
Efficiency of Managerial Control Systems: The Optimal Model

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Abstract:

The relevance of this research is associated with the difficulty of substantiating and selecting a certain managerial control model for a particular organization which would ensure the greatest efficiency of the entire system of its tools. When tailoring their control systems, organizations select from a number of various control tools. Meanwhile, not every one of the possible tool combinations will be efficient.

The paper is aimed at giving grounds for a model that allows identifying the optimum managerial control system for a particular organization proceeding from parameters based on the theory of transaction costs. The leading method for researching this problem is mathematical modeling under partial uncertainty that allows getting an integrated view of the relationship of the basic control type and the criteria determining it.

As a result of the research conducted, the authors have proven the use of result-oriented machine control type and action-oriented machine control type with the appropriate toolkit is justified for a number of aircraft engineering corporation divisions.

The materials of the paper are of practical value for both the top management and various level managers of enterprises and organizations not only in aircraft engineering but in other industries too.

Keywords: *Managerial control, control tools, management, efficiency, aircraft engineering.*

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1. Introduction

The relevance of the problem under study is associated with the wish of organizations to obtain an efficient managerial control system against minimum costs. With regard to this, it has to be borne in mind that a managerial control system is a total of quite a few mutually related control tools, such as a code of standards and rules, budgeting, the use of controlled indicators and many more. So, there arises a challenging question of justifying and selecting a certain managerial control model for a particular organization that would ensure the highest efficiency of the entire system of its tools. It is to solving the problem that this research is dedicated.

Control systems for management purposes are the control tool complexes that are used for coordinating work and creating the motivation by means of reward and punishment measures (Kupper, 2008). When tailoring their control systems, organizations make their choice of an entire number of various control tools. Alongside with that, not every one of all possible tool combinations will be efficient. The work of a control tool depends on its combination with other tools. Numerous studies deal with individual control tools (Hahn *et al.*, 2001; Horvath, 2011), however, there are few enough works exploring the control systems in their entirety. This is the reason why much is yet to be learned about effects of these systems as complexes of mutually related control tools (Reichmann, 2011). It is even less known about the efficiency of control with specific situation of a particular organization considered (Guenther, 2013).

It should be noted at once that according to the authors the effectiveness of control tools in managing corporate transformation costs lies in the plane of managerial accounting and controlling, beginning with budgeting and finishing with deviations analysis. As for the efficiency of control tools in managing transaction costs, this is the subject of scientific debate of the contemporary management. However, not all authors make a clear distinction between the approaches to control in the theory of transformation and transaction costs. So, Demsetz criticizes the theory of firm exclusively from the standpoint of transaction costs seeing its weakness in the lack of production costs accounting, which leads to neglecting the distinctions between firms if they are not associated with the control function (Demsetz, 2000). For assessing the efficiency of certain managerial control systems in corporations, their problems of control have to be identified in the framework of their existence in measures taken within the particular enterprises.

2. Literature Review

The control systems for management serve several purposes. Jensen and Meckling argue the control system gives incentives by measuring and assessing the efficiency, as well as using a system of rewards and punishments (Jensen and Meckling, 1992). Then, the authors agree with the fact that alongside with a system delimiting the rights for decision-making, the control system in the organization compensates for

the lack of the "invisible hand" which coordinates the activity in the market. Speklé shares a similar broad view of the control systems for management purposes (Speklé, 2004). He brings the main objectives of managerial control systems down to collecting the knowledge, coordinating and stimulating by means of rewards and punishments. In his work, Speklé (2004) mentions four aspects or "dimensions" of control in order to give an integrated description of the structure of control: distribution of rights for decision-making; the use of norms, rules and regulations; efficiency assessment; rewards and incentives. This is in line with the standpoint presented in the earlier literature (Zimmerman, 2000) but in this case the role of norms and rules is emphasized – they are singled out as an individual dimension.

