

Or more precisely, this angle is 180° with information vector **(+OVA).** This **DE** causes restriction of product flow on magnitude **z/w,** whereas is valid **x/y >> z/w.** The DE also evokes promptly the processes leading to the depression and the **OVA** decreasing, but simultaneously, the background creates for the resumption and rescue and settling works.

On joint (negate) interface of the case ***Undisturbed Production Batching x/y Case*** and antagonistic cases ***Case of Depression with BCM*** and also ***Case without BCM***, here the **Crisis Interface** originates. This interface is controlling actor of ***Case of Sudden Disruptive Event DE***.

The line of the depression is a union of sets of the cases ***Case of Depression with BCM*** and also ***Case without BCM;*** here the OVA can proceed in two cases:

1/ Partly it can be managed within ***Case of Depression with BCM***, where the **BCM** is the **Business Continuity Management**. However here, in time period ⟨$t_{d\ start}$; $t_{d\ conti\ 1}$⟩ the **VA** slumps on minimum quantity

$$OVA_{min\ 1} \equiv +OVA_{de1} \quad (5)$$

This depression is on Fig.3 illustrated by continuous blue line, having $\tau_{d\ depres} = 0°$.

2/ Or the **OVA** isn't managed in the ***Case without BCM***, then can it go down as far as to negative values (OVA is below zero). It means that value added is negative! The result is that OVA virtually becomes „detracted value" and in real-time proceed like **-OVD ⇒ Operating Value Detracted**. It manifests as an accounting loss in the Organization, due to catastrophic losses of the production capabilities, assets, possessions, even till the life and health of human sources of injured Organization. This functionality is blazonry formalized by black dashed line on the Fig.3.

If the Organization copes the DE on acceptable level of the OVA´s losses inside acceptable time span, then the time period ⟨$t_{d\ start}$; $t_{d\ conti\ 11}$⟩ together with ⟨$t_{d\ start}$; $t_{d\ conti\ 2}$⟩ must be found and proceeded inside acceptable time period ⟨$t_{d\ start}$; t_A⟩. If the Organization derive benefit from business continuity fruition in crisis **Environment of effective Business Continuity Management = BCM** (see Fig.3), then time period of the depression ⟨$t_{d\ start}$; $t_{d\ conti\ 11}$⟩ must be found and running over at the least to the **Target Resumption Time** t_R. It is evidence about successful **DE**'s encompassment and about successful employment of crisis management at resulting crisis situation in the **Point of Activities Resumption at Acceptable Level of OVA Loss Within Acceptable Time Frame**. From this point, the processes of successful **Recovery with BCM** are started an proceeded, controlling by common dependence of variable angle τ, which is demarcated between curve´s

