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LOGISTICS PROCESS MANAGEMENT: NEUTRALIZATION OF AFTER-EFFECTS ON THE BASIS OF COMPENSATORY MECHANISMS

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Abstract. The target of research is the algorithms allowing one to ensure monitoring of logistic activities with a view of supporting improvements achieved at the overall process level. A peculiar feature of such a monitoring is the availability of mechanisms including some means of improvement of the logistic process. The purpose of these means is to show how to improve the process instead of just tracing it in a conventional way (Kopitov, Faingloz 2008). As the logistic process is being improved, one has to achieve its one-to-one correspondence to the logistic activities (Kopitov, Faingloz 2011). By the example of a transportation enterprise, the algorithms developed have been used as a basis for building compensatory mechanisms supporting the investigated enterprise in controllable condition. The controllable condition was evaluated in terms of the enterprise's potential of maintaining a steady state after compensatory steps were actually taken.

Keywords: correspondence, activity, process, circumstance, effect, compensator, stability.

Jel classification: M10

1. Introduction

According to the data from a number of investigators (Smith, Fingar 2003; Hammer 2003; Carr 2004; Sanders, Snowman 2009), the controllability of business processes has a low level. 10 % of successful strategies are implemented practically (Kaplan, Norton 2006). 3 % of the total number of enterprises needs a mission (Prigozhin 2007). The main reasons for low controllability and efficiency are plurality of factors and uncertainty of description of main activities (Cokins 2004). As a consequence, having inexact and unpredictable information makes one insert some mistakes when developing decision-taking methods and means of organizational diagnostics (Prigozhin 2003). For example, Juran considered in 1954 that system developers building such methods create as much as 85 % of problems due to insufficient attention paid to the system. Later in 1990, Deming has increased the figure to 98 % (Neave 1990). Today, we have to acknowledge still higher meaning of the percentage. Under such circumstances, management system developers have to use innovational approaches of creating systems as far as the data volumes increase (Barnard 1948; Ackoff 1970; Beer 1986; Christensen 1997; De Gues 1997; Cumming 2005). At the expense of solicitous attitude to information, the developers should reveal the most scaled situations, and must have some means of their neutralization at their disposal.

The main goal of this investigation is revelation of extremely unfavorable circumstances accompanying future activities of enterprise and working out steps to eliminate their consequences. To accomplish these ends, some non-traditional algorithms are developed as a basis. When developing the algorithms, methods of stepwise refinement and constructive design (Schedrovitsky 1995), as well as those of value evaluation (Doyle 2000; Andriessen, Tissen 2000; Couplend, Dolgoff 2005), factor analysis etc. are used. The effect of the algorithms is transferred to logistic activities of enterprise when considering its potential from two sides: taking into account variability conditions; taking into account practical importance of efforts.

2. The enterprise capability assessment based on variability conditions

The logistic process management when describing the logistic activity is exercised on the basis of the enterprise value $\tilde{P}v_{project} = \tilde{P}v_{project}\left(\tilde{F}_1,...,\tilde{F}_i,...\right)$, where $\tilde{F}_i$ is i-th cost factor (Copeland, Coller, Murrin 2005; Scott 2000; Egerev 2003; Kopytov 2011).

Let's separate out the non-random component denoted by the original brackets «< >» , - and the random component denoted by the symbol «^»:

$$\begin{aligned} \tilde{P}v_{project} &= \left\langle Pv_{project} \right\rangle + \hat{P}v_{project}, \\ \tilde{F}_i &= \left\langle F_i \right\rangle + \hat{F}_i, \quad i = 1,..., N. \end{aligned} \tag{1}$$

Further, let us proceed to the definition of variability. In this case, by variability is meant the level of variations showing to what extent the efforts of organizing, preparation, and implementation of compensatory actions aimed at eliminating *j*-th scaled circumstances $j = 1,...,M$ allow the management system to be in a stable condition.

In general, variability is calculated as the key factor variation level to enterprise value $\frac{\Delta\hat{F}_i}{\langle F_i \rangle}$, $i = 1,...N$ (Kopitov, Faingloz 2011). Such a level is a relative magnitude which is calculated based on one of the key factors $i = 1,...N$. Such a relative magnitude is the quotient produced by division of magnitude of the change of the enterprise value random component to the anticipated value of the cost while taking into account i-th factor. It should be noted that the change of the value random variable has occurred as a result of compensatory steps taking into account the i-th factor with respect to the elimination of the j-th incidental. If the indicator value $\frac{\Delta\hat{F}_i}{\langle F_i \rangle}$ is equal to zero - we are in a controllable condition where any kind of interference into the stable process (Shewhart 1986) is excluded. The higher is the value of the indicator $\frac{\Delta\hat{F}_i}{\langle F_i \rangle}$, the ampler are the variations; this fact attesting to uncontrollability of the process. At that, the negative value of indicator $\frac{\Delta\hat{F}_i}{\langle F_i \rangle}$ describes unproductiveness of the management activities connected with the elimination of the circumstance revealed.