The first dimension, "distribution of decision-making rights", comprises delegating tasks and responsibility by the controller to the manager. It has to be solved how many duties should be delegated and what duties these will be. The key control means are the decentralization level and the extent of independence in work which the manager possesses.

The second dimension is quite a broad and diverse one; it is made up by the use of standards, norms and rules. For instance, when coordinating a controller can rely on standard working procedures and work manuals. This is one of the kinds of standardization which is frequently called "actions control" (Merchant, 1982). Other types of rules and norms focused on the behavior of employees prescribe what should not be done and act as boundary systems (Simons, 1995).

As for efficiency assessment – the third dimension, – the central problem to the controller is selecting the grounds for assessing. Assessment can be based strictly on conformity to rules and norms or it may depend on reaching the target indicators. For the purposes of assessing the efficiency, a controller can also use subjective judgment or opt for comparing the achievements against the long-term efficiency of the organization using the control indicators. Certainly, there are different grounds for assessment.

The last dimension of control is represented by a system of rewards and incentives. It is both the reward itself and the conditions of its provision that matter. Alongside with focusing one's attention on the short-term profit associated with a bonus, the career growth prospects play quite a part when long-term rewards and incentives are spoken about (La Lau *et al.*, 2012). The four dimensions of control make up the basis for the work definition of this category when studying managerial control systems. Taken together, they represent a broad view of control, which is one of the compulsory conditions for exploring control in an integrated way (Speklé and Kruis, 2014). Given these four dimensions, with numerous control means belonging to each of them, and the potential quantity of individual lines, due to mutual relations between the control elements it can be expected that only a few combinations of them will be efficient.

3. Research Methodology

The paper is aimed at substantiating a model that allows identifying an optimum managerial control system for a particular organization proceeding from parameters based on the transaction costs theory. The leading method for studying this problem is mathematical modeling under partial uncertainty that allows getting an integrated view of the relationship of the basic control type and the criteria determining it: asset specificity, information asymmetry, programmability of activity, and state participation. The research described in the paper enables the authors to make their contribution to the existing knowledge database, with special attention focused on studying the control systems for management purposes in their entirety and appraising the relative efficiency thereof.

So, for a corporate managerial control system to be efficient, it has to be similar to the control type that is appropriate for it (Kruis *et al.*, 2016). Each basic type is efficient when controlling certain activities but is not when controlling some other ones. The main assumption is: the more similar the observed managerial control system is to the corresponding type, the more efficient it is. From the said assumption, there arise several hypotheses.

In case of a low level of uncertainty and a moderate asset specificity, the market control is an efficient solution. The activities are programmable, and norms based on market indicators are available. The use of control indicators taken from the market is therefore both possible and natural when directing the behavior and assessing the efficiency. So, the first hypothesis is shaped: in case of a low level of uncertainty and a moderate asset specificity, the similarity of the managerial control system having the basic market control type is positively associated with the efficiency of this managerial control system (Speklé, 2004).

In combination with a high level of asset specificity, low uncertainty implies the necessity of machine control. What type of such control will prevail – results- or action-oriented, – depends on "the opportunity to identify the significant and strict enough target results at the output" (Speklé, 2004). This is a forced choice because the possibility of using this or that form depends on the information available. In case of a low level of uncertainty, a high asset specificity and high measurability of results at the output, the similarity of the managerial control system with the basic type of results-oriented machine control is positively associated with the efficiency of such a managerial control system.

When asset specificity is high but the output results cannot be appraised, the control of results seems no longer possible. In spite of this, owing to programmability of activity, the rules and behavior principles allow obtaining control solutions. Thus, it is action-oriented machine control that prevails here. Hence the third hypothesis arises. In case of a low level of uncertainty, a high asset specificity and low measurability of results at the output, the similarity of the managerial control system

having the basic type of action-oriented machine control is positively associated with the efficiency of such a managerial control system. A high level of uncertainty renders programming the activity complicated or impossible as it is. Standard working procedures or particular target indicators of efficiency cannot be used. It is other forms of control that will be efficient depending on the level of actual information asymmetry. In this situation, the boundary control archetype will be efficient. From this reasoning, the fourth and the fifth hypotheses follow.

