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Ivanov A.

HOW TO IMPROVE EFFECTIVENESS OF ANTI-CORRUPTION EXPERTISE: PUBLIC PROCUREMENT CASE

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Key words and phrases: public procurement; corruption; anti-corruption expertise; the Principal-agent model; quasi-corruption; linear scoring rule.

Abstract: The paper proves a necessity of changing the approach to anti-corruption expertise. The analysis of opportunities for mala fide behavior of agents and evaluation of incentives for their bona fide behavior must be supplemented by the assessment of proposed regulation quality.

In the paper two different algorithms of the extended anti-corruption expertise have been introduced: first algorithm is applied to the new regulation tool, second one – to the regulation tool which has been used in the past and some information on agents' reaction is available. In the both cases the expertise starts from the modelling of society's preferences and comparing them with the principal's preferences which are modelled on the base of proposed regulation. The relationship between proposed algorithms of anti-corruption expertise and the typology of principal-agent models, based on the assumptions of bona /mala fides of the Principal and the Agent, is underlined.
The algorithm of extended anti-corruption expertise of first type is applied to the two legal instruments regulating the determining of a winner in the tender. The reference to the implementation of second type algorithm for the anti-corruption expertise of applying the price English auction in public procurement is supplied.

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Andrei Ivanov – Associate-Professor of Public Administration Department of Graduate School of Management, St. Petersburg State University
e-mail: ivanov@gsom.pu.ru

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1. Introduction

In the hierarchy of legal acts, the effect of which is aimed at combating corruption, the highest level document is the United Nations Convention against Corruption, adopted by the resolution 58/4 of the General Assembly on 31 October 2003.

Article 5, paragraph 3 of this document lays the international legal framework for anti-corruption expertise: «Each State Party shall endeavor to periodically evaluate relevant legal instruments and administrative measures with a view to determining their adequacy to prevent and fight corruption».

At the level of Russian Federation (hereafter "RF"), the cornerstone documents regulating the conduct of this kind of expertise are the Federal Law #172-FL "On anti-corruption expertise of legal acts and drafts of normative legal acts" (hereafter "172-FL") and the Decree of the Government of the RF № 96 with the same title, which approved the rules and techniques of anti-corruption expertise.

In accordance with Federal law, anti-corruption expertise of normative legal acts and drafts of normative legal acts carried out "…in order to identify factors, which favor the corrupt behavior of agents, and their subsequent elimination. These factors are the provisions of normative acts (draft laws and regulations), which establish for the law enforcer unreasonably wide margin of appreciation, or the possibility of unjustified use of exceptions to the general rule, as well as provisions dealing with uncertain, intractable, and (or) the onerous requirements for citizens and organizations and those thus creating conditions for corruption" (Article 1).

From the above article, it follows that the subject of anti-corruption expertise is the identification and elimination of the regulation's provisions, which opens up opportunities for corruption or, more broadly, mala fide behavior of law enforcer. Thus, the problem of assessing the quality of the proposed regulation, in the sense that this regulation really enables the agents to choose the best alternative for society, currently remains outside the scope of anti-corruption expertise.

It should be noted that the expertise can be aimed at the separate tools introduced by the regulatory act as well at their totality up to the regulatory act in general.

It seems reasonable to separate the anti-corruption expertise of regulatory tools, which have been introduced into the practice for the first time (the expertise of the first type), from the expertise of tools with the accumulated practice of enforcement in the framework of the corresponding country's regulation system (the expertise of the second type). For example, anti-corruption expertise of amendments to existing legal acts belongs to the second case.

In the RF, the "Law on Placement of Orders for Supplying Goods, Executing Works, and Providing Services for State and Municipal Needs" (Federal Law #94-FL, hereafter "PPL-1"), which came into force on 01.01.2006, had introduced auction as the primary procurement method. PPL-1 had originally introduced auction in the live outcry form, and then, faced with a lot of cases of mala fides of suppliers, replaced live auctions with e-auctions. Since by the time of enacting of the law Principal had no information about the contracting authorities' response on the new regulation tool, then those time we could apply the anti-corruption expertise only of the first type.

On the contrary, by the time of enacting of the new Russian PPL – Federal Law "On the contract system in the procurement of goods, works and services for state and municipal needs" (Federal Law #44-FL, hereafter "PPL-2"), which came into force on 01.01.2014, there were more than three years of applying of e-auctions and there was a lot of information about their performance. Hence, in this case we could apply anti-corruption expertise of the second type.

The rest of the paper is structured as follow.

In the Part 2 the dramatis personae of public sector agency model (society (or basic principal), government (principal) and contracting authority (agent)) and their preferences, defined on the corresponding set of alternatives, will be introduced.

We'll separate the bona fide principal (agent) from the mala fide one depending on match or differ his preference order from the society's one. Then we'll define the extended anti-corruption expertise as anti-corruption expertise which starts from the principal bona fides identification.

After that two different algorithms of extended anti-corruption expertise have been introduced: first one is applied to the new regulation tool, second one – to the regulation tool which has been used and some information on enforcement practice is available. In both cases the expertise starts from the modelling of society's preferences and comparing them with the principal's preferences generated by the proposed regulation.

The content of the Part 3 is the case of extended anti-corruption expertise applied to the new regulation tool. We consider the linear scoring rule in the form of "Highest bid – Lowest bid scoring", which is applied in the Russian Federation in the public procurement and in the procurement stage of the public-private partnership projects.

The subsections 3.1-3.5 illustrate how algorithm of expertise works. In the subsections 3.2 we'll model the preferences of the society. It worth to note that we will not ag-aggregate the preferences of public buyers to obtain society's preference order (Arrow, 1963, p. 23), we will put forward some assumptions about society's preferences, considering the society rather as a private buyer who spend his own money and does not care about third party claims (Moszoro and Spiller, 2012).

In the subsections 3.4 we'll prove that if there are only two bidders then the principal, who prescribes to compare their bids by the linear scoring rule, is mala fide. This fact is extremely important in the institutional conditions of Russian Federation because the average number of bids/tender is about 2.

And, finally, Part 4 gives some policy implications of paper's finding.

2. Methods, Models, Algorythms

As a rule, as a methodological framework for modelling corrupt behavior is used the "Principal – Agent" model: "Pathologies in the agency/principal relation are at the heart of the corrupt transaction" (Rose-Ackerman, 2008, p. 330).

