

Conference Paper

Technology for Automated Search and Detection of Overpriced Road Construction and Repair Public Procurement Contracts

Domashova D. V., Pisarchik E. E., and Lifar A. V.

National Research Nuclear University MEPhI (Moscow Engineering Physics Institute), Kashirskoe shosse 31, Moscow, 115409, Russia

Abstract

The paper presents the results of the use of the technology developed by the authors for automated monitoring of financial and economic events corresponding to formalized typologies of suspicious activity in the area of public procurement developed by the Eurasian Anti-Money-Laundering and Combating Terrorist Financing Group (EAG). For this work, a typology based on deviation of contract price from market price in road construction and maintenance was chosen.

Keywords: public procurement, road construction and repair, AML/CFT, suspicious activity, typology

Corresponding Author:

Pisarchik E. E.

episarchik@yahoo.com

Received: 11 December 2017

Accepted: 20 January 2018

Published: 13 February 2018

Publishing services provided by
Knowledge E

© Domashova D. V. et al. This article is distributed under the terms of the [Creative Commons Attribution License](#), which permits unrestricted use and redistribution provided that the original author and source are credited.

Selection and Peer-review under the responsibility of the FinTech and RegTech: Possibilities, Threats and Risks of Financial Technologies Conference Committee.

1. Introduction

The study examines public contracts in the field of road construction and repair. The subject of the study is automated technology for the search and detection of overpriced public procurement contracts in the sphere of road construction and repair.

The purpose of the work is to develop an algorithm to automate the processes of searching for and identifying foresaid contracts.

According to official representatives of the Accounting Chamber of the Russian Federation, the damage caused by corrupted practices in public procurement sphere is "critical". Construction contracts (buildings, roads, and communications) and other areas with major funding account for the lion's share of these funds.

So far, no publicly available automated technologies for detecting overpriced road construction and repair public procurement contracts have been found. Virtually all information systems, containing information on public procurement, can only be used for the search of relevant documents, rather than for the analysis of price proposals, so the development of such a technology is quite relevant.

 **OPEN ACCESS**

2. Materials and methods

The following main sources of information were used in this research:

- The site of the Unified Information System in the field of public procurement (hereinafter-UIS PP) [1];
- Russian legislation and regulatory documents in the field of public procurement and road construction.

Raw data on public road construction procurement contracts awarded in the Udmurt Republic between 2014 and 2017 used in the study was downloaded from the UIS PP. The data included bid details; contract details; customer and vendor details; contract documents (contract, estimated costs, statement of work).

The statistics on road construction public contracts for road construction and repair awarded in Udmurtia shows that at the end of December 2016 there were 58 open tenders for the construction of the street-road network with total ceiling price of 104 billion rubles. In 2015, the level of procurement in road construction was 1.19 trillion rubles including 44% registered growth of the number of notifications; 22% growth of contracts awarded; 11% growth in budget savings. The largest amount of budget funds was spent on the procurement of construction of roads and motorways, bridges and tunnels. [2]

In addition, in April 2017, the head of Udmurtia Alexander Solovyev was detained on suspicion of having received a bribe in a particularly large amount. Solovyev received a bribe from representatives of a company involved in bridges construction across the Kama and Buy Rivers. In 2016, most of the contracts in the field of road works were awarded to the GUP "Udmurtavtodor". Only one competitive tender had two bidders, other tenders were held involving a single bidder. As it was found out, a deliberately increased procurement order was applied, thus preventing smaller suppliers from participating in the tender. There are also suspicions that all tender requirements were accurately tailored to a specific company - OOO "Avtodormostproekt", and therefore, it was awarded all contracts in the absence of any meaningful competition. [3]

An analysis of the services provided by the Russian companies in the area of road construction and repair indicates that the range of work in this industry is quite broad, and is regulated by the GOSTs and SNIps. To implement the technology for searching and identifying overpriced contracts, it is necessary to define a core list of jobs, thus narrowing the scope of the search. On the other hand, it is necessary to obtain the algorithms that are acceptable for road construction and repair works, including speed,

accuracy of the search and the ability to visualize the results of the “red flag” contracts (contracts with higher prices).

The study examines contracts containing three types of works: overhaul of road sections, repair of road sections and construction of roads.

