ECONOMICS

Modelling and Optimisation of the Business Process of Documentary Support of Cargo Transportation for Building a Digital Document Management System

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ABSTRACT

The objective of the work is to analyse the examples of optimisation of documentary support system regarding rail cargo transportation based on the transition to the electronic form of documents.

The theoretical concept of modelling the business process of documentary support of cargo transportation is developed using the ARIS (Architecture of Integrated information Systems) software, which is used for development of an integrated process model of the activities of many manufacturing and transportation companies in Russia and in the world [1].

The subject of the research is modelling of the document circulation system supporting cargo transportation to eliminate losses in a significant part of the processes of interaction with customers. The objective of business process modelling is to use all the advantages and functionality of case tools to eliminate duplication of actions and operations that do not add value to the customers of the transport company but reduce their loyalty to the products and services of railway transportation. The studied business processes ensure formation of an application for transportation and its transformation during the transportation process.

The study reflects the results of modelling business processes for documentary support of transportation in digital form. A comparative analysis of these models is followed by description of the advantages of the electronic documents in comparison with their paper form considering a possibility of using a digital signature.

Keywords: electronic document management, digital technology, modelling, business process, railway transportation, cargo transportation support.

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INTRODUCTION

Modelling of processes in any type of business, and especially in the transport sector of the economy with a predominant character of end-to-end technologies, is aimed at improving business processes and indices that serve as indicators and drivers for improving organisation performance. Modelling is one of the *methods* for analysing and improving movement of documents in an enterprise. Modelling is a description, identification, simulation and analysis of business processes, design of new processes for the purpose of their subsequent optimisation.

The cargo transportation is among core railway business processes having significant impact on economic indices of the companies in this industry. Hence, it is quite natural that cargo transportation have become one of the first fields for testing and implementing digital technology, modelling many processes including those related to document management that plays an important role in formalising relationships with cargo owners, regulatory bodies, as well as immediately during the transportation.

Research and design of information support processes for cargo transportation using modelling tools allows to:

• Represent visually, graphically the structure of the information support system for interaction with shippers.

• Describe in detail the functions of the document management system.

• Identify potential opportunities for development of document management technologies regarding railway customers.

• Identify and to analyse information links with internal and external participants in the documentary support of the transportation process.

• Optimise the technological operations of working with documents, their sequence, using the technology of describing workflows.

Modelling allows us to simplify the electronic document management system as much as possible, reflecting its most important properties and resources, which helps to eliminate losses in the business process of document circulation when using the instrumental environment as a means of optimisation and forecasting. The model, drawn up in a standard form, makes it possible to design a future process before it is reproduced in the form of software and hardware systems, which will reduce the cost of its creation

[2]. A visual representation of processes of receiving and processing information on formation of an application for transportation and its approval will eliminate the losses in efficiency and time while processing transportation documents [3].

Business modelling uses mathematical methods based on operations research (OR). The purpose of OR is to find a rational way of acting in solving organisational and managerial problems under various constraints. These problems include many linear and dynamic programming problems, inventory management, queuing theory, etc. Modern concepts of business modelling are based on a process approach to management. A huge number of publications of the theoretical nature are devoted to the process approach and implementation experience [4; 5]. The publications contain samples of business modelling, which use tools for various types of production systems and technologies [6; 7]. Thanks to the process approach and business modelling methodology, a business can be described as a set of processes, each of which can be optimised based on quality management standards, as well as on approaches allowing to eliminate losses and operations that do not add value to the customer.

The instrumental modelling tools are implemented with numerous software packages that are designed for various fields of activity. In the field of «software development and software engineering, one of the ways to represent processes is CASE (computer-aided software engineering) method» [8], which includes a set of methods, software engineering tools for software design, helping to ensure high quality support of software information systems and products [9; 10].

CASE-tools are tools designed for optimal automation of design and development processes not only for software from the standpoint of the developer's labour costs, but also for processes in other areas of activity, in particular, for describing the technologies of transportation processes. At first, CASE tools were considered only as tools that were designed to simplify the most complex and time-consuming processes of analysis and design of information systems. However, after introduction of ISO/IEC 14102 standard, CASE tools began to be defined as software tools to support the life cycle processes of digital services and software products [11].

This concept, «as a rule, is determined by the list of tasks that can be solved, as well as by set of methods and means» [12, p. 44], or, in other words, by the algorithms and formats used for describing processes for automation. CASE technology is «the totality of methodology of analysis, design, development and maintenance of complex software systems, supported by a set of interconnected automation tools» [12, p. 44].

The functional purpose of software products that are used to automate business processes of enterprises can be divided into three types: integrated corporate systems, electronic document management systems and software products for formalised presentation of business processes.

