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## IMPLEMENTATION OF CONTROLLING TECHNOLOGIES AS A METHOD TO INCREASE SUSTAINABILITY OF THE ENTERPRISE ACTIVITIES\*

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**Abstract.** We are currently facing that business environment is not stable due to globalisation processes in economics, cyclical changes and other disturbing factors. Hence, it is necessary to search such reserves that would improve efficiency of the business entity. The main objective of these reserves is to buffer negative impacts of external disturbances on financial and economic sustainability of enterprises. One of methods designed to improve the enterprise efficiency involves application of controlling technologies. In the present article the author examines results of statistical analysis of economic performance of more than 70 Russian and foreign enterprises. The author also analyses economic performance according to the author's integral indicator that shows effectiveness of primary implementation of the controlling system. On the ground of this analysis, the author determines the mean level of increase in efficiency of the enterprise's activity due to introduction of the controlling system. The analysis proves that, on average, efficiency of the economic entity's operation increases by about 17%.

**Keywords:** stability of the enterprise; economic sustainability; financial sustainability; controlling system; controlling technologies; risk; disturbing influences; effectiveness

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## 1. Introduction

Fluctuations of external environment cause economic recession, and in this context socio-economic space is quickly getting more and more diverse. External disturbances significantly affect the state of the industrial cluster, reducing its financial and economic stability. The controlling system is specially designed to neutralize the impact of such disturbances on activities of the economy's terminal segment, the enterprise.

However, today scientists and businesses do not pay sufficient attention to methodological issues in the field of developing and implementing controlling systems, which would serve as the basis for increasing sustainability of economic entities through preventive management aimed to reduce the negative impact of environmental disturbances, i.e. disturbances caused by operational environment (Ghosh *et al.* 2019). The controlling models that currently in use are mainly limited to functions of keeping accounts, controlling and planning. Most of existing models do not forecast what impact environmental uncertainty can have on indicators of financial and economic performance of the enterprise. This phenomenon can be attributed to the history of controlling systems in the Russian Federation – in fact, controlling systems were first mentioned in Russia only after perestroika. The first approaches to introduce strategic management at the economic entity emerged only at the turn of the 21st century. Since then, strategic management has been considered as dominating against the concept of accounting (Pelau and Rosca 2017). Thus, there are objective factors explaining why scientific literature presents practically no quantitative assessment of that influence the introduction of controlling systems has on financial and economic performance of the enterprise. Indeed, few researchers have attempted to quantify the impact of launching the controlling system on business performance, though most of contemporary scientific papers note positive aspects of controlling.

## 2. Methodological approach

To assess the impact of launching the controlling system on business performance, we need to take the following steps: analyse Russian and foreign experience in this field; process results of this the analysis by means of probabilistic and statistical methods (Zhuravlyov *et al.* 2018); develop integrated indicators that would allow us to come to generalized conclusions as to how introduction of the controlling system improves efficiency, both with regard to certain activities of the business entity and the enterprise as a whole (Khudyakova, Shmidt 2018).

In this context, our research shall comprise the following main stages:

- To collect, summarise and analyse information related to effectiveness of controlling systems (Grynko *et al.* 2016; Parumasur and Govender 2013);
- To calculate statistical indicators based on the data obtained from this analysis (Bertašius 2007);
- To set and calculate integral indicators;
- To make conclusions on the conducted research.

In order to compute the average value of the effect that implementation of the controlling system has on performance indicators of various activities of the enterprise (Shevchuk 2014), we find it possible to use a weighted average indicator:

$$\bar{E}_i = \frac{\sum_{j=1}^n (E_{ij} * f_{ij})}{\sum_{j=1}^n f_{ij}}, \quad (1)$$

where  $\overline{E}_i$  is the weighted average value of increase in i-type efficiency due to launching the controlling system at the enterprise;  $E_{ij}$  is the increase in i-type efficiency resulted from launching the controlling system at the j-enterprise;  $f_{ij}$  is repetition frequency of j-event;  $n$  is the amount (number) of data under analysis.