In case of a high uncertainty and a low actual information asymmetry, the similarity of the managerial control system with the basic type of human control is positively associated with the efficiency of such a managerial control system. In case of a high uncertainty and a high actual information asymmetry the similarity of the managerial control system with the basic type of boundary control is positively associated with the efficiency of such a managerial control system.

Kruis in her work "Managerial control system: design and effectiveness" (2008) attempted to prove or reject these hypotheses suggested by Speklé. Empirically, having conducted 258 observations, she tried to prove or reject the hypotheses about the possibility of using this or that basic control type when carrying out a certain activity. The results of the analysis confirm the first hypothesis. In the set circumstances, the observed control system for managerial purposes which is more similar to the market control basic type is relatively more effective. The author has found no evidence for the second hypothesis.

In the control systems for managerial purposes, there is mutual complementation between control elements, and for this reason, the changing circumstances will not lead to gradual adjustment of the structure of control – instead, a quantum leap will take place (Kruis, 2008). One of explanations of the zero result will consist in the fact that mutual complementarity is rather weak within the results-oriented machine control. If this statement is correct, then gradual adjustment is possible to a certain extent. There is another explanation of the lack of results for incompatibility as for results-oriented machine control. In the situation of a low uncertainty and a high asset specificity, managers can rely on a diverse set of control tools, from rules and regulations to particular target results. With numerous potential combinations of control tools, the same level of control can be maintained by different ways yet at different costs levels too.

Using regression analysis Kruis (2008) did not succeed in checking other hypotheses put forward. With regard to this, the proofs of hypotheses 3, 4 and 5 do not confirm theoretical ideas. As for the question of the author's research, it is impossible to make a conclusion about the control systems for managerial purposes that are similar to basic types "results-oriented machine control", "exploratory control" or "boundary control" being more effective than other managerial control systems in conditions of a high uncertainty or a high asset specificity (Kruis and Widener, 2014). As for the main question of the research – what control systems for

managerial purposes are effective in the given circumstances – it was found by Kruis (2014) that managerial control systems that are similar to the "market control" basic type are effective when controlling activities featuring a low uncertainty and a low asset specificity.

Thus, it remains an open question for scientific debate to confirm other hypotheses about the efficiency of control. With regard to this, the objective of this research is building a mathematical model that allows justifying the selection of the efficient managerial control system for aircraft engineering corporation divisions. Given this, the tasks of confirming or rejecting the hypotheses previously put forward are set, in particular, the following ones: 1. In case of a low level of uncertainty, a high asset specificity and high measurability of results at the output the similarity of the managerial control system with the results-oriented machine control basic type is positively associated with the efficiency of such a managerial control system. 2. In case of a low level of uncertainty, a high asset specificity and low measurability of results at the output the similarity of the managerial control system with the action-oriented machine control basic type is positively associated with the efficiency of such a managerial control system. 3. In case of a high uncertainty, a low actual information asymmetry and a moderate level of programmability of the activity, the similarity of the managerial control system with the human control basic type is positively associated with the efficiency of such a managerial control system. 4. In case of a high uncertainty and a high actual information asymmetry the similarity of the managerial control system with the boundary control basic type is positively associated with the efficiency of such a managerial control system.

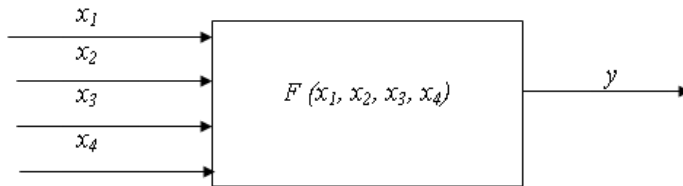
4. Results

The analysis will be based on the data of the major Russian corporation, PJSC "United aircraft corporation". The distinctive feature of the products of industrial aircraft engineering enterprises is its complicated knowledge-intensive nature (Chuvashlova, 2014b). For aircraft development, upgrade and maintenance, special scientific and technical knowledge is critical that is acquired during fundamental and applied research and development works not only along the aviation science lines but also in the adjacent fields of knowledge. Shaping the necessary experience requires a bulk of pilot testing, special research and test stand equipment, and the highly qualified staff.