This model was developed for describing processes in the private sector and understands the agency relationship as "a contract under which one or more persons (the principal(s)) engage another person (the agent) to perform some service on their behalf which involves delegating some decision making authority to the agent" (Jensen and Meckling, 1976, p. 308). Accordingly, the principal faces the task of shaping a system of incentives for the agent, in which agent's preference relation, defined on a corresponding set of alternatives, coincides with preferences of the principal.

In turn, the starting point for modeling public sector processes is the assumption that to meet public needs the political elite (principal) delegates some decision-making authority to government agencies or other public entities (agents). In contrast to the private sector, the use of the "Principal – Agent" model in the public sector has its own specifics related to the fact that in a democracy the political elite, in turn, is an agent, who elected for the achievement of social objectives. Thus, the ideal preferences in this case are not the preferences of political elite but society's preferences and we have some reasons to denote the society as a basic principal.

Assume that the basic principal, the principal, and the agent (hereafter, in the figures mostly, BP, P, and A, respectively) equally identify a set of corresponding alternatives $\mathcal{A}$, and

on this set their preference orders $\succeq_{BP}$ (BPPO), $\succeq_{P}$ (PPO), , $\succeq_{A}$ (APO), correspondingly, are defined.

Definition 1. We call that the principal (agent) is *mala fide* (MF) if its preference order is different from the basic principal's preference order: $\succeq_{P} \neq \succeq_{BP}$ ($\succeq_{A} \neq \succeq_{BP}$), and *bona fide* (BF) if otherwise.

Consider the problem of anti-corruption expertise of a legal act, enacting a new regulatory tool for which there is no law enforcement practice. It appears that in this case the first step of anti-corruption expertise is to determine the *bona fides* of the principal. Indeed, if the principal is *bona fide*, the vesting of agent with principal's preference order will inevitably lead to the achievement of public objectives, and otherwise, will not allow of achieving them.

To determine the *bona fides* of the principal is necessary, at first, put forward hypotheses about the properties of society's preferences, build a model of BPPO, then, based on the proposed regulation, model the PPO, and, finally, find out whether they match or differ.

In the first case, tradition anti-corruption expertise (TACE) aimed at the identification and elimination of corruptive factors is further applied, and in the second one it is necessary to preliminary develop appropriate amendments to the legal document in question.

Definition 2. Anti-corruption expertise, which includes in its algorithm the identification of the principal's *bona fides*, is called the extended anti-corruption expertise (EACE).

Thus, we can depict the algorithm of extended anti-corruption expertise of a new regulatory tool (first type EACE).

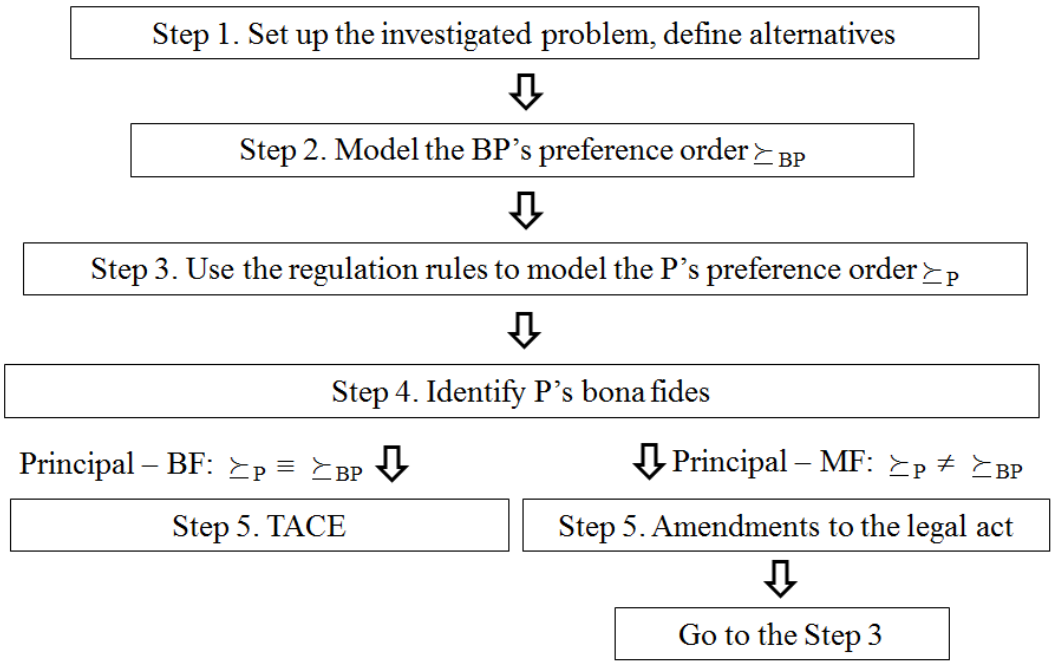

Fig. 1. The Algorithm of Extended Anti-Corruption Expertise of a New Regulatory Tool

Let us move on to the consideration of anti-corruption expertise of a legal act that applies regulatory tool for which there is an enforcement practice. The enforcement practice can supply us information for modelling of agent's preference order, and algorithm of extended anti-corruption expertise becomes more complicated than the algorithm shown in *Fig.* 1.

Suppose that following the steps 1-4 of the above stated algorithm we have revealed the *bona fides* of the principal. Let us move to the identification of the agency problem's existence.

If the accumulated legal practice does not give us reasons to consider agents as *mala fide*, we obtain the model that is trivial in terms of the agency relationships ($\succeq_P \equiv \succeq_A \equiv \succeq_{BP}$). Let us call this model the conflict-free one: agent has the opportunity to choose and is prone to selection of the optimal alternative for society.

When the assumptions for conflict-free model are true the need for traditional anti-corruption expertise disappears, and researchers tend to focus on the study of the effectiveness of public contracts, trying to identify the most completely sources of agency costs and assess their value (Laffont, Tirole, 1993), (Moszoro, Spiller, 2012).

Assume that the law enforcement practice allows us to identify the existence of agents who violate the rules and, possibly, policies of regulation: $\succeq_A \neq \succeq_P$. They are obviously *mala fide*: $\succeq_A \neq \succeq_P \equiv \succeq_{BP}$. Models based on the assumption of principal's *bona fides* and agent's *mala fides* ($\succeq_P \equiv \succeq_{BP}, \succeq_A \neq \succeq_{BP}$) are called models of bureaucratic (Jain, 2011, p. 3) or administrative (in the terminology of World Bank) corruption.

