REAL TIME ECONOMY ECONOMIC IMPACT STUDY FINAL REPORT

Procurement: Real time economy economic impact study (215632)

tieto EVRY

Contents

Definitions and abbreviations

DEFINITION NAME	EXPLANATION
CMR	The United Nations Convention on the Contract for the International Carriage of Goods by Road, or *Convention relative au Contrat de transport international de Marchandises par Route*.
DIGINNO	Digital Innovation Network 2017–2020 is a collaboration of governments and private businesses in the Baltic Sea Region co-funded by the European Regional Development Fund. It is part of the field of action of innovation of the EU strategy for the Baltic Sea region and is focussed on the development of digital economy and the digital single market of the EU in the Baltic Sea region. Three cross-border pilot projects have been initiated within the framework of the network in the fields of e-receipts, e-delivery notes (eCMR), and customer due diligence ('Know Your Customer', KYC).
IPCC	Intergovernmental Panel on Climate Change, which is an intergovernmental research organisation operating under the auspices of the United Nations.
ISO 11783	A family of standards which is concerned with the data exchange processes of agricultural machinery, the data structures and technological solutions, as well as other related issues.
GHG	Greenhouse gas which, for the purposes of this project, includes carbon dioxide (CO_2), methane (CH_4), and nitrogen dioxide (N_2O).
MTA	The Tax and Customs Board.
NIR	National Inventory Report.
RTE	Real Time Economy Real time economy is a digital ecosystem in which transactions occur between different participants in the economy in real time or close to real time and with the help of an automatic, standardised, structured, and machine-readable dataset.
GDP	Gross domestic product is an indicator of the economic situation of the population of a country which reflects the difference between the total value of the goods and services produced and the value of the goods and services spent on the interim consumption in the course of the production thereof.
TSD	Tax returns for the income and social tax, contributions to mandatory funded pension, and unemployment insurance premiums.
TÖR	Employment register.
UNECE	The United Nations Economic Commission for Europe, see https://www.unece.org/info/ece-homepage.html
XBRL (GL)	Extensible Business Reporting Language (Global Ledger) is a structured, XML-based format used for the transmission of information and it is suitable for faster and more efficient transmission, processing, and analysing of business and finance information at lower costs.
XML	Extensible Markup Language.

1. Purpose of the document

The purpose of this document is to provide an overview of the different impacts of RTE solutions. Those impact assessments can be taken into consideration in policy formation.

The target group of the document are the experts who are involved in policy shaping and are familiar with the methods for conducting economic, impact, and business analyses. It is also important to be familiar with the meanings and calculation logic of the economic indicators published by Statistics Estonia, incl. the logic of calculating GDP.

The study was conducted within the framework of public procurement no. 215632 and is based on the requirements of the public procurement.

The outcomes of the study include the final report, information sheets, and an impact calculator, which was used to calculate all macroeconomic indicators presented in the study.

2. Descriptions of business processes

The work involved analysing various different RTE solutions and the following processes related to the solutions:

1) e-invoices;

2) e-receipts;

3) automation of reporting by using XBRL GL;

4) real-time economic forecasts;

5) automation of the processing and movement of the data of agricultural machinery;

6) E-logistics, real-time delivery chains (based on the example of an electronic delivery note).

The processes were analysed at the micro level, i.e. at the level of undertakings and the processes occurring between undertakings. The results were finally expanded to the macroeconomic level by using various different numerical values, such as the number of invoices per year, the number of receipts per year, the number of shipments per year, and the number of reports submitted to the state per year, as well as the number of fields.

Processes were described based on information received in the course of interviews conducted with the experts of the Tax and Customs Board, Statistics Estonia, the Association of Estonian International Road Carriers, the Ministry of Economic Affairs and Communication, the Agricultural Research Centre, the Police and Border Guard Board, Tieto Estonia AS, and the Estonia Assembly of Accountants, who have long experience in the fields covered.

Please note! The descriptions of the stages of the processes are provided in the tables in the alphabetical order of the names of the stages.

2.1. E-invoices

Submission of e-invoices (electronic invoices) is the transmission of an electronic document between the seller and the buyer. An e-invoice is an invoice which is issued, sent, and received in a structured data format which allows automatic and electronic processing of the invoice.

Below, we present a diagram of the process of e-invoices and explanations of the content of the stages of the process presented in the diagram.

E-invoices replace the invoices printed on paper, but also the electronic invoices in the PDF format. This work involved identifying the impacts which accompany the replacement of an invoice in the PDF format with an e-invoice. It was presumed that paper invoices are used rarely today.

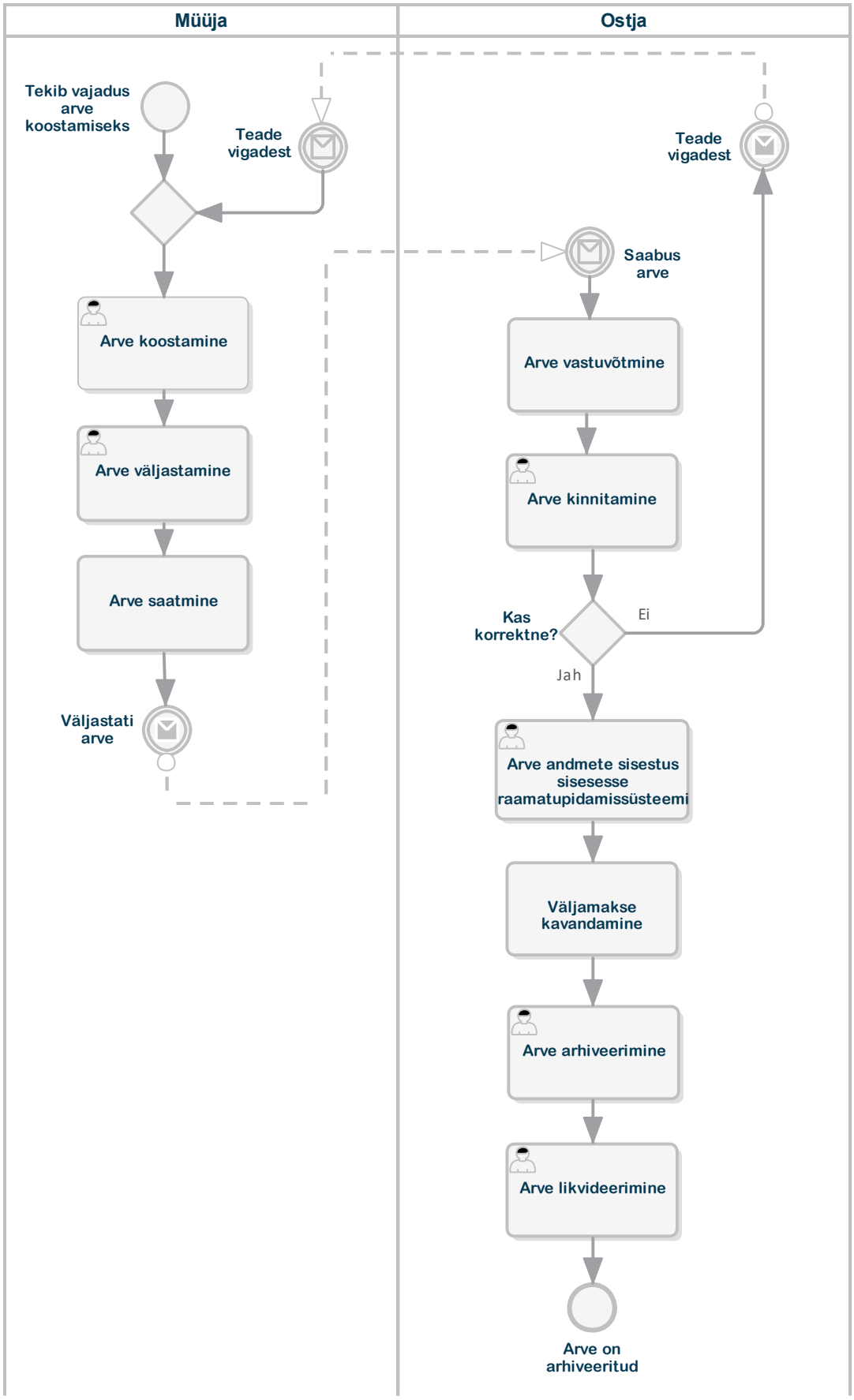


Figure 2.1. The diagram of the process of an e-invoice

Müüja – Vendor

Ostja – Buyer

Tekib vajadus arve koostamiseks – A need to generate an invoice

Teade vigadest – Error message

Saabus arve – Invoice received

Arve koostamine – Generating the invoice

Arve vastuvõtmine – Receiving the invoice

Arve väljastamine – Issuing the invoice

Arve kinnitamine – Approving the invoice

Arve saatmine – Sending the invoice

Kas korrektne – Accurate?

Ei – No

Jah – Yes

Väljastati arve – Invoice issued

Arve andmete… – Entry of the details of the invoice into the accounting system

Väljamakse kavandamine – Planning the payment

Arve arhiveerimine – Archiving the invoice

Arve likvideerimine – Disposal of the invoice

Arve on arhviveeritud – Invoice archived

Table 2.1. Description of the stages of the process of using an e-invoice

PROCESS STAGE	EXPLANATION
DRAWING UP THE INVOICE	The seller draws up an invoice to document a transaction. By an invoice, we mean the invoices the processes and data composition of which are compliant with the EU e-invoice standard (https://www.evs.ee/tooted/evs-en-16931-1-2017+a1-2019). In the case of some invoicing schemes used in Europe, the buyer draws up their own invoice and immediately sends it to the tax authority. This scheme is not commonly used in Estonia.
ISSUING THE INVOICE	The invoice is issued to a transmission system which may be one of the following: 1) an e-invoice operator which sends the invoice to the recipient via an electronic channel; 2) an operator of paper invoices which prints invoices on paper and sends the invoice to the recipient(s) by mail or e-mail which involves issuing a PDF file or a file in a similar format which can be used by a regular computer user;

	3) a bank which makes the invoice available to the recipient in the online bank.
SENDING OF THE INVOICE	The channel chosen by the issuer of the invoice transmits the invoice to the recipient or recipients depending on how many recipients have been specified. The recipients may be the person required to pay the invoice and the provider of accounting services who will register the invoice in the accounting. Depending on the channel for transmitting the invoice chosen by the party issuing the invoice, the following sub-operations are performed in the course of sending an invoice: 1) In the case of an e-invoice, the e-invoice is checked in the channel to make sure that the dataset is compliant and the recipient of the invoice is included in the network. The seller is notified of any deficiencies. 2) In the case of mailing the invoice, the invoice is mailed and, if the address is accurate, the invoice will generally reach the recipient. 3) In the case of sending the invoice directly to the bank, the dataset of the e-invoice is checked and, in the case of any issues, the party issuing the invoice is notified. 4) Any invoices not in the e-invoice format are e-mailed. A link for downloading the invoice or the entire invoice in the PDF format may be sent.
RECEIPT OF THE INVOICE	Depending on the channel used for sending the invoice, receiving the invoice involves the following: 1) checking the compliance of the e-invoice and registration of the invoice in the accounting or in the system of processing invoices; 2) in the case of a mailed invoice, the invoice is received manually and the data of the invoice may also be entered manually into a record-keeping system or the online bank; 3) if an invoice is e-mailed, the invoice is registered automatically in the document management system or received and checked manually; 4) in the case of receipt of the invoice by a bank, the invoice may be automatically paid.
APPROVAL OF THE INVOICE	Larger undertakings and state agencies conduct a procedure for approving the invoice.
ENTRY OF THE DETAILS OF THE INVOICE IN THE INTERNAL ACCOUNTING SYSTEM	If the invoice was received on paper or automatically as a non-readable file, the invoice is entered manually into the accounting system or in the online bank if the recipient is not an accounting entity.

PLANNING OF THE PAYMENT	All recipients of invoices plan the payment of the invoice which generally consists of determining the payment data and finding the funds required or holding negotiations with the issuer of the invoice.
ARCHIVING OF THE INVOICE	After entry into the accounting system and drawing up all the summaries and reports required, invoices may be archived.
LIQUIDATION OF THE INVOICE	Invoices are also regularly liquidated, which may mean processing the invoice as waste or deletion of the details of the invoice from the information system. Liquidation may occur at any time but, in the case of an accounting entity, not before seven years after the end of the financial year in which the invoice was issued.

2.2. E-receipts

Generating an e-receipt means the exchange of an electronic document between the seller and the buyer upon purchasing goods or services. An e-receipt is a receipt which is issued, sent, and received in a structured data format which allows automatic and electronic processing of the invoice.

An e-receipt project led by Omniva (https://kviitung.ee/) is being carried out by an international consortium which includes Telia Eesti AS, Trinidad Consulting OÜ, MTÜ IKT Demokeskus (MTÜ ITL Digital Lab), and Helesinine OÜ from Estonia and Authente AS from Norway, in addition to Omniva.

An e-receipt environment allows the buyer to view all receipts in one place and to manage the accompanying documents, such as letters of guarantee or product instructions. For undertakings, the e-receipt solution enables sending receipts directly to accounting for drawing up expense reports; for merchants, however, it alleviates the issues and reduces the expenses related to paper receipts and thereby enables improving the quality of customer service.

A similar functionality is enabled by the mTasku solution, but there are significant differences between the functionalities and technical solutions.

The e-receipt will replace the receipt printed on paper, and the retail customer will decide on whether or not the receipt is sent or used. Thus, it is difficult to determine the number of the receipts and the amount of paper required. This work involved indirectly calculating the potential amount of thermal paper used which was found with the help of the foreign trade export and import balance of Statistics Estonia. The calculation was based on the code CN481190 from the combined nomenclature of goods: Paper, paperboard, cellulose wadding and webs of cellulose fibres, with a coated, impregnated, painted or decorated surface or print, in rolls or as square or rectangular sheets in any format (see sections 4803, 4809, 4810, and 4818 and sub-sections 4811.10–4811.60 (goods)).