The *i*-th factor variability estimation formula taking into account variability ratio $Kc_{i,j}$ for i-th factor with respect to j-th contingency can be brought to the form as follows:

$$\frac{\Delta\hat{F}_i}{\langle F_i \rangle} = \sum_{j=1}^{M} Kc_{i,j} \frac{\Delta\hat{C}_{i,j}}{\langle C_{i,j} \rangle}, \quad i = 1,...N. \qquad (2)$$

The separate examination of contingencies is caused by revelation of uncontrollable states arising in the management system (Mandelbrot 2004). The acknowledgement of randomness in the enterprise value formation management problems should, first of all, comply with the rule (Kopitov, Faingloz 2011) suggested hereunder:

(i) The random component of value is of a self-limited nature implying the necessity of checking adjacent operations, affecting the value formation process.

Such a limitation where the latest stages of estimation are developed based on checking of the results of previous stages – not only abates the danger of disagreement of the integral logistic process but promotes refining of the logistic activity.

Solution of the above-stated problem is achieved when measuring risk premium in process of managing enterprise value division between the key factors, taking into account risks. This is ensured due to a stage-wise inspection of consistency of the system parameters in process of formation of money flows. According to the inspection results, risk premium is calculated, used as a surcharge to discount rate:

$$d^{ovh} = \frac{1}{\langle PV_{project} \rangle} \sqrt{\sum_{i,j} Kf^{d}{}_{i} \times Kf^{d}{}_{j} \times \mathrm{cov}(\tilde{F}_i, \tilde{F}_j)}, \qquad (3)$$

where:

$Kf^{d}{}_{i}$ – ratio of contribution of the random component of i-th factor into the random component of discount rate.

Further, taking into account the rule (i) and the formula (1), let us make an estimation of division of value between factors, taking into account risks, - within the framework of the enterprise in question.

Table 1 shows the estimated values of key value driver variation levels after elimination of contingencies – with respect to the enterprise investigated. In the example considered, circumstances having arisen within the 6th year of operation are shown. Within the framework of the present study, a possibility of responding to a manifestation of the major circumstance is investigated. The enterprise condition is restored as it was three years before the major circumstance arose. A full estimation of the current logistic process is made with respect to sustainable development of the enterprise in future – in the context of monitoring of logistic activities.

Table 1. Variation levels of key value factors

Circumstance (6^{th} year of enterprise functioning)	Key factors		
	Factor 1: increase in sales	Factor 2: rise in profit rate	Factor 3: floating capital decrease
Net profit loss amounting to 25 %	-0.16	-0.15	-1.32
Net profit loss amounting to 50 %	-0.07	-0.10	-0.63
Net profit loss amounting to 100 %	-0.01	-0.05	-0.20
Loss of income	0.00	-0.03	-0.11

The analysis of the data presented in Table 1 shows that the first factor is the most important one in terms of variability. With respect to the first two factors, variations are excluded when the third and the forth circumstance are eliminated. Furthermore, variations decrease as the scale of circumstances grows (Fig.1).

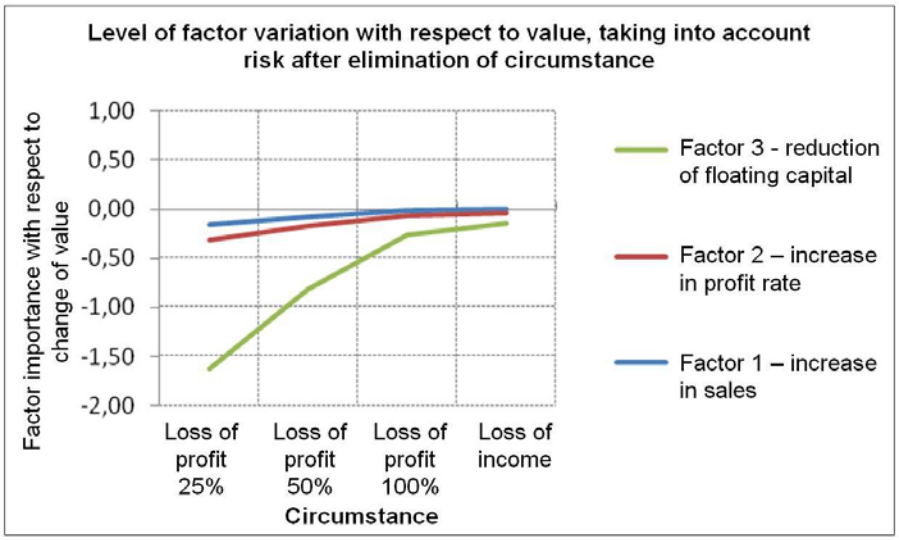

Fig. 1. Estimation of invariance under change of key factors, taking risk into account