It was found that the construction and repair work was performed according to the GOSTs and other norms and regulations. In addition, it is known that the contract documents should contain local cost estimates with the list of works to be done, their quantity in units of measure, applicable prices and amounts for the work performed.

Based on the information available, it can be assumed that, in order to find and identify overpriced state contracts in road construction and repair, it is necessary to implement the methodology briefly described below (Figure 1 presents the methodology used to develop the search and identification technology).

First, it is necessary to collect some information from a number of data sources to be processed by the developed algorithm:

- Guidelines FER-No.27 “Roads”-contains lists of road construction and repair works as well as measurement units (“measurements”) [3];
- Ministry of Transportation Order RF No. 402 (November 16, 2012) contains the types of works related to the repair of roads [4];
- official site of UIS PP contains customer, supplier, contract, procurement details. Contracts contain available downloadable contract documents. Available contract documents usually contain a State or municipal contract file, Scope of Work, and a local costs estimate (based on which the contract price is calculated);
- an additional source is needed for manual verification and testing of the methods of searching and identification of overpriced contracts/bids. Such sources could include price lists on the websites of companies working in the area of road construction and repair.

Secondly, the information collected must be pre-processed. The data obtained from UIS PP is unstructured. Therefore, both a database structure and a conversion methodology have to be developed.

Thirdly, it is necessary to develop and implement an algorithm to:

- download contract documents from UIS PP;
- search for files with local cost estimates;
- search local cost estimates for types of works contained in the FER-No. 27 Guidelines;