The diagram below illustrates the process of handling a receipt.

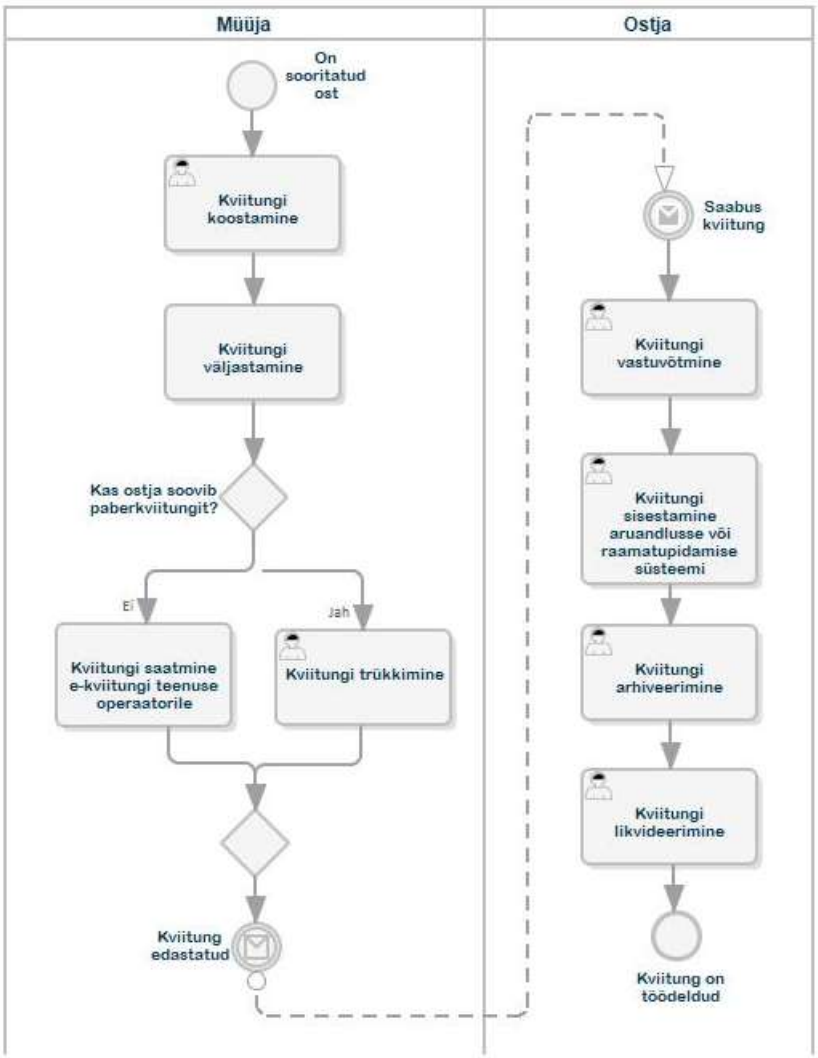


Figure 2.2. The diagram of the process of an e-receipt

Müüja – Vendor

Ostja – Buyer

On sooritatud ost – Purchase made

Kviitungi koostamine – Generating the receipt

Saabus kviitung – Receipt received

Kviitungi väljastamine – Receipt issued

Kviitungi vastuvõtmine – Accepting the receipt

Kas ostja soovib paberkviitungit – Does the buyer want a paper receipt?

Ei – No

Jah – Yes

Kviitungi sisetamine… – Entry of the receipt into the reporting or accounting system

Kviitungi saatmine… – Sending the receipt to an e-receipt service operator

Kviitungi trükkimine – Printing the receipt

Kviitungi arhiveerimine – Archiving the receipt

Kviitungi likvideerimine – Disposal of the receipt

Kviitung edastatud – Receipt sent

Kviitung on töödeldud – Receipt processed

Table 2.2. Description of the stages of the process of using an e-receipt

PROCESS STAGE	EXPLANATION
DRAWING UP THE RECEIPT	Upon making a purchase, the seller draws up a receipt specifying the goods purchased. In addition to the receipt of the goods, a payment receipt is also drawn up in the case of card payments. The receipt may be in paper or electronic format. Payment receipts are always also printed on paper.
PRINTING THE RECEIPT	The receipt is printed from the system on paper.
SENDING THE RECEIPT TO AN E-RECEIPT SERVICE OPERATOR	The system sends the receipt to an e-receipt operator.
ISSUING THE RECEIPT	The seller issues the receipt of the goods and the payment receipt to the buyer.
RECEIVING THE RECEIPT	The buyer receives the receipt on paper or as an e-receipt in the e-receipt portal (in their accounting software through the e-invoice operator).
ENTERING THE RECEIPT INTO THE REPORTING OR THE ACCOUNTING SYSTEM	If the buyer is an accounting entity, the recipient of the receipt enters the receipt information into the accounting system.

2.3. Automation of reporting by using XBRL GL

The nationwide 'zero bureaucracy' initiative, which was aimed at reducing the bureaucratic requirements established for undertakings to make the communication with the state considerably easier and less burdening and to eliminate the unjustified requirements restricting the economy, gave rise to the 'Aruandlus 3.0' initiative, to which Statistics Estonia, the Tax and Customs Board, and the Bank of Estonia have been contributing for a long time. Further information about the zero-bureaucracy project: https://www.mkm.ee/et/nullburokraatia.

The aim of 'Aruandlus 3.0' is to develop an automatic data exchange solution between undertakings and the public sector to facilitate the submission of financial, labour, and statistical data by undertakings. This means that undertakings would no longer be required to

submit declarations to state agencies or fill in questionnaires, but the data collectors would have access to transaction-based data in the information systems of undertakings to use the data for reporting or for statistical purposes.

In the first stage of the 'Aruandlus 3.0' initiative, the parties developed a uniform ontology and took into use XBRL GL as the common data exchange standard. For the submission of data, undertakings must develop an XBRL interface in their accounting software and configure automatic transmission of data to the parties which require the data. The system of the data collector will use the raw data to automatically draw up reports and make all the calculations required.

In the first stage, the Tax and Customs Board made it possible for undertakings to submit their (approved) TSD and TÖR data automatically in the XML or CSV formats. A further format, XBRL GL will be taken into use in the near future depending on the wishes and capabilities of the users. Further information is available at: https://www.emta.ee/et/ariklient/tulu-kulu-kaive-kasum/mta-statistikaameti-ja-eesti-panga-uhisprojekt-aruandlus-30.

Statistics Estonia developed an option for undertakings to automatically submit their wage and labour data in the XBRL GL format directly from their internal accounting software in the first stage, by using the national data exchange layer X-Road. Further information is available at: https://www.stat.ee/halduskoormuse-vahendamine.

Below, we present a diagram of the reporting process and explanations of the content of the activities included in the stages of the process.

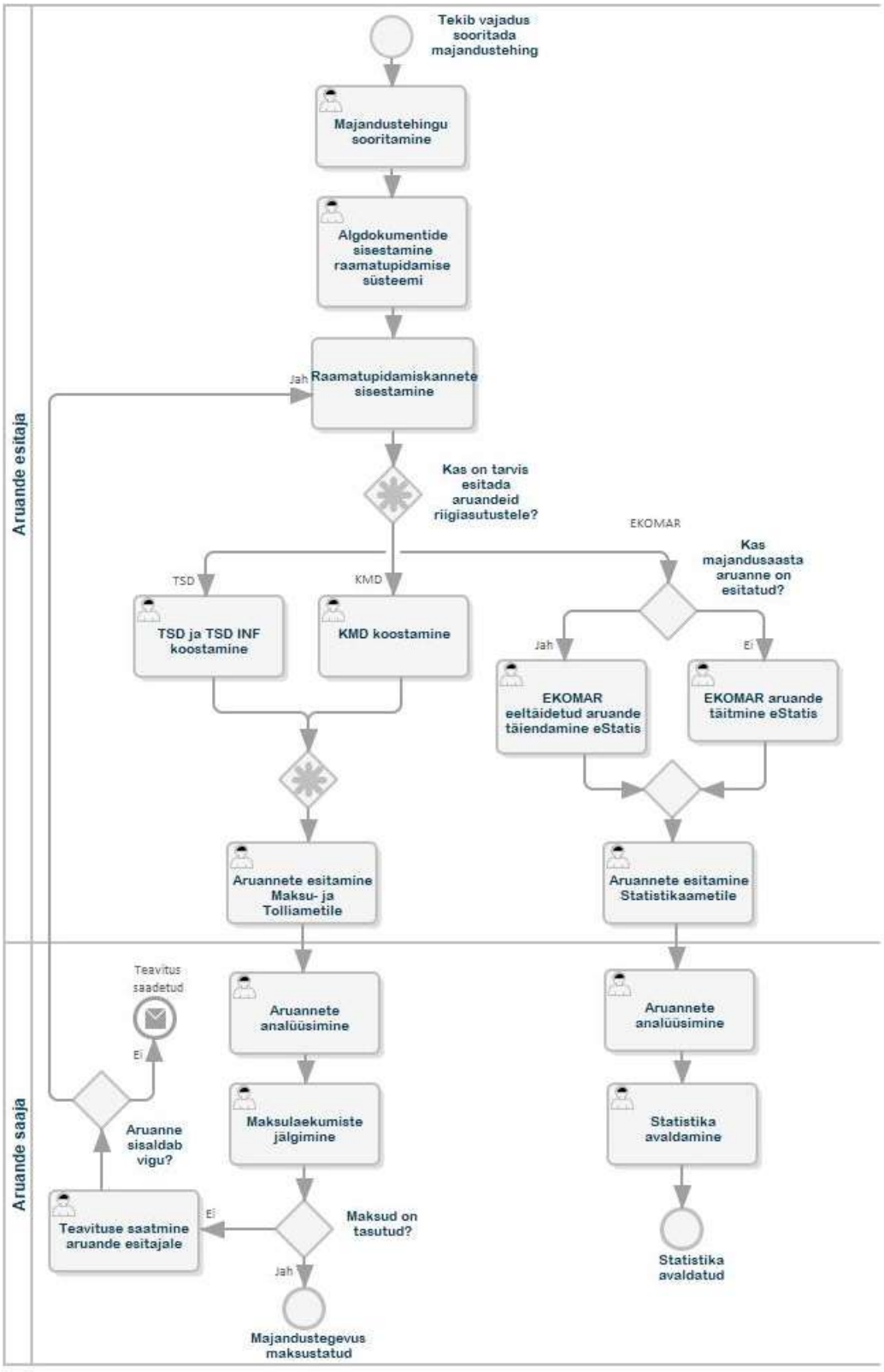


Figure 2.3. The diagram of the process of manual submission of reports to the state

Andmete esitaja – Data submitter

Tekib vajadus sooritada majandustehing – A need to complete an economic transaction

Majandustehingu sooritamine – Completing the economic transaction

Algdokumentide sisestamine… – Entry of the source documents into the accounting system

Raamatupidamiskannete sisestamine – Making the accounting entries

Jah – Yes

Kas on tarvis esitada aruandeid riigiasutustele – Is there a need to submit reports to state agencies?

Kas majandusaasta aruanne on esitatud – Has the annual report been submitted?

TSD ja TSD INF koostamine – Drawing up the TSD and TSD INF reports

KMD koostamine – Drawing up the KMD report

EKOMAR eektäidetud… – Completing the pre-filled EKOMAR report in eStat

EKOMAR aruande… – Filling in the EKOMAR report in eStat

Andmete esitamine Maksu- ja Tolliametile – Submitting the data to the Tax and Customs Board

Aruannete esitamine Statistikaametile – Submitting reports to Statistics Estonia

Teavitus saadetud – Notification sent

Aruannete analüüsimine – Analysing of reports

Andmete saaja – Recipient of the data

Aruanne sisaldab vigu – Errors in the report?

Maksulaekumiste jälgimine – Monitoring of tax payments

Statistika avaldamine – Publishing statistical data

Teavituse saatmine aruande esitajale – Notifying the reporting party

Maksud on tasutud – Taxes paid?

Statistika avaldamine – Publishing statistical data

Majandustegevus maksustatud – Economic activity taxed

Statistica avaldatud – Statistical data published

In the future process of reporting, instead of submitting reports, the source data on which the report must be based will be made available to the recipient of the report. None of the current reports would be used (incl. the KMD, TSD, and EKOMAR examined here) and the information about the economic transactions and personnel of undertakings would be transferred to the state automatically in the transaction-based manner. The state will be able to use the data to draw up the summaries required. Such reporting calls for a social agreement and respective amendments to the legislation.

Table 2.3. Descriptions of the stages of the reporting process

PROCESS STAGE	EXPLANATION
ENTRY OF SOURCE DOCUMENTS INTO	The accounting entity enters the information of the transaction in the accounting system based on the source documents.

THE ACCOUNTING SYSTEM	
SUBMISSION OF REPORTS TO THE TAX AND CUSTOMS BOARD	Submission of the reports drawn up to the Tax and Customs Board.
SUBMISSION OF REPORTS TO STATISTICS ESTONIA	Submission of the reports drawn up to Statistics Estonia.
FILLING IN OF THE EKOMAR REPORT IN ESTAT	If the undertaking has not submitted the annual report, they must enter all the details of the EKOMAR report in eSTAT manually.
COMPLEMENTATION OF A PRE-FILLED EKOMAR REPORT IN ESTAT	If the undertaking has submitted the annual report, Statistics Estonia fills in the EKOMAR report based on the annual report, thereby alleviating the administrative burden of the data submitter.
DRAWING UP THE VALUE ADDED TAX RETURN	Monthly drawing up of value added tax returns.
CONCLUDING OF AN ECONOMIC TRANSACTION	The parties conclude an economic transaction.
ENTRY OF ACCOUNTING ENTRIES	One or several entries are created in accounting based on the entries entered into the system.
DRAWING UP OF TSD AND TSD INFO	Submission of reports to the Tax and Customs Board based on the information of the payments made to natural persons.
ANALYSIS OF REPORTS	Statistics Estonia draws up statistical data based on the reports; the process consists of checking and analysing the data up to generating an output.
ANALYSIS OF REPORTS	The Tax and Customs Board submits the reports they received into the internal systems of the agency. The reports undergo automatic checks and analysis as well as risk assessment.
MONITORING OF TAX RECEIPTS	Properly drawn up reports are used to monitor the receipt of taxes and to collect taxes, if necessary.