The exponent $\frac{\Delta\hat{F}_i}{\langle F_i \rangle}$ does not take into account each factor's sensitivity to value under usual terms - in absence of major circumstances and any effect from compensatory mechanisms Kf_i. The expression of formula (5) includes the index not only taking into account Kf_i but serving as a basis for determination of final variability of the key factor, with due consideration of its sensitivity to value:

$$TSc_i = Kf_i \frac{\Delta\hat{F}_i}{\langle F_i \rangle}, \quad i = 1,...N. \qquad (4)$$

Such a level shows how far the efforts made within the framework of the program ensuring a sustainable development of enterprise based on i-th key factor, justify a future transition to stable management after the elimination of *j*-th contingency. At that, the following should be taken into account: the closer the index value TSci is to zero, the higher is the functioning stability of enterprise. If TSc_i index value is below zero – this attests to value destruction, and all the compensating efforts aimed at elimination of circumstance are unproductive in from the management standpoint.

Table 2 summarizes calculations of final variability levels of the key factor, with due consideration of its sensitivity to value. The calculations have been performed with respect to the investigated enterprise of transportation profile, - with due consideration of the investigation of the circumstances enumerated above.

Table 2. Final variability levels of key value factors

Circumstance (6^{th} year of enterprise functioning)	Key factors		
	Factor 1: increase in sales (factor sensitivity to value Kf_1=2.64)	Factor 2: rise in profit rate(factor sensitivity to value Kf_2=5.51)	Factor 3: floating capital decrease(factor sensitivity to value Kf_3=1.65)
Net profit loss amounting to 25 %	-0.42	-0.83	-2.19
Net profit loss amounting to 50 %	-0.19	-0.56	-1.04
Net profit loss amounting to 100 %	-0.02	-0.30	-0.33
Loss of income	-0.01	-0.16	-0.18

In process of analyzing the data shown in Table 2, the following deductions have been formulated:

a. The final variability of the key factor decreases in proportion to the growth of the scale of consequences stemming from revealed circumstances.
b. After elimination of extremely large-scale circumstances (in terms of losses), the management system is in controllable condition (Fig.2).
c. Compensatory mechanisms efficient from the standpoint of control not only improve the process but exclude any variations.

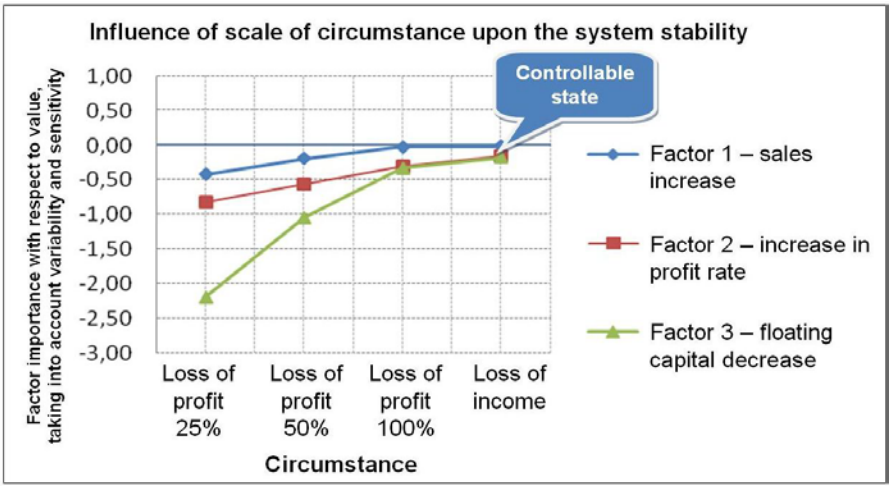

Fig. 2. Estimation of management efficiency after elimination of circumstances revealed

3. Estimation of enterprise capabilities, based on practical importance of efforts

Enterprise capabilities of making improvements to a logistic process, free from any variations, are investigated through the use of compensatory mechanisms. Such improvements should be commensurate to stability-ensuring efforts made to establish specific mechanisms. At that, the nature of uncontrollable randomness should be understood by all means. Within the framework of the example in question, introduction of random component shall imply taking into account a sign of practical importance. Practical importance is set up by expertise, based on consequences that can be brought about by actual circumstances. Further, the determined status of circumstance corresponds to the sign of practical importance. Depending on the juxtaposition results, type 2 errors, connected with special causes, are defined, rather than type 1 errors based on common causes.