As of today, the experimental design bureaus and plants can be called the main elements of Russia's aircraft engineering industry, the majority of which being united in PJSC "United aircraft corporation" (2018). With regard to this, it makes sense to justify and build a formal model of selecting the basic type of control for conditions of uncertainty, proceeding from the previously specified criteria: asset specificity, information asymmetry, programmability and the fourth factor which is characteristic for corporations with state participation – influence of the state (Kruis and Speklé, 2016). Meanwhile, two conditions of the environment should be

distinguished: partial certainty (as statistical data are known about the system for earlier time spans or as statistical data about similar systems for one time step are known), complete uncertainty (in this case a model based on expert knowledge should be considered). Let the partial certainty case be considered. Let there be a panel of statistical data on the determining factors (x_1 – asset specificity, x_2 – information asymmetry, x_3 – programmability, x_4 – participation of the state) and the resulting factor (y – control type). Then, the definition of the control kind can be presented as a "black box" model (Figure 1).

Figure 1. Initial model for determining the basic control type



Source: Authors.

Finding out the kind of dependence of the control type on the determining factors is research in nature, studies of this kind being unknown to the authors. Using the statistical data panel, the coefficients of the regression function $F(x_1, x_2, x_3, x_4)$ can be evaluated; its specification is determined by the certain kind of the enterprise. On the basis of the obtained coefficient values, the measure of factors influence on the result (control type) is ranked (asset specificity, information asymmetry, programmability, the state participation). For the simplest ranking option, the linear model can be used:

$$y = b_0 + b_1x_1 + b_2x_2 + b_3x_3 + b_4x_4$$

Here the coefficients at regressors show the value of relationship between the independent and the dependent factors. The higher the coefficient value is, the stronger the influence of the corresponding factor on the result is. The problem of using this kind of model is discreteness of the statistical data; or rather, their being qualitative and not quantitative in nature. In order to overcome this problem, the qualitative values of variables were presented in the slack numerical form:

- asset specificity: (0 – low, 1 – medium, 2 – high);
- information asymmetry: (0 – low, 1 – medium, 2 – high);
- programmability (0 – low, 1 – medium, 2 – high);
- participation of the state (0 – low, 1 – medium, 2 – high);
- control type (10 – market, 20 – machine, results-oriented, 30 – machine, action-oriented, 40 – human control, 50 – boundary control).

Based on the introduced factor levels evaluation scale, the expert survey was conducted in the aircraft engineering complex enterprises (Chuvashlova, 2014a). The data are given in Table 1 below.

Table 1. Data of expert appraisal of factor levels and control types broken down to aircraft engineering industry enterprises

Unit of the corporation	Activity	Asset specificity	Information asymmetry	Programmability	Participation of the state	Control type
PJSC UAC	The activity of holding companies	0	2	0	2	50
JSC "Aviation Holding Company "Sukhoi"	Production of helicopters, planes and other aircraft	2	0	2	1	30
JSC Russian Aircraft Corporation "MiG"	Development and pilot production of planes	2	1	1	1	20
JSC Sukhoi Civil Aircraft	Development of new aircraft designs	2	1	1	1	20
PJSC Scientific and Production Corporation "Irkut"	Aircraft production	2	0	2	1	30
OJSC Experimental Design Bureau n.a. A.S. Yakovlev	Development of design documentation	1	2	0	1	40
LLC UAC – Aggregation Center	Development of onboard equipment packages	2	2	1	1	40
JSC AeroKompozit	Production of aircraft components	1	0	1	1	30
PJSC Tupolev	Scientific research and development	1	2	0	1	40
PJSC Taganrog Aviation Scientific-Technical Complex n.a. G.M. Beriev	Scientific research and development	1	2	0	1	40
JSC Ilyushin Aviation Complex	Development, upgrade and modification of planes	2	1	1	1	20