PUBLISHING OF STATISTICAL DATA	The data processed are used for generate output indicators which are published in different formats, in a machine-readable format, as well as in the composition of analyses in the form of texts.
SENDING NOTICES TO THE SUBMITTER OF THE REPORT	If the taxes are not received in a timely manner, the undertaking is notified of the overdue payment.

2.4. Real-time economic forecasts

The Tax and Customs Board and the Centre of IT Impact Studies (CITIS) of the University of Tartu organised a pilot project for the development of the analysis and forecast models required for the real-time monitoring of certain economic indicators and for creating the respective control panels. The input data used in the project include the data of the monthly value added tax return and income and social tax returns of the last twelve months and data from other sources (e.g. the commercial register and Eurostat). The results of the analysis were visualised on control panels to provide forecasts and statistical data for policy formation.

Below, we describe the operating process of real time economic forecasts

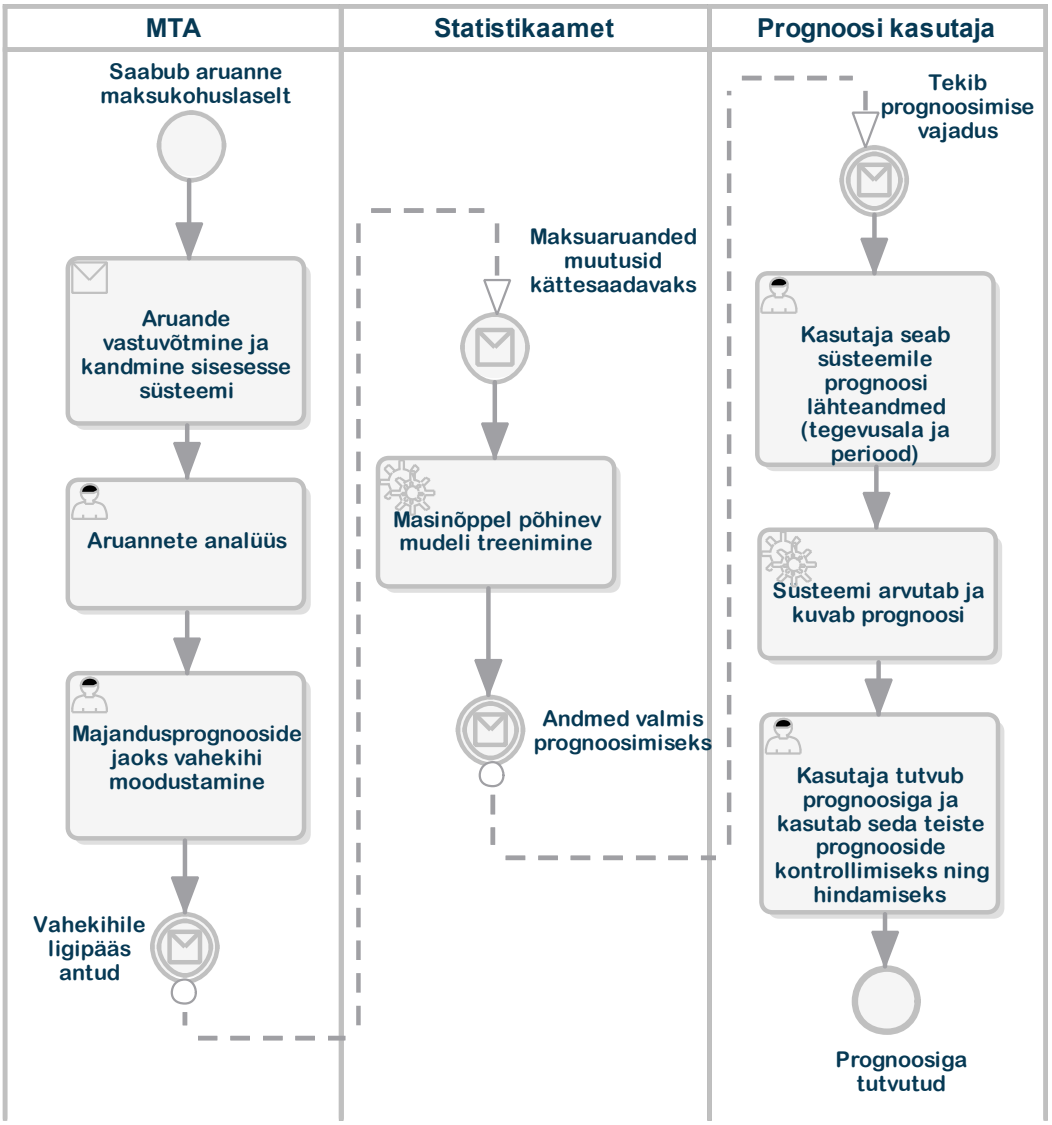


Figure 2.4. The diagram of the process of real time economic forecasts

Tax and Customs Board	Statistics Estonia	User of the forecast
Report is received from a taxable person	Tax reports become available	A need for a forecast
Accepting the report and entry into the internal system	Training of the machine-learning based model	The user determines the source data of the forecast (field of activity and period)
Analysing reports	Data ready for forecasting	The system calculates and displays the forecast
Creating an intermediate layer for economic forecasts		The user reads the forecast and uses it for checking and assessing other forecasts
Access to the intermediate layer granted		Forecast read

Table 2.4. Description of the stages of the process of real time economic forecasts

PROCESS STAGE	EXPLANATION
RECEIPT AND ENTRY INTO THE INTERNAL SYSTEM OF THE REPORT	Real time economic forecasts can be made based on the data of tax reports. The process of forecasting begins from a report being sent by a submitter of the report to the Tax and Customs Board.
ANALYSIS OF REPORTS	The Tax and Customs Board analyses the reports and, if there are any issues, takes corrective action.
DEVELOPMENT OF AN INTERMEDIATE LAYER FOR ECONOMIC FORECASTS	Economic forecasts are not made based on the so-called raw data, the Tax and Customs Board draws up a special intermediate layer of the data for real-time economic forecasts.
THE USER ESTABLISHES THE SOURCE DATA OF THE FORECAST FOR THE SYSTEM (FIELD OF ACTIVITY AND PERIOD)	Based on the models 'trained', the user of the system can initiate forecasting by defining the input data, such as the period and field of activity for which they would like to obtain a forecast.
THE USER GETS ACQUAINTED WITH THE FORECAST AND USES IT FOR THE CHECKING AND ASSESSMENT OF OTHER FORECASTS	The user can view the forecast drawn up by the system via the user interface of the system. The forecast displayed is not complete. The model can only take into consideration the data which has been submitted by accounting entities. For example, if an undertaking is not a person liable to value added tax, the model will not be able to access this information and the data are left out of the forecast. Thus, the user of the system can only use real time economic forecasts to assess the quality of their work in drawing up other, more accurate forecasts.
THE SYSTEM CALCULATES AND DISPLAYS THE FORECAST	Once the user has initiated forecasting, the system will make the calculations about the specific field of activity and period and display the outcome.
MACHINE-LEARNING BASED 'TRAINING' OF THE MODEL	The real time economic forecast software 'trains' the model based on the data, which means the assessment of the forecasting capability of the model based on past data. The system will adjust the factors forming part of the source data for the forecasts accordingly.

2.5. Automation of the processing and movement of the data of agricultural machinery

The use of the data generated by agricultural machinery has become a hot Europe-wide topic in the agricultural sector today. The machinery used in forestry employ the same technical standards. The machines generate vast amounts of data from the performance indicators of the engine of a specific machine to the yield or the amount of the inputs into a field (e.g. fertiliser, plant protection products, etc.). All of the above is also linked to spatial information received from GPS. Conclusively, this means that a modern machine generates a detailed log of its operations which can be used for planning the maintenance of the machine, as well as in the stock records or field data books of the agricultural undertaking. The number of the data elements generated reaches hundreds. An overview of the above can be found at https://www.isobus.net/.

The concept of a field data book is used in agriculture, which means a set of data about crop rotation and the works performed on the field. There are currently no nationwide electronic e-field data books or registers of field work used in Estonia yet. Such dataset would enable managing field work more accurately and providing feedback to the state about the burden caused by agricultural undertakings to the nature. The Ministry of Rural Affairs has now initiated the process of developing the e-field data book.

The data form the e-field data book could also be used by researchers in their work at different agencies (the users would include the Estonian University of Life Sciences, the Agricultural Research Centre, the Estonian Crop Research Institute, etc.). The agricultural research and agronomic suggestions would be based on actual data registered on the fields. The e-field data book would provide extensive base data for machine-learning solutions, for example for giving fertilising advice. The suggestions would be based on predictive analytic, which would be performed based on previous information about the nature (e.g. precipitation, pests), soil samples, and planned fertilisation. If the data of the works were registered regularly, there would be less need for collecting soil samples.

The data of field data books are not used in this manner today, as the data are not recorded at all, are recorded manually on paper, or are located in the data portals of the manufacturers of the machines, such as https://myjohndeere.deere.com/ or https://www.claas-telematics.com/. Thereat, it is important to point out that if an agricultural producer uses the machinery of several different manufacturers, they are unable to obtain the data of the machines from one place. Several portals must be used simultaneously and cross-use of the data is not possible, as the solutions are competing and do not share data with one another. There is no legislation which would require them to share the data.

Based on the above, it may be presumed that the regular use of the data of agricultural machinery may have several different direct as well as secondary impacts. It would save time for a farmer if the data moved from the machine to the field data book automatically; from

the perspective of the state, however, an e-field data book would create a significant dataset for the assessment and control of the environmental impact caused by agriculture.

This work involved assessment of the time saved, as well as the impacts of fuel and fertilising on GHG emissions. As there is no analytical data on the optimising field work and fertilising yet, it was predicted that the efficiency of fuel consumption and fertilising will increase by 5%, which was used as the coefficient in the calculation. The impact of fertilising was assessed on the basis of nitrogen fertilisers (N fertilisers) which means that the impact of using lime fertilisers and of other fields, such as animal husbandry, was not assessed.

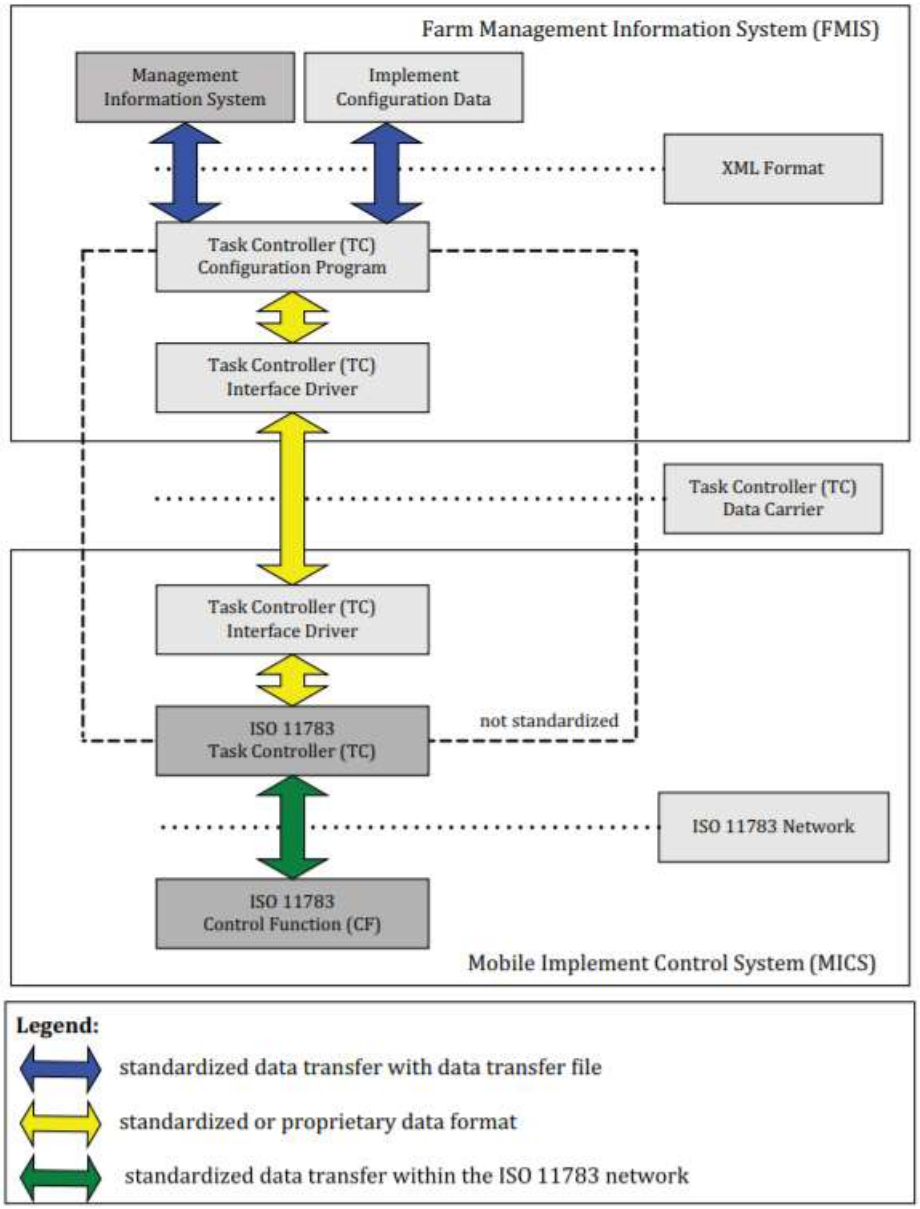


Figure 2.5. The ISO 11783 based data exchange scheme between an agricultural machine and the information system of an agricultural undertaking (source: ISO).