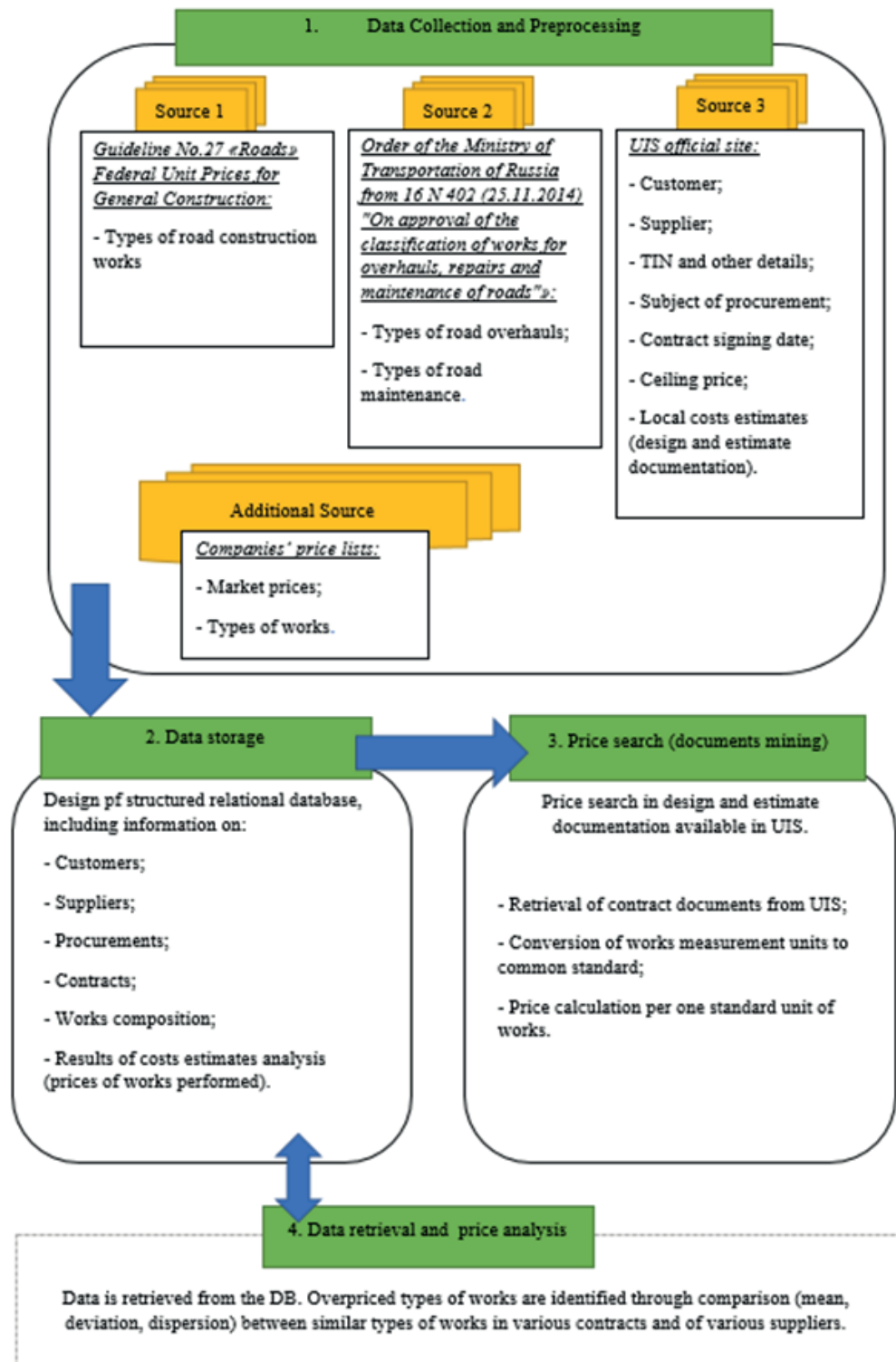


Figure 1: Price search and identification methodology.

- convert a type of work unit of measurement to a common unit of measurement;
- calculate a unit price of the work performed.

Retrieved prices for similar work types from multiple contracts can then be compared. It is possible to apply different filters and to seek patterns in the pricing of road construction and repair.

The final step is retrieving calculated prices for the composition of the work from the database. This is necessary for subsequent analysis to identify overpriced types of work by comparing similar types of work from different contracts.

3. Results

The database needs to be organized to implement collection of information. The DB tables should record the information received from UIS PP and FER-No.27 Guidelines (details of contracts, procurement, suppliers and customers, composition of the work from the Guidelines.) Moreover, the linking of the composition of work within a contract to the contract itself will allow to analyze a specific procurement to find out whether it was overpriced, or not.

Within the algorithm, downloading of contract documents containing the estimated costs calculations and contract files from the official source should be automated. The documentation that is being downloaded can consist of both the archive files and the Word or Excel files, so the system must support all required formats.

Processing of a large number of contracts requires development of a structure for the files that are being downloaded. Also, if the archive is loaded, it must also be unpacked. Thus, a separate folder will be created for each contract, including all the documents stored in UIS PP.

A "strict matching" method is used to identify the types of works from the contract costs estimates. Identified works should be converted to a common unit of measurement, and then the price per unit of such work should be calculated. The price received should be saved in a separate table, together with an indication of the type, as is stated in the Guideline.

In order to search for and identify overpriced public procurement contracts, a computer program has been developed that addresses the following tasks:

- retrieving state contract files from UIS PP;
- unpacking ZIP files containing contract documentation;
- scanning Microsoft Word and Excel documents to search for the price of a specific type of work within the contract documentation (costs estimates) and its respective price in FER-27 Guidelines;