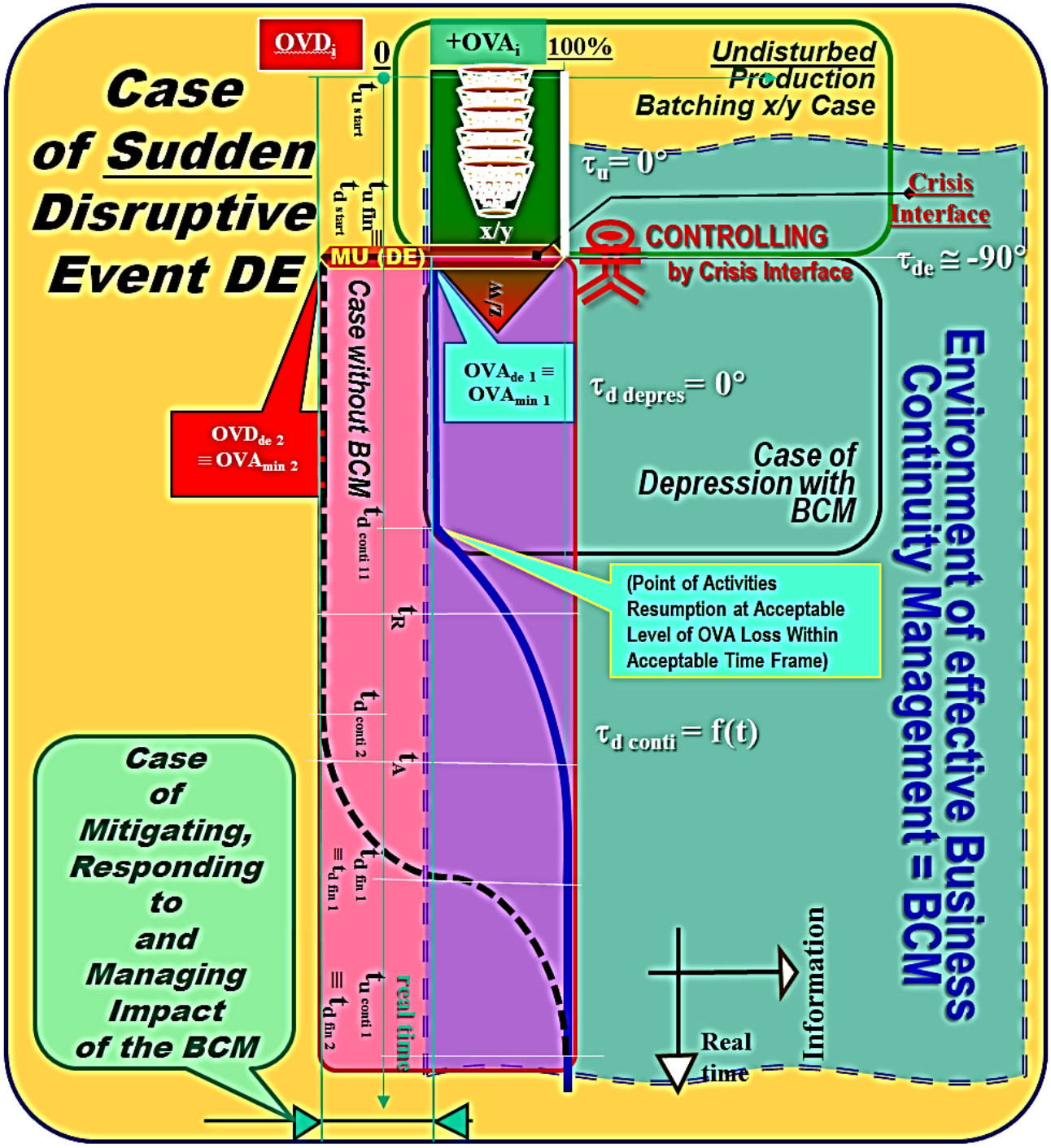

Fig.3 Functioning of sudden disruptive event to VA production of whole Organization

guideline of the OVA and between real-time´s vector according to the (6) equation

$$\tau_{d\ conti} = f(t) \qquad (6)$$

The BCM causes time period shortening ⟨**t**$_{d\ start}$; **t**$_{d\ fin\ 1}$⟩ to the ⟨**t**$_{d\ start}$; **t**$_{d\ fin\ 2}$⟩.

If the Organization disuses efficient **BCM**, or if it hasn't crisis preparedness enough mastered, but if it ad hoc faces up to the crisis successfully, then depression time period ⟨**t**$_{d\ start}$; **t**$_{d\ conti\ 2}$⟩ must be found and proceeded inside acceptable time period ⟨**t**$_{d\ start}$; **t**$_{A}$⟩; It is the evidence about **DE**´s and subsequent crisis situation [9] encompassment without a downfall of the Organization, or at least about not topical catastrophic peril of its existence, or its continuity. The **Recovery without BCM** begins in the time cut **t**$_{d\ conti\ 2}$.

If it is achieved value added OVA **≈ 100%** in the both above-mentioned cases (ad 1/ and 2/), after the recovery times of depression finalization - see equation (7).

$$t_{d\ conti\ 12} \equiv t_{d\ fin\ 1} \quad (7)$$

and/or $t_{d\ fin\ 2}$.

4 Conclusions and acknowledgements

Organization's business continuity in the crisis can be achieved even also in worse case: when especially in time cut $t_{d\ fin\ 2}$ (see Fig.3) not have to be achieved 100% of value added. It means that the **OVA < 100%,** but then the Organization wards off the crisis with particular losses of producing possibility and value added, compared to beginning level.

The better case can come rarely even: when after crisis Organization's business continuity can be strengthened. It can come then, when especially in time interval $\langle t_{d\ conti\ 12};\ t_{u\ conti\ 1} \rangle$ the substantial help is not only from the both the very effective BCM, and even the very illuminate and skilful organizational management remedy the value added over most 100%. It means that after very successful management of crisis state is the **OVA > 100%.** Then the Organization, with the help of the processes of very efficient Business Crisis Management wards off the crisis with plus profit on the Value Added, compared to original levels. However, this case requires generally the most comfortable access to the investments to better and progressive technologies, human and other resources, than those what was destructed in former crisis.

The span between values $OVD_{de\ 2} \equiv OVA_{min\ 2}$ plus $OVA_{de1} \equiv OVA_{min1}$ encloses and appreciates the **Case of Mitigating, Responding it and Managing Impact of the BCM**. This span case (left below corner of the Fig. 3) exactly mathematically evaluates big contribution of effective Organization's Business Crisis Management in a mitigation of crisis impact.

The ability of DYVELOP method is proved for mathematical – graphical – blazonry [3] and [10] expression of the relationships among entities, systems and processes acting in organizational crisis management of the disruptive events (DE) and critical situations.

Here it is possible to talk about DE's full recovery, making an establishment of Organization’s business continuity possibility. It is proofed and confirmed in-question crisis situation obtained as a part of the solution of the project by Technology Agency of the Czech Republic with the topic Research and Development of Simulation Instruments for Interoperability Training of Crisis Management Participants and Subjects of Critical Infrastructure (research project No. TA04021582). The live Power Point presentation is necessary at the Conference.

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