Below, we describe the agricultural machinery data processing and movement process in detail.

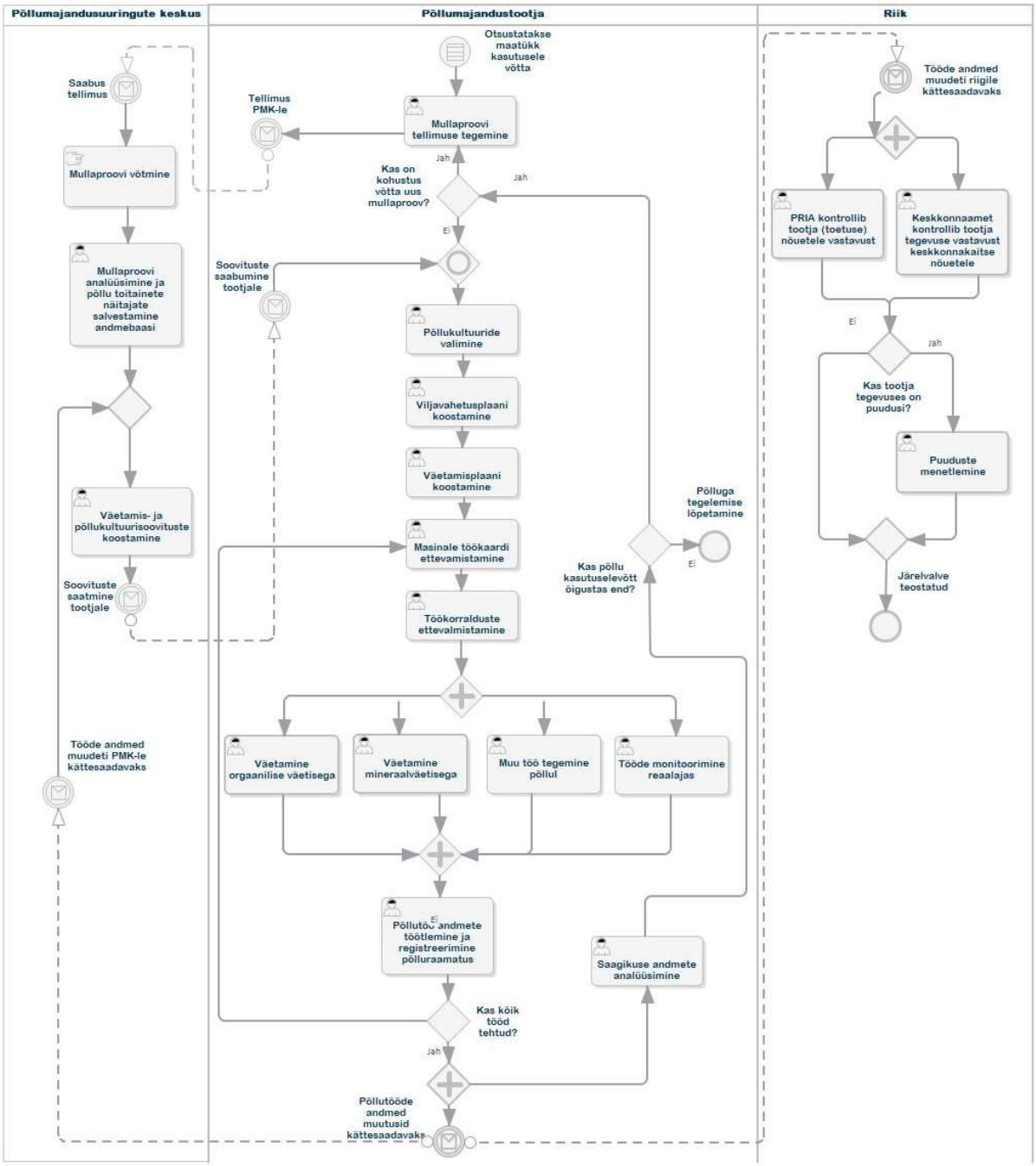


Figure 2.6. The diagram of the process of automation of the processing and movement of the data of agricultural machinery process

The Agricultural Research Centre	Agricultural producer					State	
Order received Taking soil samples Analysing the soil sample and recording	Order to the Agricultural Research Centre		Decides to start using a plot Ordering a soil sample Yes No			The Agricultural	Data of the works made available to the state The Environmental Board checks the

the nutrient information of the field in the database Drawing up fertilizing and crop selection advice Sending the advice to the producer The data of the work made available to the Agricultural Research Centre	Receiving advice Using an organic fertilizer	Using a mineral fertilizer Data of the works became available	Is the producer required to collect another sample? Selecting the crops Drawing up a crop rotation plan Drawing up a fertilizing plan Preparing the work card for the machine Preparing work commands Other work on the field Processing the data of the works and recording in the field book All works completed? Yes	Real-time monitoring of the work Analysing yield data Did it pay to use the field?	Leaving the field out of use No	Registers and Information Board checks the compliance of the producer with the requirements No Any deficiencies in the producer's activity?	complaints of the producer's activity with the environmental protection requirement Yes Processing the deficiencies Supervision completed

Table 2.5. Description of the stages of the process of the processing of agricultural machinery data

PROCESS STAGE	EXPLANATION
FERTILISING WITH MINERAL FERTILISERS	Fertilising of the field with a mineral fertiliser.
FERTILISING WITH ORGANIC FERTILISERS.	Fertilising of the field with an organic fertiliser.
PLACING AN ORDER FOR SOIL SAMPLING	Drawing up an order for soil sampling. The order must specify which field should be sampled and the concentrations of which chemical elements in the soil should be analysed.
PREPARATION OF A WORK CARD FOR THE MACHINE	Work cards must be prepared for the agricultural machines based on the fertilising plan. The work cards must specify the amount of the fertiliser or seeds sown and the working area. The amounts of the fertiliser or seeds sown differ by different areas of the field.
PERFORMING OTHER WORK ON THE FIELD	The agricultural machine will perform the work required on the field based on commands and the cards prepared. The operator controls the machine and handles any unforeseeable situations. The machine registers its movement and operating data and the amounts of the materials used. The machine saves the data in the memory or in a server or cloud via the Internet.
SELECTION OF CROPS	All crops cannot be grown in any soil conditions. The decisions on which crops to grow are made based on the characteristics of the soil, advice from researchers, and estimated yields.
PROCESSING AND REGISTRATION OF FIELD WORK DATA IN THE FIELD DATA BOOK	Modern machines enable obtaining the data of the work performed when the work has been performed. As a rule, the software of the manufacturer of the machine must be used for this purpose. In general, the manufacturers of the machines only allow agricultural producers to use the data of the machine in the own software of the machine manufacturer. This makes it very burdensome for one undertaking to use the machines of several different manufacturers. As a rule, the software applications of different machine manufacturers are not compatible. Thus, in order to transfer all data to one system, the agricultural producer must re-enter the data or make conversion of different data formats automatic, which farmers are usually not capable of.

ANALYSING OF YIELD DATA	After obtaining the data form machines or manual entry of the data in the field data book or accounting system, yield can be analysed from different perspectives.
REAL TIME MONITORING OF THE WORK	If an agricultural machine is connected to the Internet, modern machines allow monitoring the movement and operation of the machine remotely in real time. This is important at larger production companies from the perspective of working time and optimum use of the machinery. The data from the machine enable detecting mistakes in the operator's work, but also malicious theft of materials or fuel.
PREPARATION OF THE ORGANISATION OF WORK	Based on the works needed, work orders are issued to different employees at a farm in writing, in the information system, or verbally, depending on the size of the farm.
DRAWING UP THE FERTILISATION PLAN	Depending on the crop selected and the characteristics of the soil, the agricultural producer can determine the optimum fertilisation plan to get the biggest yield at the most optimum cost.
DRAWING UP THE CROP ROTATION PLAN	In order to ensure bigger yields and the sustainability of the soil, it is advisable to rotate the crop used on the fields year-by-year.
ANALYSING THE SOIL SAMPLE AND RECORDING THE NUTRITIONAL INDICATORS OF THE FIELD IN THE DATABASE	The laboratory of the Agricultural Research Centre analyses the soil sample and records the results of the analyses in the laboratory information system of the centre. The results of the analyses are recorded in the database based on orders about the following chemical elements: P, K, Ca, Mg, Cu, Mn, B. The data on the organic carbon concentration (previously referred to as humus) and the acidity level of the soil (pH) are also recorded.
TAKING OF SOIL SAMPLES	The Agricultural Research Centre or an attested collector of soil samples takes the soil samples from the fields ordered and delivers them to the soil analysis laboratories of the Agricultural Research Centre.
DRAWING UP OF FERTILISING AND CROP SELECTION ADVICE	The Agricultural Research Centre draws up recommendations on crop selection and fertilising for the field based on the soil analysis and the information about the activities undertaken on the field (if any), as well as the soil composition information from the soil map.
THE ENVIRONMENTAL BOARD CHECKS THE COMPLIANCE OF THE PRODUCER'S ACTIVITY	The Environmental Board checks the producer's compliance with the requirements of the Water Act. If the requirements are not met, the producer is contacted.

WITH THE ENVIRONMENTAL PROTECTION REQUIREMENTS	
THE AGRICULTURAL REGISTERS AND INFORMATION BOARD CHECKS THE COMPLIANCE OF THE PRODUCER WITH THE REQUIREMENTS (FOR SUPPORT)	The common agricultural policy of the EU and environmental regulations and directives establish requirements for the producer which the agricultural producer must comply with to be entitled to various grants. The Agricultural Registers and Information Board checks the compliance with these requirements and either allocates grants to the producer or not, depending on the results. Support payments which have already been made may also be reclaimed.
PROCESSING OF DEFICIENCIES	If the Agricultural Registers and Information Board, the Ministry of the Environment or another agency has found any deficiencies in the work of the producer, a proceeding is initiated depending on the character of the violation, which may result in a penalty payment or reclaiming of a grant allocated.

2.6. E-logistics, real-time delivery chains (based on the example of an electronic delivery note)

The rules concerning the delivery and transport documents of goods are generally covered by various different codes. The most important rules are included in the Convention on the Contract for the International Carriage of Goods. Based on the convention, it is mandatory to use CMRs which include information about the goods transported and the persons transporting and receiving the goods. Business partners and state agencies need this to verify the existence and accuracy of the required documents and information.

An initiation to develop a cross-border public service data exchange environment has been created within the DIGINNO network, with representatives from Estonia, Latvia, Lithuania, and Poland also contributing to it, in addition to other Baltic Sea countries. A separate DIGINNO-Proto e-conveyance document or eCMR prototype development project has grown out of the DIGINNO project which is focussed on replacing the current paper-based delivery note system used in the road transport sector with a process-based dataset.

The pilot project involves developing a functioning eCMR prototype for testing cross-border data exchange by indexing the eCMR information between Estonian, Latvian, Lithuanian, and Polish state agencies and eCMR service providers. The electronic documents are annotated with the metadata added to the index. The metadata enable drawing up index codes for registration and searching of specific documents. The metadata include, for example, the data about the sender, recipient, carrier, and truck licence plate number and references to hazardous goods, which enable state agencies to search the eCMR documentation of a specific consignment.

Indexing of the eCMR data enables inspection bodies (e.g. the Police and Border Guard Board, the Transport Administration, the Tax and Customs Board, etc.) to securely and reliably check in a machine-readable manner whether or not the trucks passing through their territories have CMR data. This information allows for assessing risks and make decisions on suspending consignment for thorough inspection of the respective consignment. The machine-readable data enable other parties, such as buyers, sellers, and carriers, also use the digital eCMR documents.

In addition to the carriers and transport inspectors, consignment data is also required by Statistics Estonia, which is tasked with providing information to policy shapers. Statistics Estonia carries out quarterly surveys about shipments made by 1,508 trucks (statistical work methodology: https://www.stat.ee/statistikatood?year=2020&code=22003). The data are provided relatively reluctantly, as there is no automatic consignment registration system and all (tables) must be filled in manually. One of the outputs of the future eCMR solution could be submission of the data to Statistics Estonia. Statistics Estonia has also specified for the project which data they need. Statistics Estonia spends approximately 26,000 euros per year on compiling transportation statistics. The costs of submitting data by the undertaking included in the sample are added to this amount. According to Statistics Estonia, obtaining all conveyance documents electronically would not reduce those costs, but the accuracy of the statistical data would improve.

This work involved assessing the savings arising from saving time, as well as the fuel consumption of the haulage operations which has an impact on GHG emissions. As there is no analytical data on the optimising logistics available yet, it was predicted that the efficiency of the routes will increase by 5%, which was used as the coefficient in the calculation.