Electronic document management systems perform the functions of accounting, transfer, and storage of documents, which is of particular importance in the transport sector, where shipping documents are the basis for paying for a special type of product which is transportation, that cannot be saved or returned to the contractor.

Business process modelling software is commonly used in an organisation's reengineering projects. The same products can be used for reengineering an electronic document management system.

Process modelling starts «at the stage of analysing the requirements and constructing the relationships and structure of operations that make up the value stream in the process. These are the most poorly formalised and time-consuming stages in development of management and control systems. When any management system is being developed, the task of choosing a design tool arises, which should allow to effectively and competently solve the assigned tasks and meet all the requirements of the designers» [13]. The choice of a CASE tool largely depends on the methods of analysis and design of intelligent systems.

To support the point, we can refer to extended quotation of K. S. Myshenkov's work [13]: «Functional models perform the functions of a structured image of the environment or system, information and objects that connect these functions. These models are used when designing a new system, when analysing system requirements, when making decisions about reengineering a management system for analysing business processes.

Data flow models are needed for graphical structural analysis that describes processes external to the system, data receivers and sources, data flows and data storage devices that are being accessed.

Business process models contain a description of workflows, business functions, departments, resources, processes, roles, media, information systems, positions. In this case, the models can be both static and dynamic since they describe the sequence and conditions for implementation of business processes. Business process models are used in implementation of management systems in enterprises, in description and reengineering of the company's activities, in analysis and definition of system requirements.

Event data models reflect the functioning of the system as of a set of states of business units or objects of labour, including significant system events aimed at their transformation. Information models of a specific subject area or its objects reflect the data structure of the systems being designed» [13].

Static models of business systems do not reflect dynamics over time. Such models have forms of presentation that at all stages of reengineering refer to classes, diagrams, components or objects of the system and their relationships with each other. Dynamic models are used for analysis, reflect the sequence of performance of system functions over time, as well as the process of changing the states of a real or projected system [13].
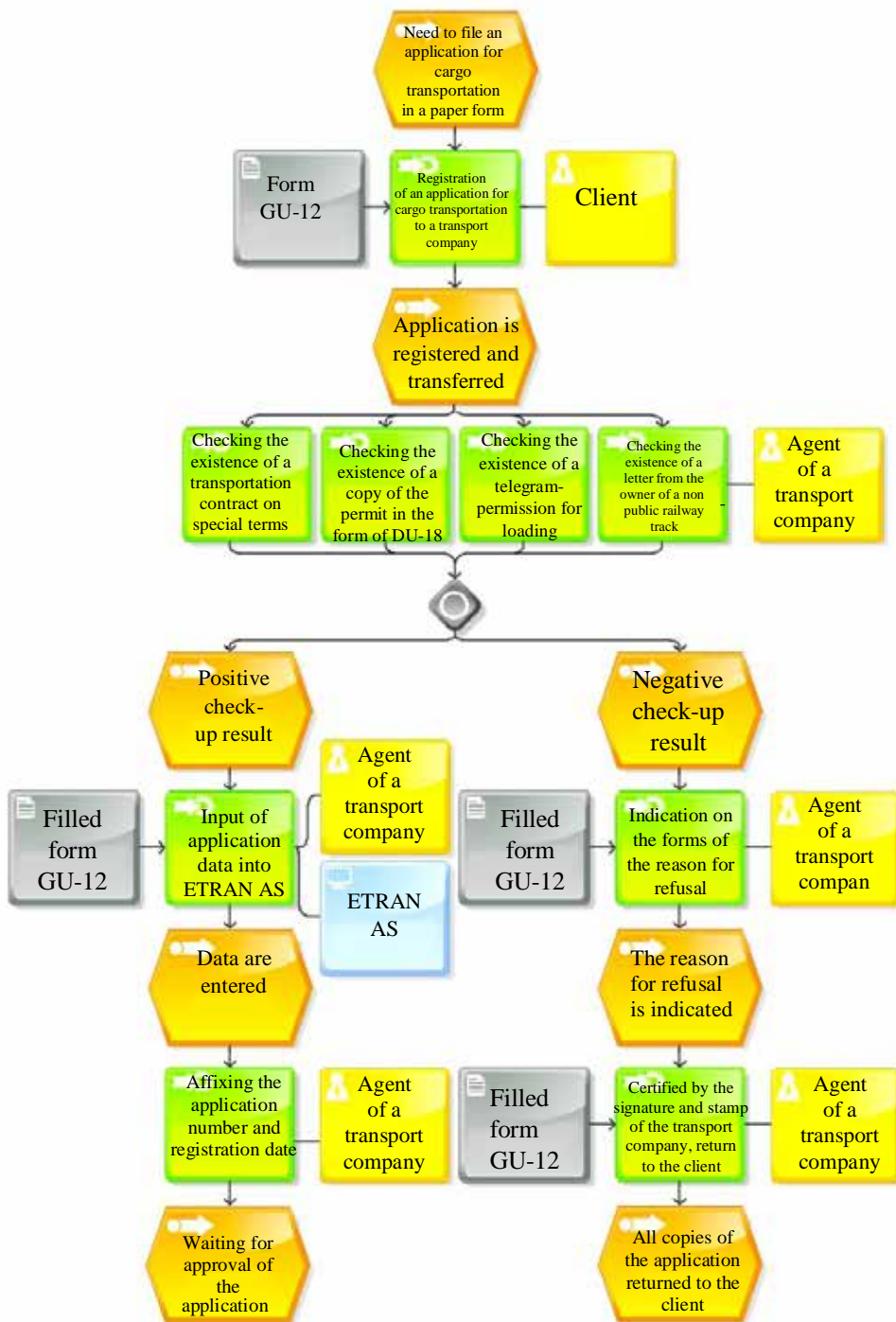
If we consider the example of Russia, then the most common software products for «modelling business processes according to the research company Gartner, which specialises in analytics of the information technology market, are the Corporate Modeler Suite and ARIS [1] systems provided globally by Casewise and IDS Scheer AG respectively. Corporate Modeler Suite occupies a leading position in a number of countries, but this tool, unlike ARIS, is not yet popular in the Russian market» [14].