Models of bureaucratic corruption are most frequently used in the study of public procurement issues. Actually, in this case the agent is endowed with a discretionary power and a certain budget to carry out procurement. In this situation two of three necessary conditions of corrupt behavior arise (Aidt, 2003, p. F633): the relevant public official possesses the authority to design or administer regulations and policies in a discretionary manner and this discretionary power can allow him the extraction of existing rents or creation of rents that can be extracted.

In the pioneer research based on the assumptions of principal's *bona fides* and agent's *mala fides* Rose-Ackerman examined the situation in which a private individual attempts to corrupt a bureaucrat in order to obtain a government contract (Rose-Ackerman, 1975, p. 187). In this case agent is considered as a potential "bribee," and the actual level of corruption is determined by how well the institutions governing the (corruptible) bureaucracy are designed (Aidt, 2003, p. F635).

Modern studies of bureaucratic corruption develop ideas of Rose-Ackerman's paper and are usually associated with the modeling agency costs and / or analysis of the specificity of the asymmetry of information between involved parties (e.g., (Lambert-Mogiliansky, Majumdar and Radner, 2007), (Coppier, Piga, 2006)).

Thus, if the bureaucratic corruption has identified, modeling the behavior of agents is made to satisfy the aims of traditional anti-corruption expertise: to identify and eliminate opportunities for corrupt behavior and to assess and strengthen the incentives for agent's *bona fides*.

Now, we can depict the algorithm of second type EACE in the case of *bona fide* principal.

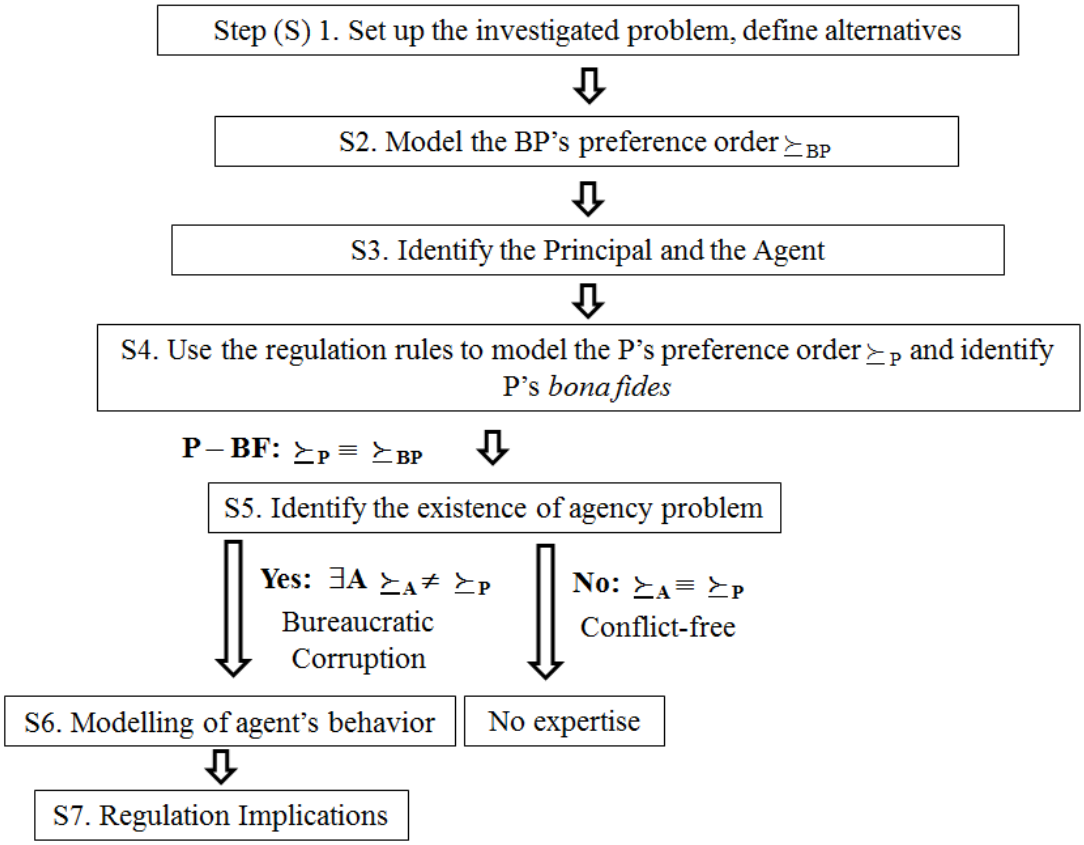

Fig. 2. The Algorithm of Extended Anti-Corruption Expertise of a Regulatory Tool with Accumulated Enforcement Practice: the Case of *Bona Fide* Principal

In the bureaucratic corruption model implicitly assumes that the political elite has developed regulatory rules relying solely on the interests of its principal, society. At the same time, consideration of the political elite as an agent hired by the society, naturally leads us to perception politicians as "…maximizing agents who pursue their own selfish interest rather than as benevolent agents seeking to maximize aggregate welfare" (Grossman and Helpman, 1994, p. 48). Corruption, directly related to activities of the political elite, was called "grand corruption" (Rose-Ackerman, 1996), unlike petty corruption, which is treated in the bureaucratic model.

A. Jain, trying to develop the typology of corruption models, offers to dispose the cases of corrupt behavior in between bureaucratic corruption and grand corruption – two extreme forms, limiting the scale of corruption activity (Jain, 2011, p. 3).

In the EACE of a legal act, involving the use of regulatory tool for which there is certain enforcement practice, improvement the regulation rules, and, possibly, regulatory policy are heavily dependent on the specific of agent behavior.

If we reject the assumption of principal's *bona fides* ($\succeq_P \neq \succeq_{BP}$) and continue to consider *mala fide* agent ($\succeq_A \neq \succeq_{BP}$), then, depending on whether the agent is prone to break the existing regulation ($\succeq_A \neq \succeq_P$) or not ($\succeq_A \equiv \succeq_P$), we must distinguish between two types of models.