The diagram below describes the general work process related to a consignment

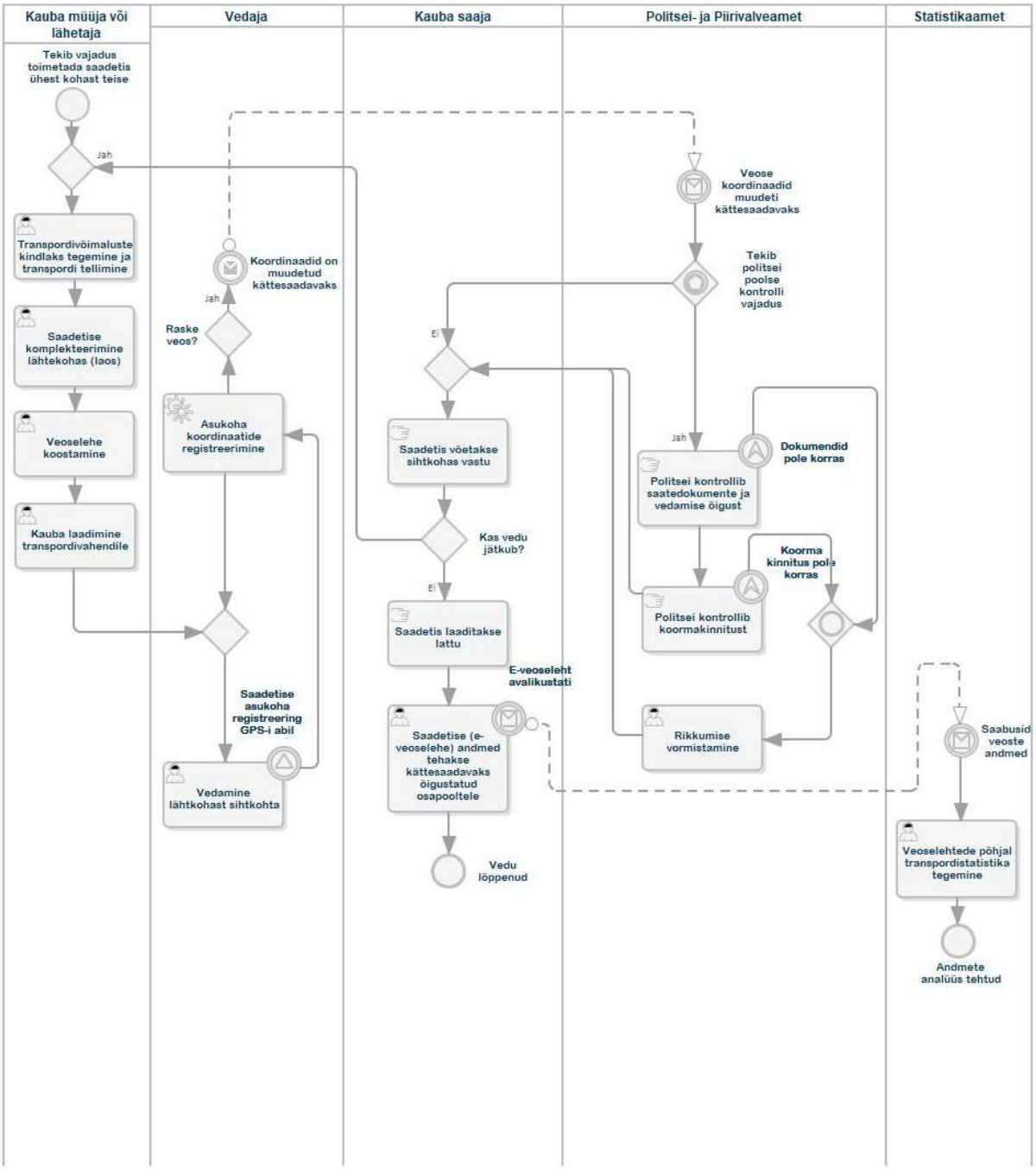


Figure 2.7. The transportation process diagram

Seller or sender of the goods	Carrier	Recipient of the goods	Police and Border Guard Board		Statistics Estonia
A need to deliver a consignment from one place to another Yes Determining the transport options	The coordinates have been made available Yes Heavy cargo?	No Receiving the consignment at the destination The haulage continues?	Yes	Coordinates of the consignment made available A need for a police check Documents compliant	Consignment data received Statistical data of haulage based on the conveyance documents

and ordering the transport Picking and packing the consignment at the place of departure (warehouse) Drawing up conveyance documents Loading the goods on the means of transport	Recording the coordinates of the location Recording the location of the consignment with the help of GPS Transport from the place of departure to the destination	No Goods unloaded in the warehouse eCMR published The details of the consignment (eCMR) are made available to the entitled parties Haulage completed	The police checks the conveyance documents and permission for haulage The police checks the fixings of the load Recording a violation	Load not fixed properly	Data analysis completed

Table 2.6. Description of the stages of the process of using an eCMR

PROCESS STAGE	EXPLANATION
LOADING OF GOODS ON THE MEANS OF TRANSPORT	The sender of the goods loads the goods on the means of transport.
PICKING AND PACKING OF THE GOODS AT THE PLACE OF DEPARTURE (WAREHOUSE)	The consignment is picked and packed based on the order, the nature of the goods, the features of the means of transport, and the characteristics of other consignments on the same means of transport.
DETERMINING THE POSSIBILITIES FOR TRANSPORT AND ORDERING THE TRANSPORT	The sender of the goods determines the possibilities for transport based on the characteristics of the goods, the locations of the places of origin and destination, and other important circumstances. If a suitable carrier is found, the transport service is ordered.
DRAWING UP THE CONVEYANCE DOCUMENT	The sender of the goods draws up the conveyance document, which is linked to the means of transport with the help of the registration number of the truck or another identifier.
THE CONSIGNMENT IS UNLOADED AT THE WAREHOUSE	The goods are unloaded by the recipient of the consignment. The goods may also be unloaded by the carrier if the consignment and the material allow for dumping the goods.
THE CONSIGNMENT IS ACCEPTED AT THE DESTINATION	The consignment arrives at the destination where it is identified what has arrived and whether the goods have arrived at the right destination. If the goods are not

	accompanied by an e-invoice or e-conveyance document, the identification process may take some time.
THE DETAILS OF THE CONSIGNMENT (E-CONVEYANCE DOCUMENT) ARE MADE AVAILABLE TO THE ENTITLED PARTIES	Conveyance documents are currently (in 2020) not disclosed to third market participants. Only competent authorities (the Police and Border Guard Board, the Tax and Customs Board) can inspect paper-based conveyance documents today. In the future, it will be possible to make conveyance documents available to entitled parties for inspection or for statistical purposes. Making the conveyance documents available before the arrival of the consignment is also important to the recipient of the goods for them to be able to arrange the conditions required for receiving the goods in a timely manner, incl. bring any lifting equipment required to the destination.
THE POLICE CHECKS THE FIXING OF THE LOAD	The police checks whether the load is securely fixed to the truck.
THE POLICE CHECKS THE DELIVERY DOCUMENTS AND PERMISSIBILITY OF THE HAULAGE OPERATION	The police may check the truck for various different reasons, for example, to determine whether the consignment is accompanied by delivery documents, whether the consignment is heavy cargo, and whether the Transport Administration has issued a permit for the haulage operation.
DOCUMENTATION OF VIOLATIONS	In the case of finding any violations, the police documents the circumstances and opens proceedings.
DRAWING UP TRANSPORT STATISTICS BASED ON CONVEYANCE DOCUMENTS	Drawing up statistics based on conveyance documents.
REGISTRATION OF LOCATION COORDINATES	If the transport vehicle enables registration of the coordinates of the location of the consignment, the coordinates may be registered. Based on the applicable standards, the coordinates registered are not included in the composition of the data provided in the conveyance documents. The GPS information of heavy cargo which requires a special permit is registered in the information system of the Transport Administration.
HAULAGE FROM THE POINT OF ORIGIN TO THE DESTINATION	The carrier transports the goods from the point of origin to the destination. Declaration of the goods at different agencies (incl. at the customs frontier) is not the obligation of the hauler.

3. Impact analysis

The work involved analysing six different processes, which are characteristic to RTE and used in different sectors. From the perspective of AS-IS, a process which is not automated with the help of an RTE solution was examined, while the TO-BE perspective was concerned with a partially automated process. The AS-IS and TO-BE perspectives were presented together in one diagram. The AS-IS and TO-BE perspectives are described in the table of assessment of the volume of the work which can be found in **Annex 3. AS-IS and TO-BE models of processes** of the document. The work involved assessment of the impact of the automation of the processes on reducing the volume of work, increasing the income, changes in the GDP, as well the cost of implementation and the changes in the GHG emissions. The data on the basis of which the impacts were assessed were mainly received from the experts who were interviewed in the course of the study, as well as from the statistical data published by Statistics Estonia. The impact assessment was based on the changes in the amount of manual work of the parties involved in the process thanks to the automation. With respect to the work, it is possible to save time and money if the volume of the work is reduced thanks to automation. The greenhouse gas emissions are also related to the working time used. Energy, fuel, and materials are used in the course of working. Saving on the expenses and increases in the income of undertakings both have an impact on GDP. Investments are required for the development and introduction of any RTE solutions. One of the most important investment objects is the development and introduction of data exchange standards. The standards are the basis for manual work-free and fast movement of data. A standard may include description of semantics, such as EVS-EN 16931-1:2017+A1:2019, or technical agreements, such as the UBL and UN/CEFACT CII e-invoice syntaxes in the case of e-invoices.

3.1. Nature of RTE

The sequence of the RTE-related operations in one sector consists of a certain event, creation of the data of the event in an IT system, processing or analysis of the data by the system, and delivery of the information obtained by processing to the consumers in real time. The consumer of the data may be a person who participated in the event or some other party. For example, Statistics Estonia, the Tax and Customs Board, or another entity operating on the basis of the data. In the case of RTE, it is important for the data to move automatically within a short period of time and be usable in the unprocessed or aggregated form. The opposite option is the movement of data with a delay, which may be due to using a slow solution (involving manual work), due to the data not being machine-readable, or due to one or both of the parties of the data exchange not being mutually interoperable. The lack of interoperability may occur at the legal, organisational, semantic, or technical level. The main focus of RTE development project is on creating interoperability at all of the afore-mentioned levels of interoperability.

3.2. Impact of RTE on saving

The table below presents the financial saving from the automation of the processes per year for entire Estonia. The monetary value was found by multiplying the difference between the changes in the work volumes of the manual and automated processes by the number of

repetitions of the process per year and the average hourly labour cost of the respective sector. The work volumes were obtained as expert assessments from the experts interviewed in the course of the study, as well as from the calculations performed by the analysts of Tieto, the Estonian Assembly of Accountants, and the Agricultural Research Centre who were involved in the study. The cost was taken from the wage statistics of Statistics Estonia from 2018. The number of repetitions means, for example, the number of invoices, the number of conveyance documents, the number of fields, the number of receipts, or the number of reports.

The biggest saving will come from taking into use the e-invoice. This is obvious even if we only examine over 1,000-euro invoices. The e-invoice is followed by the e-receipt which is also an e-invoice from the perspective of the system, although the process of creating a receipt is different.

The saving from the implementation of XBRL GL turned out to be 0. This is due to the fact that national reports (KMD, TSD, EKOMAR) have already been automated from the IT perspective and while using XBRL will make the solution more flexible, the situation will not change much for the submitter of the report if they already have the software for submitting the reports. When it comes to reports, it is important to keep in mind that generating data and ensuring the quality thereof takes time. For example, the data contained in an annual report must be checked by an auditor. If the data were submitted earlier by transactions, the auditor would be required to check the source documents and accounting entries constantly. The legislation should be amended to avoid such additional burden. The reports which involve submitting data for longer periods of time should be eliminated. All reports should be submitted for the same period or some other principles for identifying the fact of submission should be used. There must be a clear understanding of at what point tax and other liabilities arise for undertakings if the frequency of submitting the data is shorter than the reporting period. After determining the new reporting process, it would be possible to assess the impact of the changes.

Agriculture and real time economic forecasts where the number of repetitions of the processes is not very high compared to the number of e-invoices or XBRL GL reports submitted to different agencies were also more modest from the perspective of saving.

Other impact assessments are based on the indicator of saving.

Table 3.1. The savings from the solutions

PROCESS	SAVING (EUR), MACRO LEVEL

E-INVOICES	103.73 million
E-RECEIPTS	58.17 million
AUTOMATION OF REPORTING BY USING XBRL GL	0 million
REAL-TIME ECONOMIC FORECASTS	0.74 million
AUTOMATION OF THE PROCESSING AND MOVEMENT OF THE DATA OF AGRICULTURAL MACHINERY	4.08 million
E-LOGISTICS, REAL-TIME DELIVERY CHAINS (BASED ON THE EXAMPLE OF AN ELECTRONIC DELIVERY NOTE)	43.84 million

3.3. Impact of RTE on the increase of income

Increasing income is also one of the aims of automation. This may arise from reducing the amount of time required for the work and using this free time or more efficient use of the time so that the benefit is not proportional to the increased production arising from the time gained.

This study assessed the increase in income arising from the increased production which is directly caused by the implementation of an RTE solution.

The transfer to e-invoices will not directly increase the income of the issuer or the recipient of the invoice. Assuming that undertakings no longer use paper-based invoices but tend to send invoices in the PDF format, the issuer of the invoice will not save at the expense of paper or printing. The recipient's volume of work required for processing the information of the invoice will decrease. This means that the work load of the employees of the recipient of the invoice who work in accounting will decrease. The specialists working in the field of accounting are usually not involved with production or sales. This means that the production or sales capacity of an undertaking will, as a rule, not increase directly as a result of using e-invoices. The increase may result from retraining or replacement of the employees.

The processing and use of the data of agricultural machinery has a direct impact on the increase of income. If accurate methods are used for fertilising fields, the agricultural producer will be able to get a bigger yield at lower costs from the field. This effect is created if the fertilising advice used by the producer in controlling the machinery and in analysing the information of the work and planning new works later is aligned with the actual situation. The Agricultural Research Centre will draw up electronic field cards based on the information about soil composition which include the amounts of fertilisers, lime, and other materials sown on the field. The information of this card is sent to the sower via the ISOBUS of the tractor and the sower will open and close the nozzles based on the instructions given. This work uses the knowledge on which the fertilising advice is based. The fertilising advice

determines the amounts of the substances which should be sown on the field for different yield forecasts (t/ha), highlighting which amount of fertiliser would increase the yield most. The fertilising advice is drawn up by the Agricultural Research Centre based on soil analyses and the log of the works performed (i.e. the e-field data book). Information from the machines and in the e-field data book is also valuable feedback to the Agricultural Research Centre, which can adjust the advice given as needed. Such feedback is currently obtained from the tests conducted on test fields. If information about the works reached the national e-field data book as accurately as possible, all fields in Estonia would become sources of valuable information for the Agricultural Research Centre.

The most important source of the increase in income is a bigger yield, which arises from saving, transmitting, and using data for the fertilising advice. Depending on the accuracy of the advice, the yield may differ by tons per one hectare. There is 1.1 million hectares of arable land in Estonia. One ton of grain costs approximately 160 euros. Thus, if an appropriate amount of fertiliser is calculated based on soil analyses and information about the works performed, just one extra ton of yield from all fields may mean 176 million euros more income per year. The income may even be greater in the case of some crops and soils.