The *objective* of the study described in the article is to consider an example of optimisation of the process of documenting cargo transportation.

The research *method* is based on ARIS (Architecture of Integrated information Systems) toolkit. ARIS has a set of software services for building a process map; several notations for describing models, namely: eEPC (extended event driven process chain) and «business

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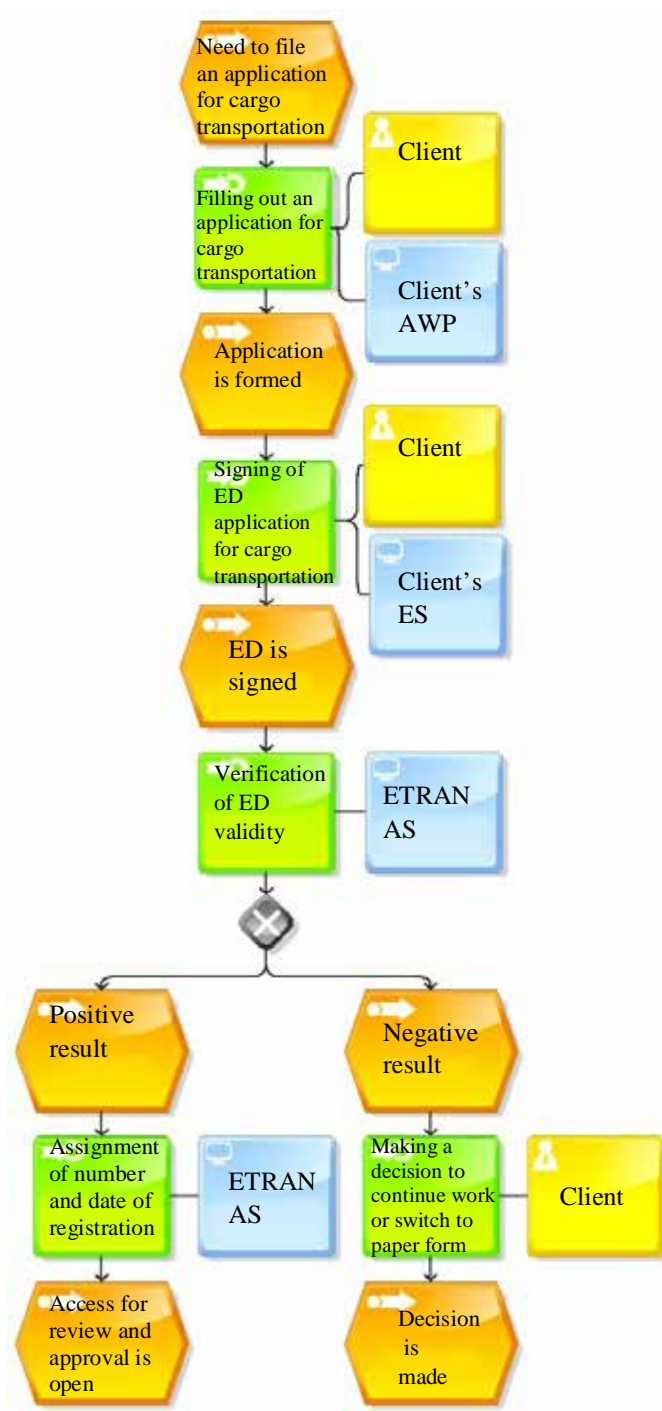
Pic. 1. The process of filing an application for transportation of goods with paper documents (compiled by the authors).

process models in BPMN notation (Business process model and notation). As part of the business capabilities of ARIS product, Smart Design function is also included, which allows us to quickly enter the necessary data for the automated creation of models» [5].