In the "queue model" (Lui, 1985) and the "auction model" (Beck and Maher, 1986) corrupt bureaucrats try to correct pre-existing government failures. In these models agent's actions violate accepted rules of regulation that allows us to identify differences in preferences of the principal and agent ($\succeq_A \neq \succeq_P$) and, correspondingly, the agency problem existence.

These models, based on assumptions of *mala fides* of both: a principal and an agent, form the class of "efficient corruption" models ($\succeq_P \neq \succeq_{BP}$, $\succeq_A \neq \succeq_{BP}$, $\succeq_A \neq \succeq_P$) (Aidt, 2003, p. F633).

As an example of this kind of corruption J. Nye viewed corruption of some factory managers in the Soviet Union, which gave some flexibility to the centralized planning system (Nye, 1967, p. 420), and Laffont and Tirole – some instructions of USA Department of Defense (Laffont, Tirole, 1993, p. 476).

It seems that in the case of an efficient corruption the modeling of agent's behavior must be primarily aimed at the identification and elimination the sources of regulation's inefficiency and, accordingly, to the conversion of efficient corruption into the bureaucratic one. In this case, the result of the anti-corruption expertise is a changing of both: regulatory legal acts and regulatory policy.

Nevertheless, the principal can create a system of incentives for the agent, which will warn the latter against taking any action in opposition to existing institutions. This kind of model ($\succeq_P \neq \succeq_{BP}$, $\succeq_A \equiv \succeq_P$) can be called a model of totalitarian corruption.

Thus, in the case of a totalitarian corruption anti-corruption expertise should be reduced to a regulatory impact assessment and the identifying of what underlies the ineffective regulation: vertical corruption (Jain, 2001, p. 73-74) or bounded rationality (Simon, 1961, p. xxiv). It should result in a changing of regulatory policy and practices of regulation, especially in terms of the expansion of discretionary powers and responsibilities of agents.

It is easy to note that linear approach of Jain, which limits the scale of corruption activity by the bureaucratic corruption and grand corruption (Jain, 2011, p. 3), is not quite satisfied for constructing the typology of models of corrupt behavior due to, in particular, different forms of grand corruption.

Let us try to construct the typology of models of corrupt behavior, based on combination of assumptions about *bona/mala fides* of principal and agent. We combine the above mentioned models in the following table.

Table 1

The Main Directions of Corrupt Behavior Modelling

Principal	Agent	Model Title
Bona Fide $\succeq_P = \succeq_{BP}$	Mala Fide $\succeq_A \neq \succeq_{BP}$	Bureaucratic corruption $\succeq_A \neq \succeq_P$
Mala Fide $\succeq_P \neq \succeq_{BP}$	Mala Fide $\succeq_A \neq \succeq_{BP}$	Efficient Corruption $\succeq_A \neq \succeq_P$
		Totalitarian Corruption $\succeq_A = \succeq_P$
Bona Fide $\succeq_P = \succeq_{BP}$	Bona Fide $\succeq_A = \succeq_{BP}$	Conflict-free model $\succeq_A = \succeq_P$

Analyzing *Tabl*. 1, we see that is currently being implemented four directions of modeling corrupt behavior from the five theoretically possible ones. We have: BM (principal is *bona fide*, agent is *mala fide*), M_1M_2 ($M_1 \neq M_2$), M_1M_2 ($M_1 = M_2$) and BB.

Let us consider the model MB, based on the assumptions of principal's *mala fides* and agent's *bona fides* ($\succeq_P \neq \succeq_{BP}$, $\succeq_A \equiv \succeq_{BP}$).

Definition 3. *Bona fide* agent's actions violating the rules of regulation created by the *mala fide* principal will be called quasi-corrupt behavior.

Definition 4. The model, which examines *bona fide* agent's behavior in institutional conditions created by *mala fide* principal, will be called quasi-corruption model.

It follows from the *Def*. 3 that in conditions of quasi-corruption agents have discretionary power broader than in totalitarian case. Therefore analysis of the applying of this power may enable us to determine the main directions of the changing of regulatory policy and, respectively, regulation rules.

The introduction of the model of quasi-corruption allows us to complete the construction of a typology of corrupt behavior models, which is based on the methodology of the agency relationships.

Table 2

The Typology of Models of Corrupt Behavior, Based on the Methodology of the Agency Relationships

Principal	Agent	Model Title
Bona Fide $\succeq_P = \succeq_{BP}$	Bona Fide $\succeq_A = \succeq_{BP}$	Conflict-free model $\succeq_A = \succeq_P$
	Mala Fide $\succeq_A \neq \succeq_{BP}$	Bureaucratic corruption $\succeq_A \neq \succeq_P$
Mala Fide $\succeq_P \neq \succeq_{BP}$	Mala Fide $\succeq_A \neq \succeq_{BP}$	Efficient Corruption $\succeq_A \neq \succeq_P$
		Totalitarian Corruption $\succeq_A = \succeq_P$
	Bona Fide $\succeq_A = \succeq_{BP}$	Quasi-Corruption $\succeq_A \neq \succeq_P$

Having finished the construction typology of models of corrupt behavior we can develop another path of the algorithm of second type EACE, corresponding to the *mala fide* principal case (first three steps the same as *Fig*. 1, *Fig*. 2).