Real time economic forecasts are not a service which could be sold to the consumer. The forecasts of the current application are not usable in the case of all sectors, as the business in the sector does not change regularly, i.e. the data of the previous periods do not provide a clear basis for forecasting the following periods. This is especially the case in exceptional situations, for example, if a large undertaking or project enters the market. Automatic forecasting does not take into consideration the changes in legislation, extraordinary changes in the business due to changes in the international situation, or epidemics. Even though some forecasts may prove accurate and taking them into consideration may enable producing or selling more thanks to better preparedness, inaccurate forecasts result in spoilt stocks and losses which may significantly reduce the profit. Automatic forecasting or the use thereof in itself will not increase anyone’s income. There is a positive effect for the agencies which are involved with forecasting (the Bank of Estonia, commercial banks, the Ministry of Finance, Statistics Estonia), as they will be able to obtain the data of the economic indicators of undertakings faster. Adding their own knowledge, a better-quality forecast can be generated which can be published to the wider public.

The current solution could also be complemented with an option to use different forecast scenarios, such as the impact of a pandemic, exceptionally large-scale business transaction, or the implementation of a project on the forecast.

Introduction of XBRL GL is, in principle, replacement of one technology with another. The replacement mainly consists of a transfer from the current electronic system to an internationally acknowledged reporting syntax in the communication between the state and an undertaking. This will not result in a direct increase in income for the parties, but will simplify data exchange in a sense. Complementing and changing the data content will become simpler. It will no longer be necessary to change the syntax to make a change, i.e. the amount of development work in the management of the data exchange of reporting will decrease.

Thus, introduction of the XBRL GL syntax will not generate further economic benefits for undertakings or state agencies, but will reduce the costs of achieving semantic and technical interoperability.

E-receipt is not related to the income of the undertaking using the e-receipt. E-receipt helps to cut down expenses, but the income will not directly increase in the case of using e-receipts instead of paper receipts.

Taking into use of a national eCMR will increase the transparency of the transport sector. It will be possible to compile realistic statistical data. The police and the Transport Administration will also gain a better overview of the consignments once the eCMR solutions has been integrated with their information systems. This will reduce the administrative burden of truck drivers thanks to the lower number of stops and checks and will reduce the need to fill in the survey questionnaires of Statistics Estonia. The recipient of goods using the eCMR system will know sooner which goods they are about to receive and when. This may have an indirect impact on an increase in their income, as they will be able to plan their production more accurately.

It is important to highlight that many consignments are transported without drawing up conveyance documents today, as this would mean excessive bureaucracy and would not increase the efficiency of delivering the consignment. On the contrary, the recipient of the goods or the carrier would have to draw up an additional document in addition to the invoice which the parties to the transaction do not need in many cases. This is especially so in the case of the consignments sent to private persons and the conveyance documents drawn up on paper or electronically. Introduction of the eCMR is especially important in the case of more complex and riskier consignments from the perspective of security, as well as for international consignments and in the cases where the goods are not accompanied by an (e-)invoice.

Thus, in the case of many consignments, drawing up the conveyance document and the eCMR may reduce the income of the recipient of the goods or the carrier due to the loss of the time required for drawing up the documents, unless the conveyance document can be generated automatically from the existing information system of the sender of the goods based on the e-invoice. If there is no automatic generation option, expenses would have to be made on building the required system or paying for using the system to achieve electronic interoperability. According to Statistics Estonia, the average length of a haulage operation in Estonia is 81 km. This means a one-hour drive on the road. As a haulage operation is a short process, the time spent on drawing up the documents has a bigger impact on the efficiency of the haulage undertaking.

The benefit from the eCMR is of a secondary nature. Income may increase if the recipient of the consignment is capable of receiving the information of the eCMR and automatically plan their inventories and production processes based on the document.

Table 3.2 below shows the direct increase in income per year which can be achieved as a result of automation of the processes. The automation of most of the processes will not result in a direct increase in income. The only exception is taking into use of agricultural data, which will enable planning and executing the fertilising of fields considerably more accurately. This will

result in a significantly bigger yield, which also means more income for the agricultural producer.

Before the analysis, we hypothesised that saving on costs would also result in an increase in income. **The analysis revealed that the money saved does not automatically affect an increase in income (turnover)**; thus, the income is, by default, 0 in table 3.2 below. The time or money saved may not be spend on producing additional production or providing more services, although this is often assumed. The processes will presumably become faster, but what happens next will depend on the management decisions. Production does not increase automatically, as the time saved cannot often be used in the production, as the speciality in which the time is saved cannot be automatically involved in production. For example, if using e-invoices saves the accountant's time at a production company, it is unlikely that the accountant will use the free time working as an electronics assembler, which would result in an increase in income. This example makes it clear that different professions require very different things from the employee and it is not possible to transfer working time automatically. The eCMR process may be examined as another example. If the eCMR enables the police to stop less trucks for inspection, this will save the time of the driver of the haulage company, and they will be able to complete more haulage operations. As highlighted above, the length of an average haulage operation in Estonia is 81 km, which means that if the driver saves 1–2 hours thanks to not being stopped, they will be able to complete an additional haulage operation. This would immediately create additional income. The difference between the examples of the accountant and the driver lies in the fact that the driver is a production worker for the haulage undertaking in this case, while the accountant is involved with a support process. However, the accountant is not always a person who works within the framework of a support process. An accountant who is employed at a company providing accounting services is a producing employee and saving this accountant's time would create additional income, as the time saved would be immediately used for providing an additional service. A driver employed at an accounting bureau would, however, usually be involve with ancillary activities.

As a result of the analysis, we can state that income is increased by those automations which are directly related to optimisation of the use of resources in the process of production or providing a service, as well as in the sales process. The automation of an ancillary activity usually only results in cutting down the costs. Whether a specific activity is an ancillary or principal activity depends on the area of activity of the undertaking.

Table 3.2. Direct impact of the solutions of the increase in income

PROCESS	INCREASE IN INCOME (EUR), MACRO LEVEL
E-INVOICES	0 million
E-RECEIPTS	0 million
AUTOMATION OF REPORTING BY USING XBRL GL	0 million
REAL-TIME ECONOMIC FORECASTS	0 million
AUTOMATION OF THE PROCESSING AND MOVEMENT OF THE DATA OF AGRICULTURAL MACHINERY	200 million
E-LOGISTICS, REAL-TIME DELIVERY CHAINS (BASED ON THE EXAMPLE OF AN ELECTRONIC DELIVERY NOTE)	0 million

3.4. Impact of RTE on GDP

GDP is impacted by changes in the monetary volume of the realisation of the production of the undertakings which is designed for the end consumer. GDP is also affected by changes in the public sector expenses, as the public sector expenses are also treated as production in the GDP. In this analysis, we discuss the impacts on the GDP by using a production method-based GDP calculation methodology. In this methodology, end consumption is included in the GDP and interim consumption is left out. Interim consumption is the amount of production and services which is used as input in producing further production or providing a service. The GDP calculated based on the production method also includes public sector expenditure and export, whether or not the goods exported are used in intermediate consumption.

The processes and solutions examined had negative, as well as positive impacts on GDP. The effect of digitalisation on GDP is positive at the time of introduction, as the public sector is spending, but will turn negative later due to the drop in the public sector expenditure arising from the automation of manual work. Automatically functioning processes are often, but not always, less expensive.

Depending on the methods used for calculating GDP, the following solutions have a negative effect on GDP if used in the public sector:

1) using e-invoices;
2) using e-receipts;
3) using eCMRs;
4) using XBRL GL;
5) using real time economic forecasts.

The impact of the afore-mentioned processes on GDP is negative, as using technology helps save public sector expenditure. The lower the public sector expenditure, the less the expenditure increases GDP. The negative impact is compensated by deciding to release the left-over funds back into circulation through another development or expense.

The processes examined have a positive effect on GDP through the higher yield achievable as a result of processing agricultural data. Real data and mainly optimised fertilising may increase the yield achieved in production by as much as dozens of percentages. This has been confirmed in the field test with different crops conducted by the Agricultural Research Centre, the Estonian Crop Research Institute, and the Estonian University of Life Sciences over the years.

A direct impact on GDP comes from the agricultural production for the end user (vegetables and fruit). Indirect impacts come from grain and plant production, in the case of which the yield is directed to intermediate consumption, i.e. the yield must go through significant processing to be consumable by the end consumer. Thus, the increase in GDP from a larger grain harvest is expressed in the form of the sale of the products made of the grain. The positive effect on GDP may be reduced by a drop in the prices due to more efficient production. Weather and weather forecasts are also an important factor in agriculture. Poor weather and inaccurate forecasts may result in losing the harvest.

Using accurate, data-based agricultural measures is estimated to potentially increase the production by dozens of percentages. Thereat, real-time analysis of data and making a nationwide dataset accessible as a result of automated saving of the data in the national e-field data book is the important factor.

The digitalisation development and introduction projects in the fields of e-invoicing, XBRL GL, e-receipts, and eCMRs conducted in the public sector also have a positive impact on GDP. When it comes to the impact on GDP, it should be kept in mind that public and private sector production are calculated differently. A decrease in the expenditure of public sector also means a lower GDP in the extent of the lower expenditure. In the case of the private sector, GDP includes the income from the sale of production to the end consumer. Changes in expenditure do not directly impact GDP in the case of the private sector, unless they result in changes in prices. Lower expenditure has an effect on the business profit. In this study, only the direct impact on GDP was taken into consideration. The direction of indirect effects may, however, often be the opposite, as the freed resources may be redirected into production or into improving or expanding the services of the public sector.

The table below is based on the following assumptions:

1) E-invoices and e-receipts as used in the public sector, as they are mandatory in this sector.
2) XBRL GL is used (generation of information) in the private sector, as reports are generated by the private sector.
3) Real time economic forecasts are used by the public sector.
4) The data of agricultural machinery is processed and used in the private sector.
5) eCMRs are used in the private sector.

Table 3.3. Direct impact of using the solutions on the GDP

PROCESS	IMPACT ON THE GDP (EUR)
E-INVOICES	–103.73 million
E-RECEIPTS	–58.17 million
AUTOMATION OF REPORTING BY USING XBRL GL	0 million
REAL-TIME ECONOMIC FORECASTS	–0.74 million
AUTOMATION OF THE PROCESSING AND MOVEMENT OF THE DATA OF AGRICULTURAL MACHINERY	200 million
E-LOGISTICS, REAL-TIME DELIVERY CHAINS (BASED ON THE EXAMPLE OF AN ELECTRONIC DELIVERY NOTE)	0 million

The impact indicated for the e-invoice (–103.73 million) means that this amount will be excessive on one line in the state budget if e-invoices are used. The budget may be cut in this extent or the amount may be re-allocated to another line of the budget and used for another purpose. Thus, taking into consideration the impacts generated in other spending processes, the final impact on the balance will be zero, unless the budget is cut.

3.5. RTE investments

For automation of manual operations, investments must be made in the hardware and software of systems. If it is necessary to involve several organisations in the automation, the need to develop the interoperability of the organisations and systems must also be taken into consideration. The interoperability must function on the legal, organisational, semantic, and technical levels. See: https://joinup.ec.europa.eu/collection/nifo-national-interoperability-framework-observatory/3-interoperability-layers.

Legislation must enable and often also regulate the data exchange between the parties, as using the data may also result in legal consequences in addition to the economic impact. If the jurisdiction does not support or permit the use of the data, the automation must be accompanied by legislative drafting, which is also a financial investment by nature.

Organisations must change their operating logic and the respective internal regulations to achieve functioning data exchange with other organisations. The main question here is whether automatically received information is sufficiently reliable and acceptable for the organisation.

Semantic interoperability means understanding the data and processes in the same way. All parties to the data exchange must understand the data of the data submitter and be capable of receiving the data. For example, with the price of goods, it is relatively important to know

if the price includes two or four decimal places. In the case of large amounts of goods, the total amounts are different depending on whether or not the prices are rounded. It is also important to use the same units, exchange rate information sources, classifications, registers of objects or persons, data formats, etc. All such data content is referred to as semantics. Achieving semantic interoperability may in many cases turn out to be the most expensive part of achieving interoperability between organisations.

Technical interoperability calls for using the same technical standards. The technology must be compliant with the standards agreed on. The standards may concern machinery and the sensors of machinery which generate data, as well as computing technology and software. Using cloud technology may be a good option here. A cloud can be used to make all software and hardware tools uniformly available to all parties. This will significantly simplify agreeing on and using a common architecture.

The investments made in different levels of interoperability and service are described in table 3.4.

In the case of RTE, one of the most significant development needs is achievement of the interoperability of different organisations and systems. Complementation and amendment of legislation and system developments are required for this purpose.

The table below presents the amount of the investments required for the development and introduction of the solutions. This is the assessment of the experts involved in the project for a once-only investment.

Investments may be made by the state or by private undertakings. State and EU funds have often been used in Estonia for extremely large-scale infrastructure investments, for example, in road construction. On the other hand, there are examples from other countries of private funding being used for building roads. Private funding has also been used for creating mobile connection infrastructure and services. In the case of developing services or infrastructure with a higher impact, it is important to the state to have at least some right to control the system created. For example, there is the Financial Supervision Authority in Estonia which checks the operations of banks to ensure the reliability and stability of Estonia as a state. Operations of banks have direct impact on the latter. For example, the Financial Supervision Authority has paid special attention to the inspection of the prevention of money laundering. The Financial Supervision Authority has even had to take the extreme measure of closing a bank. Even though the bank was established by private investors, the state was entitled to close it if it was found that the bank had a negative effect on the reputation and financial stability of Estonia.

In the agricultural sector, Estonia has decided that the e-field data book which would help support efficient agricultural production must be developed at the national level. Creating a uniform system would ensure the best possible cooperation between universities, research institutions, and agricultural producers.