PJSC Voronezh Aircraft Manufacturing Company	Production of helicopters, planes and other aircraft	2	0	2	1	30
JSC Aviastar-SP	Production of helicopters, planes and other aircraft	2	0	2	1	30
JSC UAC – Transport Aircraft	Project management in military and transport aviation	0	1	1	2	50
OJSC Experimental Machine-Building Plant n.a. V.M. Myasishchev	Development of new aircraft designs	2	1	0	1	20
JSC Flight Research Institute n.a. M.M. Gromov	Flight research and flight testing of planes	2	2	0	1	40
LLC UAC – Purchases	Financial services provider, purchases management	0	2	1	2	50
LLC UAC – Capital	Financial services provider, capitals management	0	2	1	2	50
JSC Ilyushin Finance Co	Financial and operational leasing	0	2	1	2	50
OJSC V/O Aviaexport	Export and import operations	0	2	1	2	50
LLC UAC – Antonov	Project management	0	2	1	2	40

Source: Authors.

As it can be seen from the content analysis, the basic type of market control was not in the sample, so it does not seem possible to confirm or reject the research of Kruis (2008) as for the first hypothesis. Concerning the remaining control types, in this research, there appears the possibility to continue the scientific exploration of Speklé and Kruis as for the efficiency of the structure of managerial control (Speklé and Kruis, 2014). First of all, the survey data were subjected to statistical analysis: correlation analysis was performed and regression analysis was done after that. Based on the correlation analysis, the conclusion was made about the randomness of the control-type influencing factor level values. The closest statistical relationship was found between the control type and asset specificity (correlation coefficient – 0,84), as well as between the control type and the state participation (correlation 0,77). There is a weaker relation between the control type and information

asymmetry (correlation of almost 0,64), with there being no statistically significant relationship between the control type and programmability (correlation –0,23).

When analyzing the interdependence between the influencing factors, the strongest relation turned out to be that between the state participation and asset specificity (correlation –0,91), as well as the one between programmability and information asymmetry (correlation –0,71), with other dependencies being not confirmed statistically. If it is supposed that the control type features ordering expressed by a quantitative scale, then building a regression dependence of the control type on the influencing factors makes sense. So, the linear regression was built:

$$y = 40,21 - 9,62x_1 + 6,25x_2 + 4,73x_3 - 3,65x_4$$

which has formally allowed ranking the force of influence of factors on the control types. So, the greatest influence belongs to asset specificity, then, in the descending order, to information asymmetry, programmability, and to the state participation.

The significance of the regression equation obtained proved high in general (reliability of over 99%), while the statistical significance of programmability and the state participation proved weak. On balance, this does not allow statistically reliably forecasting the type of control on the basis of a fixed set of influencing factor levels. Similarly, if the control type is not ordered according to its levels, then the regression equation analysis results should be treated with more care – in this case, probability analysis of correlating the set of values of the relevant control-type influencing factor levels should be used. Let the model of calculating the probability of adopting a control type based on a fixed set of influencing factor levels be built. The following designations are introduced:

a_i – i -th level of asset specificity, $i = 1, 2, 3$;

b_j – j -th level of information asymmetry, $j = 1, 2, 3$;

c_k – k -th level of programmability, $k = 1, 2, 3$;

d_l – l -th level of the state participation, $l = 1, 2, 3$;

A_m – m -th level of the control type, $m = 1, 2, 3, 4, 5$.