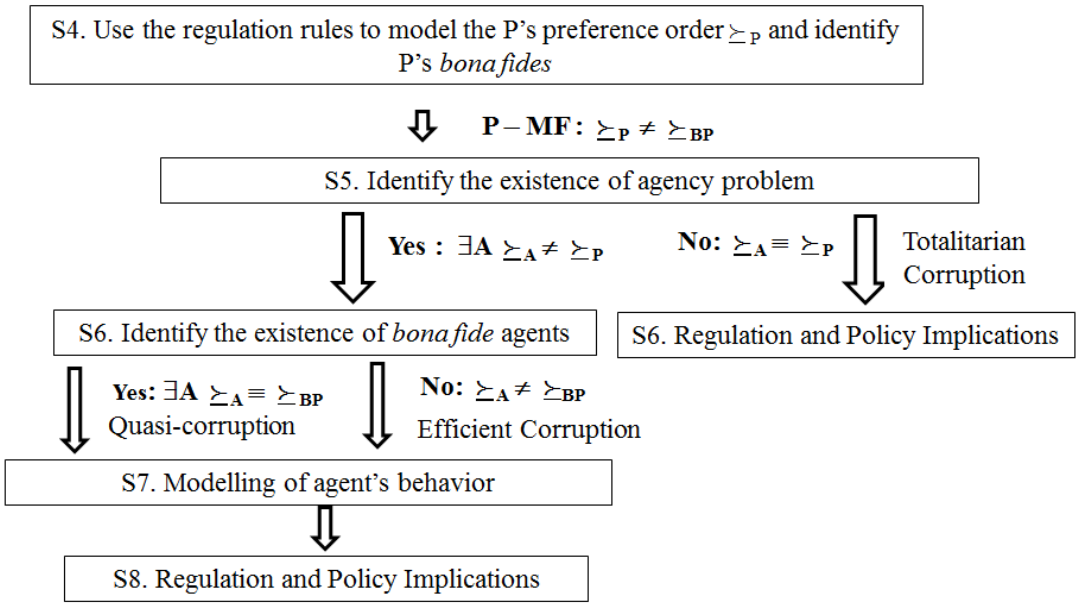

Fig. 3. The Rest of Algorithm of Extended Anti-Corruption Expertise of a Regulatory Tool with Accumulated Enforcement Practice: the Case of *Mala Fide* Principal

3. The Extended Anti-Corruption Expertise of Public Procurement Issues: the Case of 'Highest Bid – Lowest Bid Scoring'

Let us apply the algorithm of EACE to two legal instruments regulating the determining of a winner in the tender. The algorithm of extended anti-corruption expertise supposes the preliminary identification of the principal's *bona fides*. To do that we have to model the principal's preference order on the base of rules of regulation and compare it with the basic principal's preference order.

3.1. Step 1: The Problem Definition

Below we consider the linear scoring rule in the form of "Highest bid – Lowest bid scoring". The rule gives maximum score to the best bid and minimum one – to the worst bid, and scores all other bids proportionally their distance from the worst bid (Dini at al., 2006, p. 309).

In Russia this rule was introduced by guidelines on assessment of bids and qualification of suppliers, participating in public procurement tenders, which were enacted by the letter of Ministry of Economic Development from June 2, 2000 №AS-751/4-605 (hereafter – Rule 1), and applied before the introduction of the new rules, approved by the Government Decree on September 10, 2009 № 722.

Besides this, under federal law on concession agreements of July 21, 2005 №115-FZ similar rule is used in the evaluation of participants' bids in public-private partnership projects to date (art. 32-5) (hereafter – Rule 2).

We'll apply to the linear scoring rule the algorithm of extended anti-corruption expertise of the first type (*Fig*. 1) and identify whether it is possible to obtain the contract which is best for the basic principal in the conditions of proposed regulation.

3.2. Step 2: Mathematical Modelling of Basic Principal's Preference Order

We will start from the basic principal's preference order modelling[1]. Let us assume that the basic principal is able

1) to formalize the supplied good as a bundle of finite number of its specifications (for the simplicity reasons only, let us include into the bundle the time of delivery, volume and duration of the warranty, operation and, may be, utilization costs and so on)

$$x = (x_1, x_2, \ldots, x_n),\ x_i \in D_i,\ i = 1, 2, \ldots, n,\ \ x \in D \subseteq D_1 \times D_2 \times \ldots \times D_n,$$

there the Cartesian product $A \times B$ of sets A and B is the set of all ordered pairs (a, b), where $a \in A$ and $b \in B$;

2) to point out the feasible sets $\tilde{D}_i$ for every specification:

$$x_i \in \tilde{D}_i \subseteq D_i,\ i = 1, 2, \ldots, n,\ \ x \in \tilde{D} \subseteq \tilde{D}_1 \times \tilde{D}_2 \times \ldots \times \tilde{D}_n.$$

The set of outcomes of the procurement procedure $A = \{(x, p) \mid x \in D,\ p \in [0, +\infty)\}$,

Where: x is a formalized description of the supplied good and p is the price by which a contract is awarded, and its elements (x, p) we'll call, correspondingly, set of contracts and contracts.

[1] This section is simplified consideration of principal's preferences modelling. The more rigour consideration can be find in (Ivanov, 2015).

Denote by p_0 the initial (maximum) contract price which usually should be included into the procurement notice. Let us introduce into consideration the set $\widetilde{A} = \widetilde{D} \times [0, p_0]$, each point of which $a=(x, p)$ is acceptable contract for the basic principal.

Suppose that on a set X $\left(\widetilde{A} \subseteq X\right)$ a preference order $\succeq_{\text{BP}}$ of the basic principal is defined. We put forward the following assumptions about its properties.

1. BPPO is reflexive (Varian, 1992, p. 95): the basic principal is indifferent between every two identical contracts.

Since above we assumed that the bundle of good's specifications contains all specifications essential to the buyer, it is natural to assume that, by comparing the two contracts that match the content, terms and cost of delivery, he considers them as indifferent to each other.

2. BPPO is complete and transitive (Ibid.).

The Russian public procurement legislation demands that contracting authority must be able to rank the received bids on the base of tender documentation. Hence, agent's preferences are supposed to be complete and transitive, and, a fortiori, basic principal's preferences must possess these properties.

Thus, given these assumptions, the preferences of the basic principal on the set of contracts A can be represented by his indifference map – symbolized set of indifference sets of the subject on which the arrow indicates the direction in which lie strictly more preferred alternatives for him (Ivanov, 2015).

Consider a bidding for the purchase of differentiated goods. We restrict ourselves to the case which considers all qualitative characteristics beginning from the second as selecting criteria. This assumption means that any two acceptable contracts $\left((x, p) \in \widetilde{A}\right)$, which differ by values of characteristics x_i (i = 2, 3, ..., n) only, are indifferent to each other.

Thus, the quality of purchased goods may be described by a single numerical characteristic $x_1=q$ and, respectively, any contract can be represented as an ordered pair of numbers: a = (q, p). We assume that q varies in the set $[q_0, +\infty)$ and the contract, which *ceteris paribus* corresponds to the larger value of characteristic q, is strictly more preferred for the basic principal.

Definition 5. We call that contract $a^1=(q_1, p_1)$ dominates contract $a^2=(q_2, p_2)$ ($a^1 \neq a^2$), if both inequalities $q_1 \geq q_2$ and $p_1 \leq p_2$ are true.