Thus, large-scale investments may be made by private undertakings or the state. If the service or infrastructure is of a critical importance for the society, the state must always have the right of scrutiny.

From the perspective of investments, the eCMR and e-invoices will be most expensive, as they require, in principle, creating interoperability with the entire Europe in the legal (directives and legislation), organisational (such as the PEPPOL network), semantic (the e-invoice standard, the eCMR standard), and technical (development of the accounting and logistics systems to align them with the syntaxes of UBL and UN/CEFACT CII) perspectives.

Table 3.4. Investments to be made in developing the solutions

PROCESS	LEGAL INTEROPERABILITY (EUR)	ORGANISATIONAL INTEROPERABILITY (EUR)	SEMANTIC INTEROPERABILITY (EUR)	TECHNICAL INTEROPERABILITY (EUR)
AUTOMATION OF THE PROCESSING AND MOVEMENT OF THE DATA OF AGRICULTURAL MACHINERY	200,000	200,000	500,000	1,500,000
INTRODUCTION OF E-INVOICES	5,400,000	500,000	1,000,000	3,000,000
DRAWING UP OF REAL TIME ECONOMIC FORECASTS BASED OF THE REPORTS OF THE TAX AND CUSTOMS BOARD	–	200,000	300,000	300,000
INTRODUCTION OF THE ELECTRONIC CONVEYANCE DOCUMENT	5,400,000	5,400,000	1,000,000	3,000,000
INTRODUCTION OF XBRL GL IN REPORTING	200,000	200,000	500,000.00	3,000,000

INTRODUCTION OF THE ELECTRONIC RECEIPT	200,000	500,000	100,000	4,000,000

3.6. Impact of RTE on greenhouse gas emissions

Greenhouse gases (GHG) include carbon dioxide (CO_2), methane (CH_4), and nitrogen dioxide (N_2O). The so-called greenhouse effect is naturally also affected by water vapour, with the water molecules in the atmosphere catching the heat reflected from the ground. Carbon dioxide is the main GHG which is mostly generated in burning processes and the emissions of which can be reduced by each individual and production company by using energy as efficiently as possible. Methane, but also nitrous oxide, are important greenhouse gases in agriculture. N_2O is released in an environment rich in nitrogen in anaerobic conditions. In agriculture, using fertilisers containing nitrogen (N) is an important source of N_2O.

An EU Greenhouse Gas Monitoring and Reporting Mechanism has been established to find possibilities for measuring and reducing GHG emissions and Estonia also submits National Inventory Reports (NIR) within the framework of this mechanism. The methodologies, collection of source data, and selection of specific emission factors used in Estonia are compliant with IPCC (guidelines drawn up by the UN Intergovernmental Panel on Climate Change). In order to ensure this, the IPCC guidelines are observed, the main version of which has been in force since 2006 and which was last updated in 2019[1]. There are three IPCC methods for the calculation of emissions (*tier 1, tier 2 and tier 3*). Method 1 (tier 1) is a simplified approach in which GHG emissions are found by using general emission factors found from literature or those found by the more thorough method 2 (so-called IPCC default). Method 2 (tier 2) calls for country-specific data and characteristics and provides more accurate results. Method 3 means data collection at the level of a specific industry (business). The process of calculating GHG emissions is complicated in the case of using the life cycle concept, which includes the production of a product from buying and processing raw materials to final disposal of the product. For example, when using paper invoices, the input required for manufacturing paper, as well as the emissions generated in the course of processing and transporting the outputs may be counted under GHG emissions.

As the IPCC methodology and calculations are complex, the indicators and factors provided in the NIR are used in this report to calculate the impact on GHG emissions generated in the course of changing the business processes discussed in the study. It would also not be reasonable to calculate the GHG emissions based on the concept of 'life cycle', which includes the production of a product from buying and processing raw materials to final disposal of the product, in which case it would be necessary to find and add up the GHG emissions generated in all processes related to the product.

Based on the above, the principle of IT and e-system development being part of different manufacturing and business processes and having an impact on GHG emissions in the form of changes in the efficiency of **energy, fuel, and material** use is applied. We would also like to

point out that the impact on GHG emissions is related to fossil fuels, while the CO_2 emissions released in the air in the course of the combustion of biomass-based fuels is usually deemed zero. The same applies to using wind and solar energy. Thus, the fuels used for producing energy have an effect on the calculations performed in the course of the work and may render them unnecessary in the future. On the other hand, the GHG emissions arising from using agricultural land will still remain important in the future and those emissions can be changed by selection of production technology and fertilising. [1]

Based on the above, it was found that the source data presented below would be appropriate for assessing the impact of the processes on GHG emissions.

Table 3.5. Description of the source data used in the assessment of the activities

ACTIVITY	SOURCE DATA
ACTIVITIES CONDUCTED IN THE OFFICE (DRAWING UP INVOICES, CONVEYANCE DOCUMENTS, RECEIPTS, DRAWING UP SCHEDULES OF AGRICULTURAL WORK, ETC.)	Thermal energy and electricity consumption. Based on energy management report conducted by Riigi Kinnisvara AS in 2018 (total energy consumption in office buildings (electricity, thermal energy)). Estimated time cost.
WORK WITH MACHINES (FIELD WORK, HAULAGE,	Diesel fuel consumption based on the average consumption provided in previous studies and NIR reports
USE OF MATERIALS (FERTILISERS)	Use of mineral and organic fertilisers based on the average consumption provided in previous studies and NIR reports. Indicative thermal paper consumption for printing receipts

The GHG emissions in CO_2 equivalents were calculated based on energy, fuel, and material consumption and based on the CO_2 concentration of an electricity and thermal energy unit (kWh) generated in Estonia (CO_2 special emission factor) or the CO_2 concentration and release rates of fuel or materials.

More specifically, the detailed formula for calculating CO_2 emissions, which is based on multiplying the amount of fuel used, the calorific value of the fuel, and the specific carbon dioxide emission factor of the fuel, was not used in this case. The calculation was based on the

[1] Source: 2006 *IPCC Guidelines for National Greenhouse Gas Inventories; 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories*

formula for the calculation of carbon dioxide emissions, which is based on the so-called transformed energy consumption:

$CO_{2S,\,e,t} = \Sigma B_{(e,t)} \times Q_{CO2(e,t)}$,

where e is e-content and t indicates customs;

CO_{2S} means the carbon dioxide released in ambient air in the case of using transformed energy (tCO_2);

B – the transformed energy consumption (district heating thermal energy, electricity), kWh;

Q_{CO_2} – the special emission factor of transformed energy, $tCO_2/(kWh)$.

In order to calculate the GHG emissions of the haulage and agricultural sectors, the following peculiarities were also used. The logistics sector is assessed as the mediator in the chain between the raw material inserted into industry and the production generated, with the CO_{2S} emissions calculated through the change in the volume of transport. Thereat, increasing the efficiency of road transport or reducing the mileage is also assessed in the logistics sector. It is also possible to assess the change in the fuel consumption in the agricultural sector. The formula for calculating the CO_2 emissions in the transport sector (based on IPCC) is specified below, provided that the fuel consumption can be assessed:

$CO_{2S,i,j} = \Sigma F_{(e,p,i,j)} \times EF_{(i,j)}$,

Where i and j mean truck type and fuel type, respectively;

F – fuel consumed;

EF – the special emission factor of the energy used (fuel).

For the summarised assessment of the processes covered in the study, the change in the CO_2 emissions was calculated at the macro level by calculating the difference between the GHG emissions of the e-solution and traditional solution and the difference was compared per unit specified in the process. This means assessing the efficiency and comparing the GHG emissions of the current system and the emissions of the potential new system. The resource efficiency formula was used for this purpose:

$E_{e,t} = CO_{2E(e,t)} / T_{(e,t)} \times Sn$,

where e is e-content and t indicates customs;

E – resource efficiency;

$CO_{2E(e,t)}$ – emissions from fuel or energy consumption (electricity, thermal energy) for the provision of the respective product/service;

$T_{(e,t)}$ – volume of product or service;

S_n – total number of activities (in the selected process).

Finally, the results were compared to the GHG emissions specified in the NIR. Comparison of the potential links presented in the table below was used for this purpose.

Table 3.6. Comparison with NIR

ACTIVITY	NIR area of activity total	NIR in total
AGRICULTURAL MACHINERY: Performing other work on the field	3.D.1 Direct N_2O Emissions From Managed Soils	Agriculture (CRF3)
AGRICULTURAL MACHINERY: Fertilising with organic fertilisers.	3.D.1.1 Direct Soil Emissions – Inorganic N Fertilizers (N_2O	Agriculture (D. Soils N_2O)
AGRICULTURAL MACHINERY: Fertilising with mineral fertilisers	3.D.1.2a Direct Soil Emissions – Animal Manure Applied to Soils (N_2O)	Agriculture (D. Soils N_2O)
E-INVOICE: TOTAL	1.A.1 Energy Industries	Total net emission (without LULUCF)
E-RECEIPT: TOTAL	1.A.1 Energy Industries	Total net emission (without LULUCF)
ECMR: TOTAL	1.A.3.b Transport/Road Transportation – Liquid Fuels	Total net emission (without LULUCF)
ECONOMIC FORECASTS: TOTAL	1.A.2 Manufacturing Industries and Construction	Total net emission (without LULUCF)

Conclusively, the transition to RTE was found to have a significant effect on GHG emissions due to the automation of most processes and primarily due to the fuel and fertiliser savings (agriculture and logistics and haulage). As automation reduces the time consumption, which in turn comes with using less electricity, thermal energy, and fuels, the GHG emissions also drop. The processes assessed would mainly reduce CO_2 emissions, approx. by 28 thousand tons per year.

In assessing the material consumption of e-receipts, it was found that 1,023.5 tons of thermal paper was imported to Estonia in 2018 and the amount was compared to the export figure. In total, 734.5 tons of paper was exported from Estonia, which means that the difference between the import and export volumes is 289 tons. This is presumably the amount of thermal paper used in Estonia per year for printing receipts.

The impact of the automation of e-invoices and e-receipts is smaller (approx. 1.7 thousand tons per year), but this is also due to the fact that partial use of paper was counted in the study. It was assumed that the transition has mainly been made to PDF documents. Even though the customers of catering and retail establishments increasingly refuse or do not need receipts, an estimated 289.0 tons of thermal paper is used in Estonia (equivalent to 50 million receipts). The CO_2 emissions from thermal paper before amount to 138.7 tons before recycling (the special emission factor of the paper is 0.480 t/CO_2 per 1 ton of material; while the relative density of the paper is 80 gsm^{-2}). Thus, the transition to e-receipts would not have a significant impact on GHG emissions in Estonia.

Comparing the change in the emissions with the Estonian GHG emissions in the sectors specified in the NIR report, the effect is low (mostly under 0.1%). The effect is bigger in the agricultural sector (over 0.5%).

The functioning of RTE has an impact on reducing GHG emissions via energy, fuel, and material consumption. As the calculation of GHG emissions based on primary indicators is a very complex and systematic operation, it was not reasonable to undertake this operation to assess the processes selected. In this work, GHG emissions were simply calculated based on energy used during the working time and the carbon concentration thereof, and assessing the potential change in efficiency.

The results showed (table 3.7 below) that the transition to the RTE solutions has a significant impact on the GHG emissions, mainly due to the automation of processes. As automation reduces the time consumption, which in turn comes with using less electricity, thermal energy, and fuels, the GHG emissions also drop. The greatest positive impact of RTE can be observed in the transport and logistics sectors but also in agriculture, where the level of automation implemented has been the lowest so far. The estimated impact of the automation of e-invoices and e-receipts is smaller, but this is also due to the fact that the partial use of paper was counted in the study. As the exact extent of using paper invoices is not known, it was presumed that the transition had mainly been made to PDF documents. Only the volume of paper used for printing receipts was counted.

We would like to point out that the impact of RTE on GHG emissions will decrease significantly due to phasing out fossil fuels. If fossil resources are no longer used for generating energy, automation will only impact the time consumption or financial expenses, or calculation of the life cycles of IT solutions and hardware must be used. The work was based on the assumption that the required IT hardware is available in a significant extent today and it would not be reasonable to calculate the GHG emissions arising directly from the life cycle of technology.

Table 3.7. The impact of using the solutions on reducing CO_2 emissions

PROCESS	DECREASE IN THE CO_2 EMISSIONS (TONS)
E-INVOICES	949
E-RECEIPTS	664
AUTOMATION OF REPORTING BY USING XBRL GL	0
REAL-TIME ECONOMIC FORECASTS	4.5
AUTOMATION OF THE PROCESSING AND MOVEMENT OF THE DATA OF AGRICULTURAL MACHINERY	10,540

E-LOGISTICS, REAL-TIME DELIVERY CHAINS (BASED ON THE EXAMPLE OF AN ELECTRONIC DELIVERY NOTE)	15,710

4. Summary

In this chapter, we provide a brief overview of the results of impact assessment in Estonian and English. We also make some suggestions for policy shaping.

4.1. RTE mõjude hindamise kokkuvõte

Üldiselt võib öelda, et kõik vaadeldud protsessid annavad kasutamisel kulude kokkuhoidu või tulu juurdekasvu.