Getting back to the enterprise in question, let's determine the status of circumstances entered. To do that, let's make use of the results obtained in paper (Kopitov, Faingloz 2010). According to the results, it was determined that manifestation of a special cause related to a specific circumstance starts with the 15 % - loss of enterprise value.

Apart from that, we shall take into account the concluding importance of variation $\frac{\Delta\hat{P}v_{project}}{\left\langle Pv_{project}\right\rangle}$. This index reflects the change of value with respect to the entire set of related circumstances and the complete set of key factors in

process of action of compensators developed. The index value close to zero characterizes a loss of effect of variations.

The formula of estimation of concluding importance of variations may be presented in the form as follows:

$$\frac{\Delta\hat{P}v_{project}}{\left\langle Pv_{project}\right\rangle}=\sum_{i=1}^{N}Kf_i\sum_{j=1}^{K}Kc_{i,j}\frac{\Delta\hat{C}_{i,j}}{\left\langle C_{i,j}\right\rangle}. \quad (5)$$

Furthermore, we shall use the Deming rule (Niv 2007) when defining status of circumstance:

(ii). A compensator can abate the effect of variations only if special causes are present in the system.

Table 3 shows the data that served as a basis for revealing reasons of circumstances entered into logistic process.

Table 3. Revelation of circumstance status with respect to the enterprise in question

Circumstance	Change of value, %	Test for presence of special cause: comparison with critical value *(based on column 2)*	Concluding importance of variation $\frac{\Delta\hat{P}v_{project}}{\left\langle Pv_{project}\right\rangle}$	Test for presence of special cause: abatement of effect of variations *(based on column 4)*	Determination of status *(based on columns 3 u 4)*	Practical importance of logistic activities (*Expert's opinion)*
1	**2**	**3**	**4**	**5**	**6**	**7**
Net profit loss 25 %	1.6 %	General (< 15 %)	-3.43	Total (the value incommensurable to zero)	General case	General case
Net profit loss 50 %	3.4 %	General (< 15 %)	-1.80	Total (the value incommensurable to zero)	General case	General case
Net profit loss 100 %	7.0 %	General (< 15 %)	-0.65	Total (the value incommensurable to zero)	General case	General case
Profit loss	15.4 %	General (> 15 %)	-0.35	General (value close to zero <0.5)	Special case	Special case

On comparison of the results stated in the sixth and the seventh columns of Table 3, no discrepancies have been revealed.

Thus, full correspondence has been stated between the time-dispersed logistic process and the logistic activity.

Therefore, the tools worked out enable one to make improvements to the logistic process, excluding variations in logistic activity.

Therefore, we have obtained an algorithm that has helped us to confirm – with specific reference - E.Deming's thesis related to improvement of each process with the exclusion of any variations.

By the example of a carrier, we have managed to determine how a logistic process should be improved in the course of monitoring logistic activities. In the course of improvements, compensatory mechanisms maintaining the investigated enterprise in controllable condition have been developed. To this end, the enterprise's capabilities, allowing the enterprise to stay in a steady state on carrying out the compensatory actions, were investigated. As a result of carrying out the compensatory actions, management system coordination measures have been exercised when estimating the logistic activity. The formulated rules (i)-(ii) are complied with based on such mechanisms. Apart from that, the enterprise has a great potential for the estimation of possible fundamental changes. The proposed estimation tools enable the management system to use mechanisms capable of maintainig its structure and passing it over from one version of management system to another.

4. Conclusions

As a result, the approcach proposed by the authors developed with due consideration of the formulated rules (i)-(ii), is an objective basis for elaborating compensatory mechanisms of management, allowing one to advance the functionality of business process management technology. With the aid of non-traditional mechanisms of that kind, it will be possible not only to run fundamental diagnos-

tics of complicated situations arising when estimating logistic activity, but also have some objective tools available to allow one to introduce modifications

The obtained results of estimation of logistic activities run by the specific carrier are a gage of efficiency of mechanisms developed on the basis of measuring the importance of key factors. The thesis has proved that applying a correct stimulus upon those factors within the framework of the proposed value-related tools proposed by the authors allows one to make improvements, and, which is the most important thing - excluding variations at the same time. This is achieved due to recognition of special causes of large-scale circumstances. This paper shows that elimination of special causes allows one to transfer the system into a controllable state. Such a transfer eliminates any interference into stable process, making the management system tolerant to changes. Ensuring stability of logistic activity enhances manageability of a logistic process. Thereby, in the course of investigation of factors' sensitivity, the needed conformity is found, allowing one to determine the management system predisposition to risk and resistance to affecting efforts.

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