RESULTS

The main purpose of applying the methods of modelling the business process of workflow is to increase its operational efficiency, to organise data transfer in the most optimal way, resulting in decrease in time, labour, and material

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Pic. 2. The process of filing an application for transportation of goods using electronic signature (ES)(compiled by the authors).

losses, and in an increase in the level of transportation and logistics services and competitiveness.

ARIS workflow business process modelling toolkit considers the organisation from the following five aspects: «products and services, processed data, functionality, organisation, structure of business processes. These aspects are further subdivided into three sublevels: specification description, requirements description, implementation description. When describing business processes, about 80 types of

models are used, each of which refers to one of the aspects. The main principle in ARIS is the ability to integrate models of different types within one repository by detailing objects. As a result, any organisation can be described using a hierarchy of models»: from, i. e., top-level processes to the «level of procedures and resource environment of functions» [15].

Models of the application process for transportation of goods are presented below, developed using the ARIS toolkit (Pics. 1 and 2). Comparison of business process models of document flow clearly shows the effectiveness of the electronic form of shipping documents in comparison with the paper one. To make the examples more detailed, we used some of the procedures and forms of documents used on JSC Russian Railways network.

The electronic form of documents neutralises several repetitive iterations in the course of approvals and corrections of documents, while significantly reducing time for processing documents and simplifying the approval procedure. In particular, registration of an application for transportation of goods, with paper document circulation, is reduced by eight operations performed by the agent of the transport company when filling out an application in electronic form. The entire process of approval, including five outcome options (transfer of an application with the result of approval, refusal of a partially agreed application, withdrawal of an application for transportation of goods, refusal to fulfil an agreed application, refusal to fulfil a part of an agreed application) is reduced to one client's action: entering information into the AWP (automated workstation).

The obvious advantage of electronic document interchange is the absence of the need for a customer to visit the company to confirm each operation for filing and correction of the document. The current level of technology does not allow interacting with shippers in any other way from the point of view of the client-oriented strategy of railway transport.

ETRAN (Automated System «Electronic Waybill») AS is intended to electronic document interchange in an organisation that provides for an electronic signature. Form GU-12 indicated in Pic. 1 is an application for railway transportation of goods submitted by the consignor for transportation of goods; form DU-18 is an application for transportation of goods.

The electronic document interchange system allows us to completely abandon such operations as:

• Filling of paper copies of the document.

• Unnecessary travelling of the client's representatives associated with the need to deliver paper forms.

• Correction of errors that occur when filling out forms.

• Processing associated with affixing of stamps and written filling of paper forms of documents.

• Automatic entry of data and printing of documents using a system of centralised preparation and execution of documents for transportation.

• Checking the correctness of filling and availability of the necessary documents.

• Affixing stamps and filling out the paper form in writing.

• Storage of copies of documents.

• Unnecessary travelling of the transport company employees associated with transfer of the document to the responsible agent.

• Verification by the agent of the transport company of the authority of the consignee's representative.

CONCLUSIONS

As a result of abolition of the paper form of shipping documents, time of all the participants in the transportation process, labour and material resources of the companies are saved.

Graphical reflection and comparison of existing models of the system is not an end task itself. The analysis of presented models allows planning further adaptive transformations and forming the architecture of the digital document interchange system, which should ensure the efficiency the use of resources, processes, as well as the market efficiency of the company.

The choice of ARIS tools in building these models is due not only to its ability to create an organisation model, but also to the ability to conduct a sufficiently in-depth analysis of business processes. ARIS allows us to look at the organisation and understand where the bottlenecks of the processes have arisen, which resources are inefficiently used, and which business process chains need to be changed. Various ARIS modules allow us to dynamically consider all kinds of scenarios for execution of business processes without changing the real structure of the organisation.

Through the analysis of business processes and the definition of a conceptual scheme, it is possible to determine the main goals of the business, and before that, to identify new business processes that will need to be designed, as well as to identify weaknesses. In addition, using strategic analysis of business processes, it helps to calculate what new information technologies are possible and appropriate for implementation in the company's activities [16].

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