In addition, it seems necessary to determine the confidence interval for the general average, which would allow with a probability of at least 0.95 to declare that the average value of i-type efficiency increase due to launching the controlling system at the enterprise will not exceed the found interval in case of a gross sample:

$$S_i = \frac{\sqrt{\sum_{j=1}^n (E_{ij} - \overline{E}_i)^2 * f_{ij}}}{\sum_{j=1}^n f_{ij} - 1}, \quad (2)$$

where  $S_i$  is an estimate of the root-mean-square deviation of the increase in the i-type efficiency due to launching the controlling system at the enterprise.

Then the confidence interval for the average value of the increase in i-type efficiency due to launching the controlling system at the enterprise will be calculated with Formula (3):

$$\left( \overline{E}_i - t_{tablei} * \frac{S_i}{\sqrt{n}}, \overline{E}_i + t_{tablei} * \frac{S_i}{\sqrt{n}} \right), \quad (3)$$

where  $t_{tablei}$  – is Student’s t-criterion.

In order to come to a generalised assessment of the efficiency of launching the controlling system at the enterprise, we propose to use the integral indicator:

$$E_{int.} = m \sqrt{\prod_{i=1}^m \overline{E}_i}, \quad (4)$$

where  $m$  is the number of analysed types of indicators that show efficiency of launching the controlling system.

### 3. Theoretical Framework and Literature Review

Thus, we will analyse the increase of efficiency due to launching the controlling system at the enterprise by applying the above stated methods.

As we have already noted, there are currently no papers providing generalized information on how introduction of controlling influences the performance indicators of one economic entity that could be projected onto a group of homogeneous enterprises (Mousavifard *et al.* 2016). Therefore, we find it essential to make necessary calculations and draw conclusions applying the proposed set of methods.

In their article "Controlling in Russia" founders of controlling in Russia Falco S., Russell K. and Levin L. claim that according to experts estimate, introduction of the controlling system at the enterprise "can result in achieving the growth of integrated performance indicators by 15–30%" (Falco, Russell & Levin 2015). Herewith, introduction of controlling at enterprises engaged in innovative development will increase their efficiency by about 50–75% (Falco, Russell & Levin 2015).

Syuzeva O.V. (Syuzeva 2010), Yunusova D.A. (Yunusova 2009), and Yusupova S.Ya. (Yusupova 2008), Golovanova N.B., Basyuk A.S., Taranova I.V., Kramarenko E.R., Goloshchapova L.V. (Golovanova *et al.* 2016) conducted a research based on official data of the Chamber of Commerce and Industry (The data of the chamber of Commerce of the Russian Federation 2006). Similar conclusions can be drawn based on Suhaimi, Nawawi and Salin’s research (Suhaimi *et al.* 2016).

According to their research and the methodological approaches listed above, the effectiveness of made decisions calculated as the increment in profit to the cost increase significantly improved due to the implementation of the controlling system at industrial enterprises. Using the results of their research, we determined that the initial implementation of controlling in Russian enterprises contributed to the increase in the efficiency of decision-making from 11% to 18.9% (Table 1) and the increase in the productivity of managers from 9.6% to 16% (Table 1).

**Table 1.** Effectiveness of the primary implementing controlling at industrial enterprises (in the short-term)

Indicator		Rate of increase in the effectiveness of the decision made, %	Growth rate of labor productivity of management personnel, %
initial data	Sistema OJSC	11.0	12.6
	Power Machines PJSC	16.2	16.0
	PJSC Inter RAO	15.0	14.3
	Bishkek Machine-Building Plant OJSC	13.2	9.6
	Holding Company SUIholding LLC	18.9	14.5
	Hals Development PJSC	15.9	12.2
calculated data	Variation range for the indicator value	11.0–18.9	9.6–16.0
	The theoretical mean value	15.03	13.2
	Mean square deviation	2.47	2.04
	Variability index	16.45 (weak variation)	15.48 (weak variation)
	Integrating efficiency indicator	14.09	

*Source:* compiled by the authors based on  
(The data of the Chamber of Commerce of the Russian Federation 2006, Syuzeva 2010, Yunusova 2009)

At the same time, the efficiency of decisions is understood as the ratio of the increase in the value of the surplus product as a result of the implementation of a specific management decision to the increase in costs caused by this management decision. In our case, these solutions are understood as actions aimed at the formation and implementation of the controlling system in industrial enterprises. The increase in the productivity of managerial

personnel is understood as an increase in the indicator calculated as the ratio of the products produced to the number of managerial personnel.