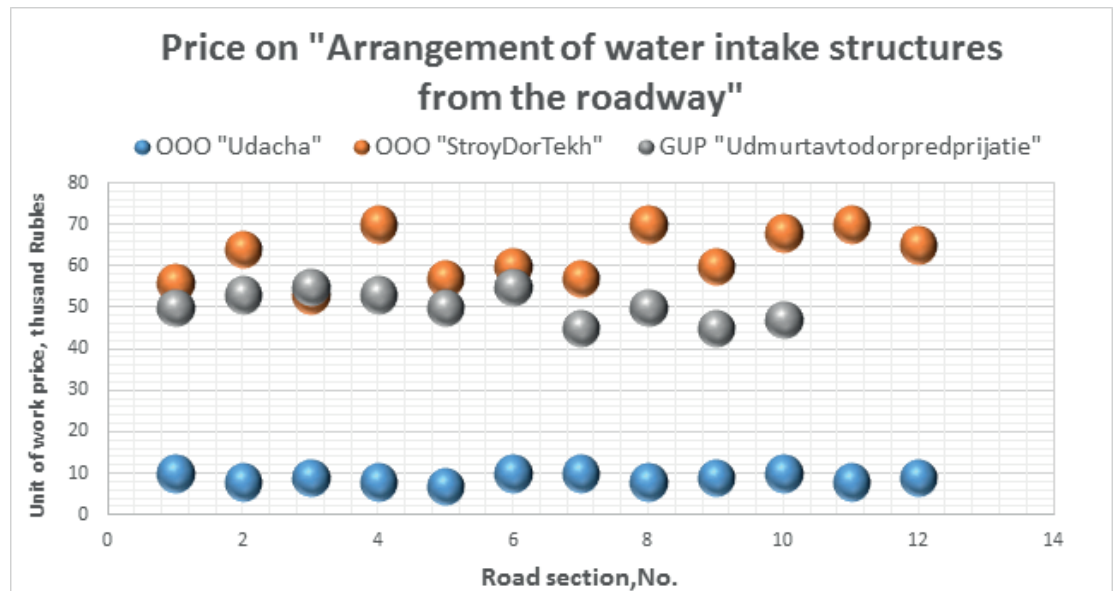


Figure 2: Correlation between work unit prices, road sections and suppliers.

- saving the search results for a specific contract in a separate table "contract-Works"
- saving the contract, purchase, contractor, and customer details in the relevant database tables.

4. Discussion

The data in the database can be exported directly to the table editor from the database. Below are various presentations of visualized information obtained with the help of the developed technology on the types of work and their prices in the contracts.

Figure 2 shows correlation between work unit prices, road sections and suppliers. The price is calculated for the unit of "arrangement of water intake structures from the roadway" work. The Y-axis contains unit price in thousand rubles. The X-axis contains road sections, as specified in the contract. As can be seen, the price of the contract signed with OOO "Udacha" is lower than that of the other two companies performing the same type of work.

Figure 3 shows correlation between work unit prices, contract prices and suppliers. The price is calculated for the unit of "dismantling of coverings and bases of crushed stone" work. The Y-axis contains unit price in thousand rubles. The X-axis contains

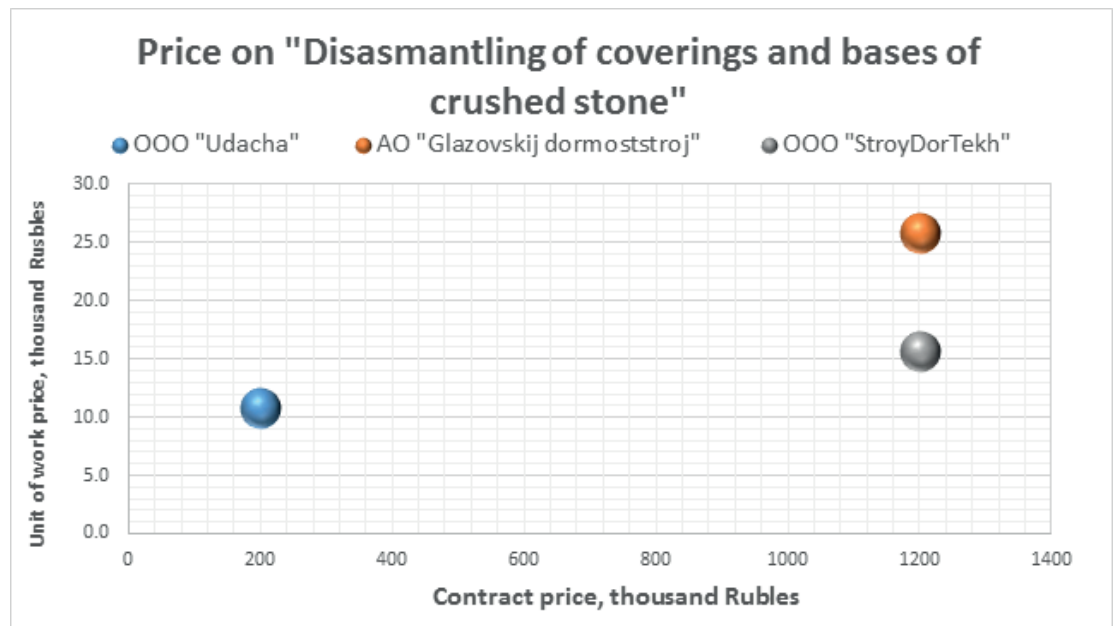


Figure 3: Correlation between work unit prices, contract prices and suppliers.

contract price. The graph shows that the contract signed with AO "Glazovskij dormostroj" costs more to the budget than other two contracts signed with two other vendors for the same type of work.