Definition 6. We call that the preference order is strictly monotonic[2], if for any contracts a^1 and a^2 such that a^1 dominates a^2 then $a^1 \succ a^2$.

Let us additionally assume that BPPO is strictly monotonic, continuous (Varian, 1992, p. 95) and convex (Ibid, p. 96).

Since by monotonicity assumption an arbitrarily small increase (decrease) of the contract price (*ceteris paribus*) gives to the basic principal a strictly less (more) preferable contract, the set of indifference, representing his preference order, does not contain interior points, and the term "indifference set" may be replaced by the term "indifference curve".

Thus, given assumptions, basic principal's indifference curves are the graphs of strictly monotonically increasing, continuous, concave functions and his indifference map looks like follow.

[2] This definition differs from the traditional definition of strong monotonic preference order (Varian, 1992, p. 96); however, since it does not lead to confusion, the name of the property has not changed.

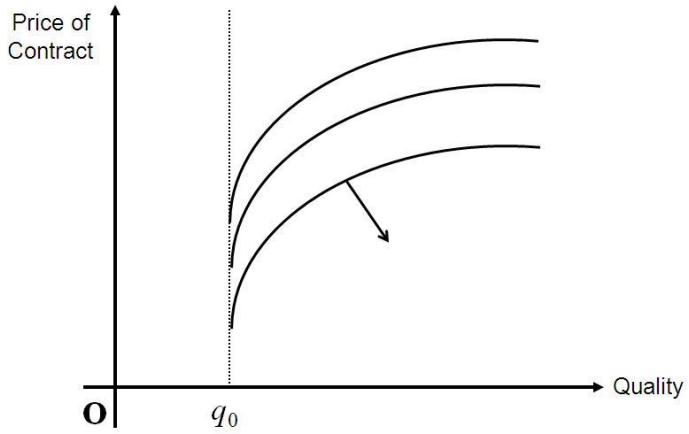

Fig. 4. Basic Principal's Indifference Map: the Case of Differentiated Goods

Thus, the indifference map tells how much extra money society is ready pay for extra quality and how much is not ready.

3.3. Step 3: The Identification of the Principal and Agent

The main features of the modern Russian public procurement system were formed under the influence of PPL-1. After the Law took in force, the Ministry of Economic Development was authorized to develop policy in the public procurement (or, other words, to be a Coordinator of public procurement policy) and the Federal Antimonopoly Service – to be a Monitor of the public procurement. The Coordinator and the Monitor, the Bureaucrats in their nature, played a so active role in interpretation and implementation of PPL-1 that we have to identify them closer to the principal than to the agent.

As a result, the Russian Federation developed a system of regulation of public procurement with the aggregate Principal consisting of political and legal elite, Coordinator and Monitor and the aggregate Agent consisting of regional public procurement authorities and bodies governed by public law.

We refer to the regional public procurement authorities as an agent because, on the one hand, they have a very limited discretion power, and, on the other hand, they were authorized not only to coordinate and control regional public procurement but also to act as a public buyer.

3.4. Step 4: Mathematical Modelling of the Principal's Preference Order

Let us move on the modelling of the principal's preference order if he prescribes to apply the linear scoring rule.

We suppose that there are two awarding criteria (quality and price) and the principal's preference order can be modeled by utility function, which attributes to each supplier's bid $a=(q, p)$ the following score:

$$U(a) = w_q Q + w_p P, \qquad (1)$$

Where: w_q and w_p – the weights of awarding criteria defined by the agent under some restrictions established by the principal,

Q and P – the scores of the same scale, assigned to the values of criteria according to the scoring rule.

Suppose that selecting stage of the tender have passed N ($N > 1$) suppliers with bids (q_1, p_1), …, (q_N, p_N). We designate

$$q_{\min} = \min_{1 \le i \le N} q_i, \quad q_{\max} = \max_{1 \le i \le N} q_i, \quad p_{\min} = \min_{1 \le i \le N} p_i, \quad p_{\max} = \max_{1 \le i \le N} p_i.$$

Let us start from the variant of the rule which was applied in RF for public procurement tenders (Rule 1). In this case the scoring rule takes following expression:

$$Q_i = 1 + \frac{q_i - q_{\min}}{q_{\max} - q_{\min}}(10-1) = 1 + \frac{q_i - q_{\min}}{q_{\max} - q_{\min}} \times 9, \quad P_i = 1 + \frac{p_{\max} - p_i}{p_{\max} - p_{\min}} \times 9, \qquad (2)$$

Where: q_i and p_i – the i-th supplier's quality and price bids, Q_i and P_i – the i-th supplier's quality and price score.

It is clear that for both criteria the Rule 1 assigns to the worst bid score 1, and to the best bid – score 10. For what reason the rule was named "linear scoring rule" stems from the geometric interpretation drawn on the *Fig*. 5a-5b.

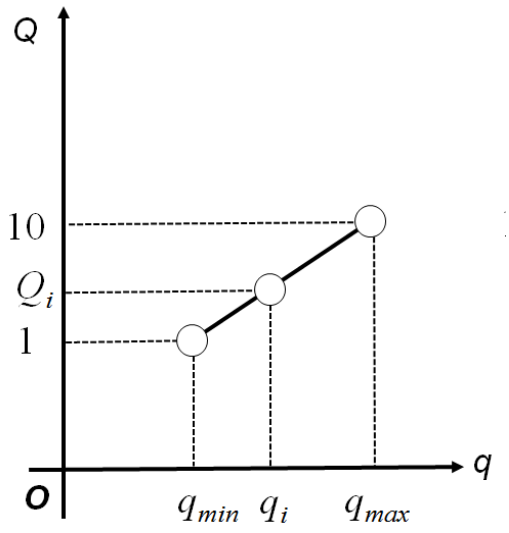

Fig. 5a. Rule 1 for the Increasing Criterion

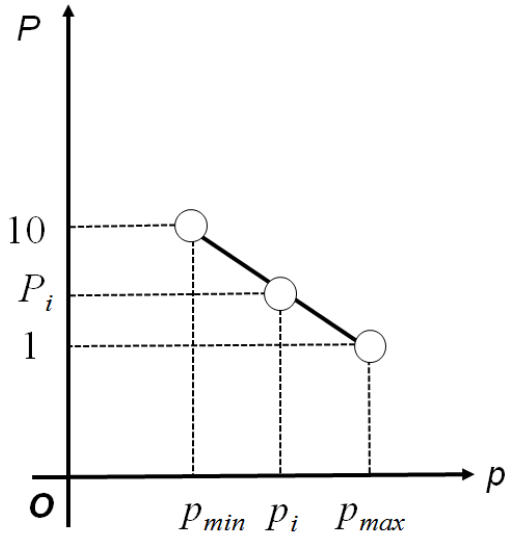

Fig. 5b. Rule 1 for the Decreasing Criterion

Let us consider the variant of linear scoring rule which is applied in RF for concession tenders (Rule 2). In this case the rule takes following expression:

$$Q_i = \frac{q_i - q_{\min}}{q_{\max} - q_{\min}}, \quad P_i = \frac{p_{\max} - p_i}{p_{\max} - p_{\min}}. \qquad (3)$$