Thus, the theoretical mean value for increase in efficiency of the made decision amounts to 15.03%, while the theoretical mean value for increase in the labour productivity of managerial personnel amounts to 13.2% (Table 1).

The calculations presented in Table 1 bring us to conclusion that the theoretical mean value of increase in the efficiency of the decision made and labour productivity in the given sample are almost identical. Herewith, the calculated coefficients of variation are not significant (<30%), thus, the input data for analysis are considered homogeneous, which allows us to conclude that the calculations are valid. The integral indicator of increasing the efficiency of Russian enterprises due to implementation of the controlling system in the short term is 14.09% (Table 1).

In the long term the increase in the enterprises efficiency due to implementation of the controlling system is higher than in the short term (Table 2). For example, for Russian enterprises the integral indicator of efficiency of the controlling system in the short term varies within 14% (Table 1), while in the long term it doubles and amounts to 32.46% (Table 2). At the same time, it is necessary to note that the quality of decisions is calculated as the ratio of the number of qualitatively executed decisions to the total number of management decisions taken at the enterprise.

**Table 2.** Efficiency of making long-term financial decisions based on primary controlling activities

Company / Indicator		Growth rate of increase in quality of decisions, %	Growth rate of management effectiveness, %
initial data	Luding LLC	43.4	38.7
	SPI-RVVK OJSC	41.1	36.9
	Locator LLC	34.5	30.6
	Uniastrum Bank PJSC	32.2	29.8
	Solid CJSC	18.9	18.9
calculated data	Variation range for the indicator value	18.9–43.4	18.9–38.7
	The theoretical mean value	34.02	30.98
	Mean square deviation	8.61	6.96
	Variability index	25.3 (weak variation)	22.46 (weak variation)
	Integrating efficiency indicator	32.46	

Source: compiled by the authors based on (Syuzeva 2010, Yunusova 2009)

According to the research conducted by the international company PricewaterhouseCoopers (The Pricewaterhouse Cooper's bulletin, 2002), analysis of the impact of implementing the controlling system at foreign enterprises proved that the trends are similar to those in Russia (Table 3).

**Table 3.** Efficiency of primary implementing the controlling system at foreign industrial enterprises

Company / Indicator	Growth rate of management effectiveness, %	Rate of increase in the efficiency of the production process, %
Sony	25.0	18.4
Samsung	24.2	18.0
LG	18.7	25.9
Akai	11.8	8.4
Kodak	11.7	31.9
Nokia	10.2	25.3
Mazda	9.9	22.9
Siemens	9.3	21.5
British Petroleum	9.1	19.6
Shell	8.6	19.0
AIG Brunswick Capital	7.2	14.9
Variation range for the indicator value	7.2–25.0	8.4–31.9
The theoretical mean value	13.25	20.53
Mean square deviation	6.06	6.17
Variability index	45.74 (moderate variation)	28.65 (weak variation)
Distribution type	normal distribution	normal distribution
Integrating efficiency indicator	16.49	

*Source:* compiled by the authors based on (Yunusova 2009; The Pricewaterhouse Cooper's bulletin, 2002)

Checking samples for normality of the statistical law made it possible to conclude that the values of growth rates of management efficiency and the production process are normal. Herewith, the theoretical mean value for the increase in management efficiency at foreign industrial companies amounts to 13.25%, while the increase in efficiency of the production process amounts to 20.53%. At the same time, the calculated integral index is 16.49% (Table 3).

Analysis of changes in performance indicators at foreign industrial enterprises resulted from introduction of controlling systems (Table 4) allows us to indicate the following positive trends in the development of these economic entities. Firstly, implementing this or that kind of controlling allowed enterprises to increase, on average, the level of investment attractiveness practically up to 9%. Secondly, on average it allowed to increase efficiency of documents circulation practically up to 10%. Thirdly, on average it allowed to increase financial stability by more than 8%.

Materials of the analytical department of the State Duma of the Russian Federation for monitoring and financial monitoring (Materials of analytical Department of the state Duma of the Russian Federation for control and financial monitoring 2004) present another official source, which provides data on implementation of the controlling system at foreign enterprises. Analysis of this source brings us to conclusion that the level of investment attractiveness resulted from implementation of the controlling system at the enterprise increases on average by 8.9%, the efficiency of document circulation increases by 9.7%, the level of financial stability increases by 8.3% (Table 4).