Figure 4 shows correlation between work unit prices, road sections and suppliers for the unit of "assembly of side stones" work for road sections. A comparison was made between three different contracts, where three different suppliers performed the same work under state contracts. The Y-axis contains prices per work units in thousand rubles. The X-axis contains road sections as specified in the Scope of Work. Judging by the information presented, the GUP "Udmurtavtodorpredpriyatie" has higher prices for the unit of work than the rest of the companies.

5. Conclusion

An automated technology for search and detection of overpriced public contracts in road construction was developed. The technology is implemented using PHP 7.1 programming language and MySQL 5.6.

The advantage of an automated approach to searching for and identifying overpriced public contracts is mainly to reduce the time: it speeds up the process of analyzing the estimated documentation. The contract files are automatically saved from UIS PP, analyzed, and then, according to the algorithm, the unit price is calculated.

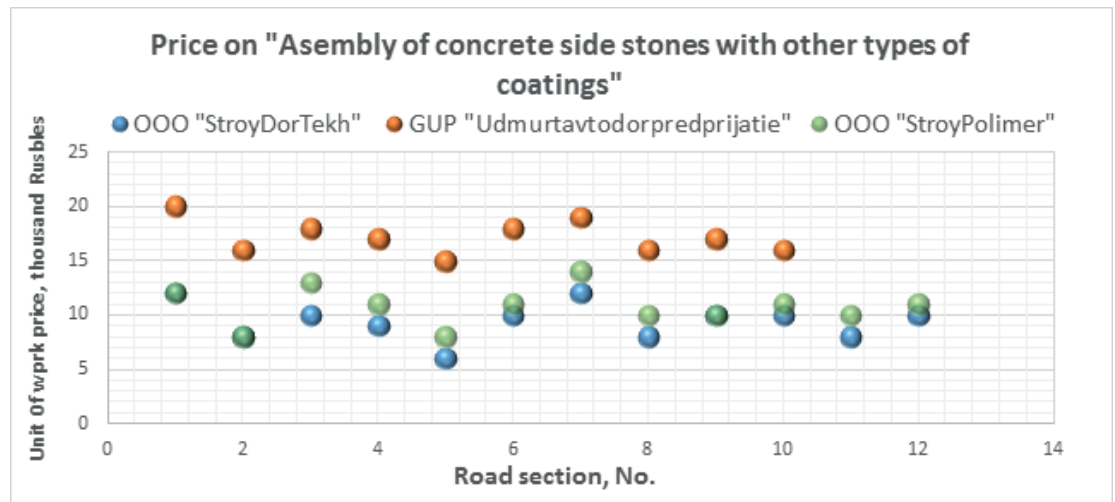


Figure 4: Correlation between work unit prices, road sections and suppliers.

The results of this study can be used by law enforcement agencies and FIUs to search for and identify signs of fraud and corruption in the execution of the state order in the organization and execution of construction work, repair, overhaul of roads, based on a comparative analysis of the prices of the public contract to market prices for similar work.

Acknowledgements

The study was supported by a program to improve the competitiveness of the federal State autonomous educational institution of higher education, the National Research Nuclear University of Institute.

References

- [1] The Moscow authorities would spend 136 billion rubles on road construction in 2017, [electronic resource].- Vedomosti - Access mode: <https://www.vedomosti.ru/realty/articles/2016/12/26/671194-moskvi-dorozhno-stroitelstva> (accessed May 29, 2017).
- [2] Federal unit prices for construction work FER-2001 Guidelines 27 Roads [electronic resource]. - Consortium Code: Tehjeksport-access Access mode: <http://docs.cntd.ru/document/1200032370> (accessed May 29, 2017).
- [3] Unified information system in the field of procurement [electronic resource]. - Official Site - Access mode: <http://zakupki.gov.ru> (accessed May 29, 2017).

- [4] The Head of Udmurtia Alexander Solovyev Is Apprehended [electronic resource].
– Kommersant.ru – Access mode: <https://www.kommersant.ru/doc/3261407>
(accessed – May 29, 2017).
- [5] Order of the Ministry of Russia from 16 N 402 (25.11.2014) “On approval of the classification of works for major repairs, repairs and maintenance of roads” [electronic resource]. – Consultant Official Website access mode: http://www.consultant.ru/document/cons_doc_LAW_146832/ (accessed November 17, 2017)