Thus, the result of modeling will be a set of conditional probabilities determining the probabilities of applying a certain kind of control at the specified influencing factor levels set:

$$P(A_1|a_i, b_j, c_k, d_l), \quad P(A_2|a_i, b_j, c_k, d_l), \quad P(A_3|a_i, b_j, c_k, d_l), \quad P(A_4|a_i, b_j, c_k, d_l),$$

$P(A_5|a_i, b_j, c_k, d_l)$. Proceeding from the properties of conditional probability, the following chain can be built:

$$P(A_m | a_i, b_j, c_k, d_l) = \frac{P(A_m \cap \{a_i, b_j, c_k, d_l\})}{P(a_i, b_j, c_k, d_l)} = \frac{P(\{a_i, b_j, c_k, d_l\} | A_m) P(A_m)}{P(a_i, b_j, c_k, d_l)}$$

If the independence of the influencing factors is supposed (asset specificity, information asymmetry, programmability, participation of the state), the relation is fulfilled:

$$P(\{a_i, b_j, c_k, d_l\} | A_m) = P(a_i | A_m) P(b_j | A_m) P(c_k | A_m) P(d_l | A_m)$$

Therefore, the target probability is determined by the relation:

$$P(A_m | \{a_i, b_j, c_k, d_l\}) = \frac{P(a_i | A_m) P(b_j | A_m) P(c_k | A_m) P(d_l | A_m) P(A_m)}{P(\{a_i, b_j, c_k, d_l\})}$$

If the influencing factor levels set is a fixed one, then the consequent in the right part of the relation will be constant, which does not influence the variability of the target value. Let the measure of the target event be determined as follows:

$$Q(A_m | \{a_i, b_j, c_k, d_l\}) = P(a_i | A_m) P(b_j | A_m) P(c_k | A_m) P(d_l | A_m) P(A_m)$$

The probability estimates in the right part of the formula obtained were found according to the data of expert appraisal of the factor levels and control types for the aircraft engineering industry enterprises as frequency response characteristics.

It can be seen from the analysis of the calculations obtained that a part of conditional probabilities adopts zero value. This is due to the lack of the corresponding imputations in the estimate observed – yet this does not mean there will be none of them in the future. If new precedents arise, the conditional probabilities should be determined further. For practical use of the model taking into account the potential results of influencing factor sets that were not observed in the data available, the conditional probabilities can be further determined on the basis of expert opinion. Let it be supposed that experts do not reject any of the variants of factor levels for all control types. Then, zero probabilities will be further determined by small positive value ε (Table 2).

Now the control type probability estimate for a fixed levels set can be determined according to the formula:

$$q(A_m | \{a_i, b_j, c_k, d_l\}) = \frac{Q(A_m | \{a_i, b_j, c_k, d_l\})}{\sum_{s=1}^5 Q(A_s | \{a_i, b_j, c_k, d_l\})}$$

Table 2. Control type values

Control type value	Level of asset specificity	Estimate of conditional probability of asset specificity	Information asymmetry level	Estimate of conditional probability of information asymmetry	Programmability level	Estimate of conditional probability of programmability	State participation level	Estimate of conditional probability of the state participation level
20	0	ϵ	0	ϵ	0	0,25	0	ϵ
	1	ϵ	1	1	1	0,75	1	1
	2	1	2	ϵ	2	ϵ	2	ϵ
30	0	ϵ	0	1	0	ϵ	0	ϵ
	1	0,2	1	ϵ	1	0,2	1	1
	2	0,8	2	ϵ	2	0,8	2	ϵ
40	0	0,16667	0	ϵ	0	0,666667	0	ϵ
	1	0,5	1	ϵ	1	0,333333	1	0,833333
	2	0,33333	2	ϵ	2	ϵ	2	0,166667
50	0	1	0	ϵ	0	0,166667	0	ϵ
	1	ϵ	1	0,166667	1	0,833333	1	ϵ
	2	ϵ	2	0,833333	2	ϵ	2	1

Source: Authors.