**Table 4.** Dynamics of performance indicators at foreign industrial enterprises resulted from primary implementation of controlling

	Company	Growth rate of the level of investment attractiveness, %	Growth rate of workflow efficiency, %	Growth rate of financial stability, %
initial data	British Petroleum	+11.4	+5.2	+6.3
	Tesco	+9.3	+11.6	+8.9
	METRO GROUP	+7.2	+15.3	+22.1
	Cristall Gross	+6.5	+11.3	+22.5
	Ford	+1.2	+14.8	+6.3
	Mazda	+16.8	+27.6	+9.9
	Bayer AG	+3.5	+5.2	+2.2
	Schwarzkopf	+6.3	+8.9	+9.3
	Oriflame	+3.3	+9.3	+5.7
	Motorola	+6.8	+9.3	+11.0
	Chivas	+3.9	+1.6	+5.2
	Huawei	+16.5	+11.9	+3.5
	Ziegler	+0.2	+0.96	+0.45
	Singer Corporation	+1.6	+2.9	+3.6
	Renault	+13.3	+6.9	+9.2
IBM	+33.9	+11.8	+6.9	
calculated data	Variation range for the indicator value	1.2–33.9	0.96–27.6	0.45–22.5
	The theoretical mean value	8.86	9.66	8.32
	Mean square deviation	8.16	6.28	5.99
	Variability index	92.1	64.99	72.05
	Integrating efficiency indicator	8.93		

Source: compiled by the authors based on (Materials of analytical Department of the state Duma of the Russian Federation for control and financial monitoring 2004, Yunusova 2009)

At the same time, the efficiency of the document flow is understood as an indicator calculated as the ratio of profit growth as a result of the introduction of measures improving the document flow process in the enterprise to the increase in costs due to innovation. Financial stability of the enterprise (Table 4) is determined on the basis of the coefficient of autonomy and is calculated as the ratio of the own funds of the entity to the currency of its balance sheet.

Thus, analysis of growth rates of investment attractiveness, efficiency of document circulation, financial stability of foreign industrial companies allows us to conclude that the introduction of this or that kind of controlling contributes to improving an economic situation at the enterprise and increasing its efficiency. Besides, though growth rates of indicators vary from a company to company, we observe that a general change dynamics for all analysed enterprises is positive. The resulting conclusion is that introduction of controlling systems at industrial enterprises makes it possible to increase the level of stability of the economic entity (Table 4), which is especially important in the context of recession.

At the same time, a number of researchers note the positive impact of introduction of controlling technologies on other financial, technical and economic indicators of the enterprise performance. For example, Asaul A.N., Starovoytov M.K. and Faltinsky R.A. point out in their work that the rate of increase in the sales volume due to implementation of controlling will amount to 20%, net profit – to 2%, and the shareholder value – to 100% (Asaul, Starovoytov, Faltinsky 2009). Moreover, the authors examine controlling in the limited framework of budgeting. Obviously, in its full capacity controlling is expected to produce even a more significant effect (Mateljak and Mihanović, 2016).

The company AT&T Canada, the largest mobile operator in Canada, which implemented the Balanced Scorecard System (BSC), serves as another illustration of high efficiency of controlling for the enterprise. After the system was launched, the company showed the following performance dynamics: the trading profit increased by 15%, the output per worker increased by 11%, the market value of the enterprise showed 4 times growth. One more evidence is introduction of the controlling system at the Airbus Group, which in 2015 caused an increase in the turnover profitability by 10% (Hubert, Falco 2015).

#### **4. Result**

Overall, in the course of the research the author analysed increasing the efficiency of performance resulted from introduction of the controlling system at more than 70 Russian and foreign enterprises.

Giving a quantitative assessment of the impact of the controlling system introduction, it is safe to say that the introduction of the controlling system has a positive impact on the indicators of efficiency and profitability of enterprises. This means that the increase in profit as a result of improved management based on controlling exceeds the increase in the cost of these changes in the management system. Summary indicators of the analysis are presented in Table 5.