It is clear that for both criteria the Rule 2 assigns to the worst bid score 0, and to the best bid – score 1 (*Fig*. 6a-6b).

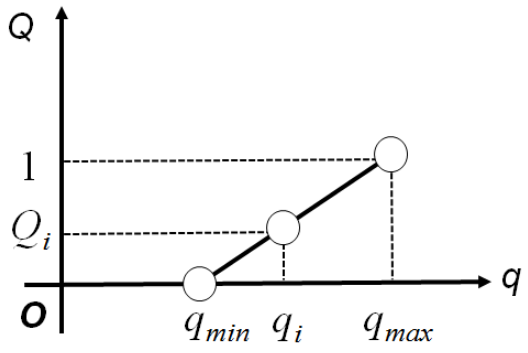

Fig. 6a. Rule 2 for the Increasing Criterion

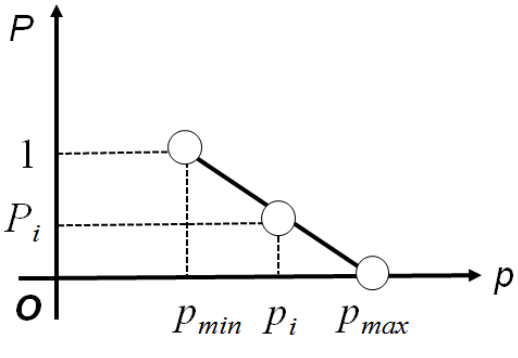

Fig. 6b. Rule 2 for the Decreasing Criterion

Proposition. If the selecting stage of the tender have passed two bidders, and principal prescribes to compare their bids by the linear scoring rule, then the principal is *mala fide*.

Proof. Let us consider an arbitrary contract $a^1 = (q_1, p_1)$ $(q_1 \geq q_0)$. The BPPO can be modelled by the ordinal sets of contract a^1 (strictly better set $B(a^1)$, indifference set $I(a^1)$, and strictly worse one $W(a^1)$) (*Fig*. 7).

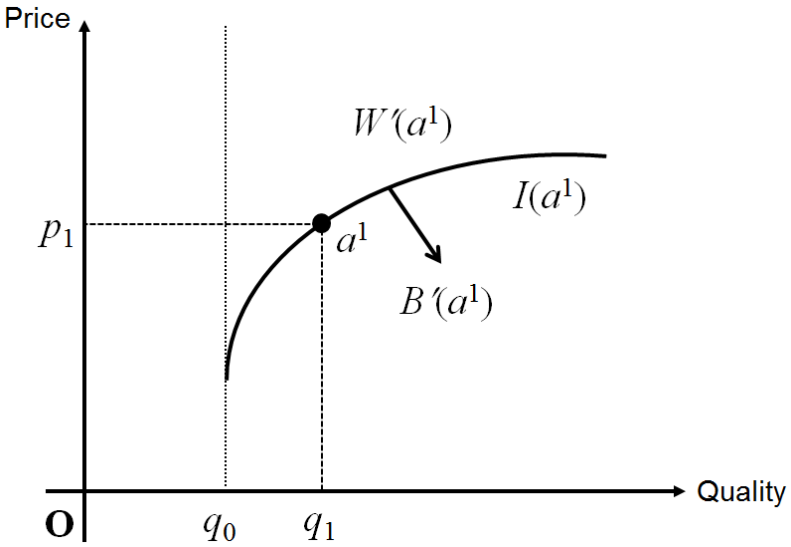

Fig. 7. Basic Principal's Ordinal Sets

Let us consider an arbitrary contract $a^2 = (q_2, p_2)$ $(q_2 \geq q_0)$, different from a^1. The Principal assigns scores to bids following way (1): $U(a) = w_q Q + w_p P$.

We assume that $w_q > w_p$ (the other case $w_q \leq w_p$ is considered the same), and the linear scoring rule is applied in the form of Rule 2 (the other case is considered the same).

We have:

$$q_2 > q_1 \Rightarrow \begin{cases} U(a^1) = w_p \times P_1 + w_q \times 0 < w_q \\ U(a^2) = w_p \times P_2 + w_q \geq w_q \end{cases} \Rightarrow a^2 \succ_P a^1$$

$$q_2 < q_1 \Rightarrow a^1 \succ_P a^2$$

$$\begin{cases} q_2 = q_1 \\ p_2 < p_1 \end{cases} \Rightarrow \begin{cases} U(a^1) = w_q \\ U(a^2) = w_p + w_q > w_q \end{cases} \Rightarrow a^2 \succ_P a^1$$

$$\begin{cases} q_2 = q_1 \\ p_2 > p_1 \end{cases} \Rightarrow a^1 \succ_P a^2$$

Thus, the Principal preference order can be modelled by the ordinal sets of contract a^1 (strictly better set, indifference set (in this case $I(a^1)=a^1$), and strictly worse one) (*Fig*. 8).