Let the operating capacity of the obtained model be demonstrated. Let it be supposed that all influencing factors have intermediate values: asset specificity=1, information asymmetry=1, programmability=1, participation of the state=1. It should be noted that the expert data did not contain such a set of levels. According to the formula obtained, with further determined probability of 0,1% (), the following probability estimates are obtained:

$$q(20\{1,1,1,1\}) = 0,743648, q(30\{1,1,1,1\}) = 0,049576, \\ q(40\{1,1,1,1\}) = 0,206569, q(50\{1,1,1,1\}) = 0,000206$$

It can be concluded that under the above factor values the results-oriented machine control type will be efficient in 74,3% of cases, while the action-oriented machine control type will be efficient in 4,9% of cases and the human one – in 20,6%, with the boundary control being almost inapplicable. Here, when deciding on selecting the control type, the results-oriented machine control type clearly prevails. Let the option be considered when the influencing factors have different values: asset specificity=2, information asymmetry=1, programmability=2, participation of the

state=1. The expert data did not contain this set of levels either. According to the formula obtained, with further determined probability of 0,1% ($\varepsilon=0,001$), the following probability estimates are obtained:

$$q(20|\{1,1,1,1\})=0,555427, q(30|\{1,1,1,1\})=0,444342, \\ q(40|\{1,1,1,1\})=0,000231, q(50|\{1,1,1,1\})=0,0000001$$

5. Discussion

The suggested model for estimating the efficiency of basic control types enables the authors to confirm two hypotheses put forward. The first one says that in case of a low level of uncertainty, a high asset specificity and high measurability of results at the output the similarity of the managerial control system with the results-oriented machine control basic type is positively associated with the efficiency of such a managerial control system. This model based on the data of an aircraft engineering corporation shows its efficiency with 55% of cases. The second hypothesis that was also confirmed in 44% of cases is that under a low level of uncertainty, a high asset specificity and low measurability of results at the output the similarity of the managerial control system with the action-oriented machine control basic type is positively associated with the efficiency of such a managerial control system.

Therefore, it can be concluded that the use of results-oriented machine control with the relevant toolkit is justified for such divisions of the aircraft corporation as JSC Russian Aircraft Corporation "MiG", JSC Sukhoi Civil Aircraft, JSC Ilyushin Aviation Complex, and OJSC Experimental Machine-Building Plant n.a. V.M. Myasishchev that deal with development and pilot production of new designs of planes and aircraft. The use of action-oriented machine control basic type with the relevant toolkit is also justified for such divisions of the aircraft corporation as JSC "Aviation Holding Company "Sukhoi", PJSC Scientific and Production Corporation "Irkut", JSC AeroKompozit, PJSC Voronezh Aircraft Manufacturing Company, and JSC Aviastar-SP producing helicopters, planes and other aircraft.

As a result of this research, the hypotheses put forward concerning the human factor control and boundary control were not confirmed, which can be explained by a high level of uncertainty and complexity which are inherent in this kind of activity that creates a shortage of preliminary, forecast knowledge about it too. There also arises the question about the efficiency of the activity of the corporation in general under the efficiency of certain structures within it. With the control system for managerial purposes being expected to influence the employees' behavior for achieving the objectives of the entire corporation, an effective managerial control system is very likely to have a positive influence on its structural divisions. The studies focusing on the dependence between the effectiveness of the entire corporation's control system and the effectiveness of its subdivision will be highly relevant. They can allow obtaining the information about the effectiveness of control systems as such and about the influence of the control systems on the corporation or on its division, too.

6. Conclusion

As a result of the research conducted, the authors have justified the boundaries of application of certain managerial control models, including the market one, the result-oriented machine control, the process-oriented machine one, the human one and boundary control. In corporations, possible variants of managerial control systems have to be modeled relying on consideration of such factors as: the uncertainty effect with programmable and non-programmable participation justified, asset specificity with differentiated access to the market mechanism justified, actual information asymmetry with justifying the assessment of quality of any personal contribution made, the controlling role of the state in its pursuing its policy or the state as the risk-minimizing managerial control factor. The suggested mathematical model allows giving grounds for the managerial control model based on the proposed criteria.

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