After analyzing the results presented in table 5, it is safe to say that the introduction of the controlling system in those enterprises that have not previously used it can have a significant positive effect by increasing the overall efficiency of the enterprise. Also, during the crisis and the increased uncertainty of the external environment, the introduction of the controlling system will become a buffer reducing the negative impact on the financial and economic performance of the enterprise.

**Table 5.** The impact of introduction the controlling system on performance of the enterprise

Indicator	The rate of increase in the effectiveness of made decisions, %	The rate of increase in managers' productivity, %	The rate of increase in management effectiveness, %	Rate of increase in the quality of decisions, %	The rate of increase in efficiency of the production process	The growth rate of financial stability,%
Variation range for the indicator value	8.7–18.9	9.6–17.2	7.2–38.7	18.9–43.4	8.4–31.9	0.45–22.5
The theoretical mean value	13.60	13.39	18.52	34.02	20.53	8.32
Mean square deviation	2.86	2.48	9.6	8.61	5.88	5.99
Variability index	20.99 (weak variation)	18.54 (weak variation)	51.82 (moderate variation)	25.30 (weak variation)	28.65 (weak variation)	72.05 (strong variation)
Distribution type	normal distribution	normal distribution	normal distribution	normal distribution	normal distribution	abnormal distribution
Confidence interval for the mean (significance value $\alpha=0.05$ )	(11.45; 15.75)	(11.52; 15.26)	(13.77; 23.27)	(22.08; 45.96)	(16.39; 24.67)	(5.02; 11.62)
Confidence interval for the mean (significance value $\alpha=0.01$ )	(10.51; 16.69)	(10.7; 16.08)	(12.01; 25.03)	(14.21; 53.83)	(14.64; 26.42)	(5.02; 11.62)
Integrating efficiency indicator	16.42					

Source: own compilation

## 5. Conclusions

Having analysed the works containing a quantitative assessment of the effectiveness of implementing the controlling system at the enterprise, we found it practical to draw the following conclusions.

Introduction of controlling makes it possible to increase the effectiveness of made decisions by 8.7% – 18.9%. Moreover, it should be noted that with a probability of 95% the value of the analysed indicator falls in the range from 11.45% to 15.75%. Moreover, probability of the fact that the effectiveness of the decision will the increase within the range from 10.51% to 16.69% amounts to 99%. Herewith, we can also observe an increase in the productivity of managerial personnel from 9.6% to 17.2%. As for this indicator, the findings are that with the probability of 95%, its value falls in the range from 11.52% to 15.26%, and with the probability of 99% it falls in the range from 10.7% to 16.08%. The increase in management efficiency ranges from 7.2% to 38.7%. Besides, we note that with the probability of 95% the value of the analysed indicator falls in the range from 13.77% to 23.27%, and with the probability of 99% it falls in the range from 12.01% to 25.03%. The quality level of made decisions is also growing, while the increase has a spread across the analysed enterprises from 18.9% to 43.4%. For this indicator, its value falls within the range of 22.08 – 45.96% with the probability of 95%, and with the probability of 99% it will fall in the range from 14.21% to 53.83%. Introduction of the controlling system at the industrial enterprise results in an increase of the efficiency of the production process by 8.4% – 31.9%. For this

indicator, with the probability of 95%, this value falls in the range of 16.39–24.67%, and with the probability of 99%, it falls in the range of 14.64–26.42%.

Generalization of the obtained results allows us to calculate the integrated indicator of the effectiveness of introduction of the controlling system at the industrial enterprise, which amounted to 16.42% (Table 5).

The obtained results lead to a logical conclusion that introduction of the controlling system at the enterprise is an effective method, which becomes especially relevant in the context of globalisation of economy and growth of disturbances in the external environment. The reserve, allowing to enhance business efficiency, identified when applying the controlling system, can and must act as a sort of a buffer designed to reduce negative impacts that external environment factors make on sustainability of the enterprise (Pozdnyakova *et al.* 2017).

Moreover, we believe that we should apply an integrated approach to launching the controlling system. It implies taking into consideration financial and economic aspects, use of certain advanced features designed to include not only functions of control, accounting and budgeting, but, in the first place, the function of preventive business management in a variable environment based on scientific simulation models. In this case, the enterprise will not only increase the effectiveness indicator of launching the controlling system, but also eliminate probability of losing financial and economic sustainability of the mini-economic system.

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