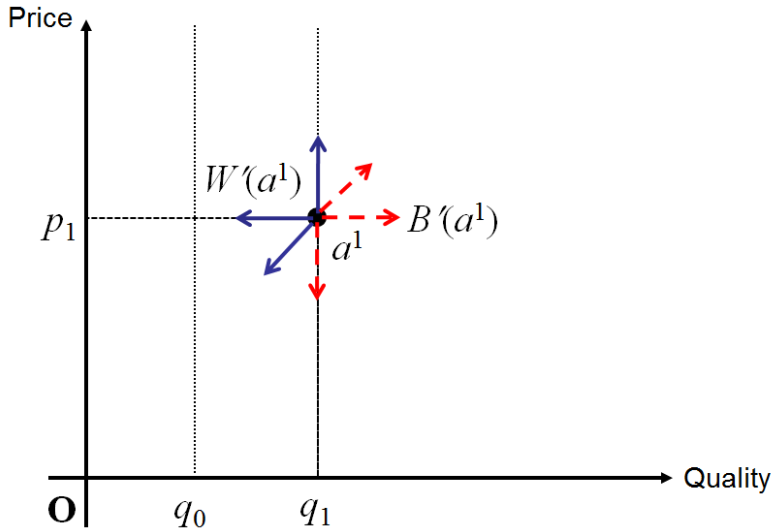

Fig. 8. Principal's Ordinal Sets

Let us introduce into consideration the set $X = W_{BP}'(a^1) \cap B_P'(a^1)$ and the set $Y = B_{BP}'(a^1) \cap W_P'(a^1)$. It is easy to prove that these sets are not empty (we'll prove it for the first set).

Actually, consider the contract $a^*=(q^*, p^*)$, such that $a^* \in I_{BP}(a^1)$ and $q^* > q_1$. Then the contracts $a=(q^*, p)$, $(p > p^*)$ belong to the set $W_{BP}'(a^1)$ and to the set $B_P'(a^1)$ at the same time.

Thus, for any contract $a^2 \in X = W_{BP}'(a^1) \cap B_P'(a^1) \left(a^2 \in Y = B_{BP}'(a^1) \cap W_P'(a^1) \right)$ we have:

$\begin{cases} a^1 \succ_{BP} a^2 \\ a^2 \succ_P a^1 \end{cases} \quad \left(\begin{cases} a^1 \succ_P a^2 \\ a^2 \succ_{BP} a^1 \end{cases} \right)$ (*Fig*. 9).

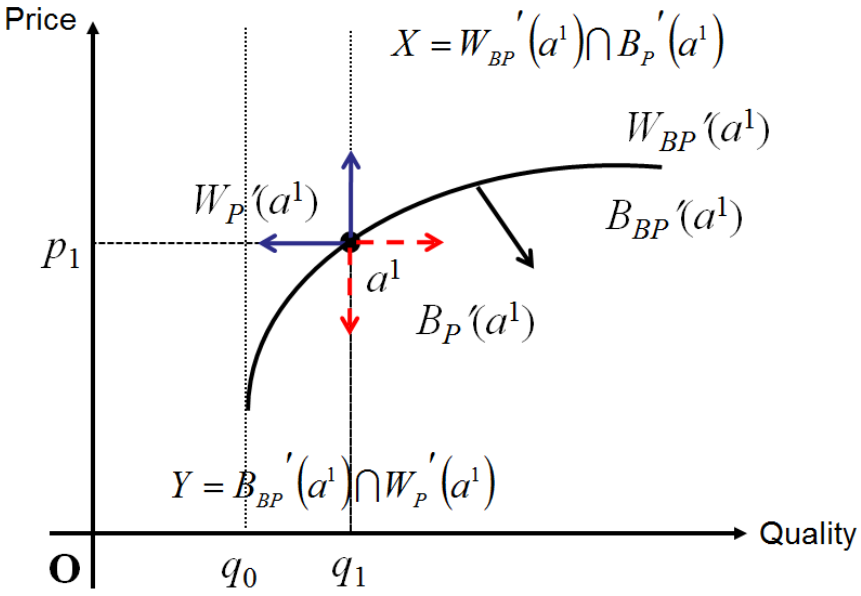

Fig. 9. The Principal's *Mala Fides* Illustration

Hence, according the *Def*. 1, the Principal is *mala fide*.

Thus, if there are only two bidders, the agent by means "Highest bid – Lowest bid scoring" cannot award the contract which optimal for society.

3.5. Step 5: Amendments to the Legal Act

Thereby the amendments in the regulation tool are necessary. It is clear that in the case of two awarding criteria the linear scoring rule can be applied only if three or more bidders are taking part in the tender.

Thus, the Principal may demand from contracting authority to designate in the tender documentation

- the minimum number of suppliers' bids for the tender to be performed (Model Law, 53-j);
- that in the case of two bidders, who passed the selection stage, the other scoring rule has to be applied.

These amendments are especially important for the public procurement system of RF, which is characterized by the lack of competition (*Tabl*. 3).

Table 3

Tenders' Performance in RF (for federal contracting authorities)

	2010	2011	2012	2013	2014
Competition in the tenders (bids/tender)	2.18	2.07	2.04	2.24	2.27

Source: Federal State Statistic Service[3].

After making the corresponding amendments to the guidelines on assessment of bids and qualification of suppliers, participating in public procurement tenders, the principal can move to the traditional anti-corruption expertise, aimed at identifying and eliminating corrupt factors.

4. Concluding Remarks

The paper proves a necessity of changing the approach to anti-corruption expertise: an analysis of opportunities for *mala fide* agent's behavior and evaluation of incentives for his *bona fide* behavior have to be completed by the assessment of possibility of making a best choice for the society in terms of regulation proposed by the principal.

In the paper two different algorithms of extended anti-corruption expertise have been introduced: first one is applied to the new regulation tool (*Fig*. 1), second one – to the regulation tool which has been used and some information on enforcement practice is available (*Fig*. 2-3). In both cases the expertise starts from the modelling of society's preferences and comparing them with the principal's preferences generated by the proposed regulation.

The paper refines the typology of models of corrupt behavior (*Tabl*. 2), based on the methodology of the agency relationships, proposed in (Ivanov, 2015), and clarifies interdependence between type of corruption and aims of agent's behavior modelling in the process of extended anti-corruption expertise.

In the paper the algorithm of extended anti-corruption expertise of a new regulatory tool has been applied to the two legal instruments regulating the determining of a winner in the tender in the RF.

[3] http://www.gks.ru/wps/wcm/connect/rosstat_main/rosstat/en/main/.

The implementation of main steps of the algorithm of extended anti-corruption expertise of a regulatory tool with accumulated enforcement practice (*Fig*. 2-3) can be found in the (Ivanov, 2012), where quasi-corruption model was introduced and applied to the examining of case of using English auctions in RF public procurement, and in the paper (Ivanov, 2015).

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