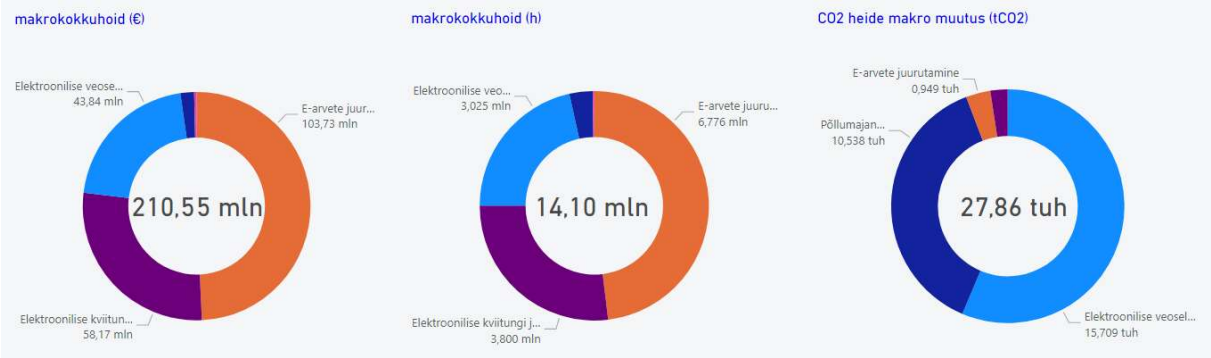
Avaliku sektori majandusarvestuse ja avaliku halduse alastel RTE lahendustel on kahene mõju SKP-le. Arendusprojektide läbiviimise ajal on mõju SKP-le positiivne, kuna avaliku sektori investeeringud ja kulud kasvavad. Hiljem muutub mõju negatiivseks, kuna avaliku sektori kulud võrreldes RTE arendusprojektieelse ajaga vähenevad. See tuleneb sellest, et avaliku sektori kulud loetakse SKP arvutamisel toodangu hulka. Kui kulud vähenevad, väheneb ka toodang.

Erasektoris mõjutavad SKP-d positiivses suunas RTE arendused, mis muudavad tootmise efektiivsemaks nii, et ettevõtted suudavad samade kulude juures rohkem toota ja tooteid turustada. Juhul, kui saavutatakse kulude kokkuhoid, näiteks ainult majandusarvestuse alal, siis tulud ega SKP sellest otseselt ei kasva. Raha küll säästetakse, kuid mõju SKP-le sõltub pigem sellest, kuidas see raha uuesti investeeritakse. RTE arendusprojektide ajal tekkiv mõju erasektorile on negatiivne, sest tootmisega seotud inimesed kaasatakse projektidesse, mis koheselt toodangut juurde ei tekita.

RTE mõju aja ja raha kokkuhoiule on olemas, kuid see on lahenduste puhul erinev. Oluline on kokkuhoid avalikus sektoris, kus RTE lahenduse puudumisel ei olegi osasid protsesse võimalik läbi viia või nende tulemus ei ole adekvaatne, kuna reaalsed algandmed ei ole mõistliku aja või kuludega kättesaadavad. Näitena võib siin tuua transpordistatistika koostamise. Andmeid kogutakse statistika jaoks küsitluse abil. See on seotud tuhandete inimestega ning nende tööajaga, mis kulub andmete esitamisele ja töötlemisele. Lõpptulemus ei ole täpne, kuna sarnast arvestust ei pruugita ettevõttes järjepidevalt pidada. Esitatakse ka hinnangulised andmed või ei esitata andmeid üldse, ettekäändel, et veok seisis või oli vaatlusperioodil remondis. Statistikaamet teeb statistikat esitatud andmete põhjal.

Tulude kasv tekib peamiselt protsessides, kus RTE lahendus on otseselt seotud tootmise või teenuse osutamise automatiseerimisega. Mõju on väiksem, kui lahendus on seotud ainult abitegevuste automatiseerimisega. RTE lahendus peab reaalselt sekkuma tootmise või teenuse osutamise protsessi. Sekkumine tähendab seda, et RTE lahendus teeb midagi inimese eest ära sellisel moel, et inimene saab tegeleda selle tõttu täiendava väärtuse loomisega, mis väljendub suuremas toodangus. Kuna RTE osas on peamiseks teemaks infotehnoloogilised lahendused, siis efektiivsuse kasvule kaasa aitamine saab enim tekkida mingi konkreetse olukorra näitajate põhjal järgmiste sammude info tekitamises ehk töö planeerimises ja prognoosimises. Tootmises inimtegevuse asendamine tähendaks füüsilise robottehnika kasutamist, mis juhinduks väljaarvutatud plaanist. Sellised süsteemid ei ole enam haruldased

tootmisettevõtetes, samuti põllumajanduses, kus professionaalne tehnika on programmeeritav ja võimeline töid teostama ilma inimese pideva järelevalveta.



Joonis 4.1. Vaadeldud protsesside mõju kokkuvõte

Makrokokkuhoid – macro saving

Co2 heide makro muutus – Macro change in CO2 emissions

Elektroonilise veose – Introducing eCMRs

E-arvete.. – Introducing e-invoices

Põllumajandus – Agruculture

Elektroonilise kviitungi – Introducing e-receipts

Joonisel on näidatud arvulised väärtused agregeeritult kõikides töös hinnatud protsessides kokku. Välja pole toodud otsest tulude kasvu, kuna see esineb ainult põllumajanduse andmete töötlemisel (ca 200 milj. eurot aastas). Esitatud on rahaline kokkuhoid eurodes aastas. Selgus, et RTE lahendustele üleminek valitud protsessides hoiab kokku kulusid üle 210 mln euro aastas. Töötundides on sama väärtus 14,10 miljonit tundi.

Jooniselt 4.1 ilmneb, et KHG heitekoguse vähenemine vaadeldud lahenduste kasutamisel on ligikaudu 28 tuhat tonni aastas.

Projekti käigus koostatud mõjude kalkulaatoris on võimalik vaadata RTE ülemineku mõjusid protsesside kaupa nii mikro- kui makro tasandil.

4.2. Summary of the RTE Impact Assessment

Generally speaking, all of the processes considered, can result in cost savings or gain in use.

The RTE solutions for public accounting and public administration have a dual impact on GDP. During development projects, the impact on GDP will be positive, as public investment and expenditure will increase. Later, the impact will be negative, as public expenditure will decrease compared to the time before the RTE development project. This stems from the fact

that public expenditure is included in output for the purpose of calculating GDP. If costs are reduced, output will also decrease.

In the private sector, GDP is positively affected by RTE's developments, which makes production more efficient, so that companies can produce more and market products at the same cost. If cost savings are achieved, for example only in accounting, then neither revenue nor GDP will directly increase. Money is saved, but the impact on GDP depends more on how that money is reinvested. The impact on the private sector during RTE development projects is negative, as people involved in production are involved in projects that do not immediately generate additional production.

The impact of RTE on time and money savings is different, but it varies with the solutions. It is important to make savings in the public sector where, in the absence of a RTE solution, some processes cannot be carried out or their results are inadequate, since the real raw data is not available in a reasonable time or cost. An example here is the compilation of transport statistics. The data is collected through a questionnaire for statistics. It is related to thousands of people and their time spent on data submission and processing. The end result is not accurate because similar accounting may not be consistently maintained within the company. Estimated data, or no data at all, shall be provided under the pretext that the vehicle was stationary or under repair during the reference period. Statistics Estonia compiles statistics on the basis of the submitted data.

Revenue growth is primarily generated by processes where the RTE solution is directly related to the automation of production or service delivery. The impact is smaller if the solution is only about automating ancillary activities. The RTE solution must actually interfere with the production or service delivery process. Intervention means that the RTE solution does something for the person in such a way that the individual can work on it to create additional value, that translates into greater output. As the main topic for RTE is information technology solutions, contributing to efficiency gains can most often be based on the indicators of a specific situation in the generation of information about the next steps, i.e. work planning and forecasting. Replacing human activities in production would involve the use of physical robotics based on a calculated plan. Such systems are no longer rare in manufacturing companies, as well as in agriculture, where professional techniques are programmable and capable of performing work without constant human supervision.

Figure 4.1 shows the numerical values aggregated across all processes evaluated in the work. There is no direct income increase as it only occurs in the processing of agricultural data (ca

EUR 200 million per year). Reported financial savings in euros per year. It was found that switching to RTE solutions in selected processes will save more than € 210 million a year.

Figure 4.1 shows that the reduction of GHG emissions from the use of the solutions considered is approximately 28 thousand tonnes per year. In the project impact calculator, it is possible to view the effects of RTE transition by process at both micro and macro levels.

4.3. Suggestions for policy shaping

RTE projects have so far mainly concerned the standardisation of the information of various different economic transactions and accelerating the transfer of this information. Now, Estonian economic and financial information management solutions are very developed. Online banks and e-invoices have been taken into use thanks to banks, which have taken care of monitoring the movement of the funds and organising the operations required. The more specific sectors where there are no IT solutions at all or those solutions are primitive have not been paid much attention. Those sectors include using satellite images and other satellite information. The same applies to agriculture, which is complicated by nature, which it is why it is possible to achieve significant effects there by using data through IT solutions that organise production and forecast future situations. European satellite information is the basis for the development of various different business services in construction, agriculture, as well as environmental protection. Complementing smartphone photos with satellite information allows for using them as tamper-proof evidence in various different fields of activity, incl. construction, traffic, agriculture, or law enforcement. This is untouched territory today, where RTE as the provider of data transmission solutions could play a role.

Some facts were identified in the course of the project, which enable making some suggestions that should be kept in mind in shaping the policy:

1) **For an RTE project to have a positive effect, the use of the resources freed should also be planned before launching the project.** The effect of digitalisation on the economic growth may prove negative otherwise. The growth of the income of businesses and GDP growth are not directly linked to digitalisation if this entails a switch from existing ‘paper’ documents to the digital format. This allows saving money but does not directly generate additional income. As no income is generated and the public sector expenditure decreases due to digitalisation, the direct impact of digitalisation on GDP is negative. The negative impact of the decrease in the public sector expenditure on GDP can be balanced by using the money saved for building a better service in the country. Businesses must also knowingly allocate the funds generated by cutting costs for increasing their revenues to ensure a positive impact on GDP and an increase in productivity.
2) **The data exchange channels developed in RTE must be complemented with services which provide business value.** The revenues of businesses primarily increase thanks to the automation and improvement of processes so that an IT system is used to plan production or a service better and manage the execution of the plan more efficiently. This means that stimulating the development of solutions which control production

processes or service providing processes could be a priority of RTE. If only data exchange channels are developed, the impact of RTE on economic growth may remain modest.

3) **It is expensive to simultaneously use several standards established for similar purposes.** Global use of largely the same Internet protocols is an example of this. Multitude of protocols would make quick communication between different parts of the work extremely problematic. The decisions concerning choosing standards have been made on different grounds so far. For example, Estonia has its own e-invoice standard. EU recommends using the UBL and UN/CEFACT CII standards. UNECE (The United Nations Economic Commission for Europe) is one of the most comprehensive developers of standards and recommendations. The standardised data and structure of the UNECE are also linked to the European e-invoice standard. All standards developed by the UNECE have the same structure. This makes it easy to convert one e-document into another, for example, an e-invoice into an eCMR. Using similar standards reduces the cost of implementing the standards considerably.
4) **Development and introduction of a standard are later followed by management of the standard.** One of the important priorities of RTE has been standardisation, which is expected to accelerate the movement of data and thereby also economic processes. Standards are the foundation of interoperability. On the other hand, standards may also restrict development. Especially if they are not updated. In the case of selecting a standard developed by a viable international organisation, such as the UNECE, as the standard used in a solution, the UNECE may be expected to develop and manage the standard and the owner of the solution will not have to worry about this. It is also important to introduce the standard to stakeholders in the course of managing the standard and train the specialists required. See also http://tfig.unece.org/contents/recommendations-and-standards.htm.
5) **It is very important to create or involve service providers and infrastructure operators who will make the solutions accessible for a wider circle of consumers. Thereat, the role of the state is to ensure an appropriate legal space and the control mechanisms to ensure the quality and sustainability of the service.** It is important to keep in mind that taking into use of different electronic data formats usually takes millions of euros of investments (see 'Table 3.4. Investments to be made in developing the solutions'). It is impossible to use such formats without appropriate software tools. Even if a solution already exists, various different issues may arise in the course of implementation. There is therefore no reason to expect private consumers or small enterprises to start using such systems at their own expense. Especially if the benefit in the form of saving is not generated for the issuer of an electronic document but for the recipient of the document. The state or large companies must always help with making the first investment. Thus, the important role of RTE promoters is to find interested parties and organise the work so that the parties would achieve continuing cooperation.
6) **RTE does not cover spatial information, incl. satellite information solutions. Automatic remote monitoring is an important topic in several different fields and could be one of the fields covered by RTE.** One of the possibilities for increasing the

impact of RTE is taking advantage of other data in addition to business data. In Europe, for example, satellite information is used for describing local conditions and changes in the conditions. The information made available by the European Space Agency and other related authorities is voluminous, but has found little use, as that would call for a relatively big initial investment. Satellite information enables assessing the use of building permits issued, sinking of structures, land and field use, or mapping flooded areas. The latter is important information about the value of land. Different indexes characterising the situation in cities, fields, forests, and water bodies can be calculated based on satellite images. Satellite information can be used to get a very quick overview of what is happening in large areas. Processing of satellite information and sending the information to the consumer in real time is an area not covered by RTE. Similar examples can be found from the field of mobile communications.

7) **If a solution developed in an RTE development project requires amendment of the legislation, the required amendments should be made.** Otherwise, the impact of the solution will remain low or it will be unusable.

Annex 1. Detailed data analysed

Andmestik.xlsx

Annex 2. Impact calculator

https://app.powerbi.com/view?r=eyJrIjoiMTZhZGU5ZDQtZTc0Mi00NTg4LThmZTYtOThmMjA0NDJjYzI5IiwidCI6IjRhOWM2MDRhLTUwNDMtNDQ2YS1iYzk4LTgxNzdmNmVlYTliNyIsImMiOjl9

RTE mõju uuring.pbix

Source file:

Annex 3. AS-IS and TO-BE models of processes

The table below describes the volumes of AS-IS and To-BE works. The difference between TO-BE and AS-IS is that the workloads are smaller in some project stages in the case of TO-BE due to automation.

Table 4.1. Estimated work volumes of the activities of the processes

OPERATION	WORKING TIME AS-IS	WORKING TIME TO-BE	HOURLY COST (EUR)	IS THERE A SAVING?
AGRICULTURAL MACHINERY: PLACING AN ORDER FOR SOIL SAMPLING	1.0000	0.1000	8.8165	YES
AGRICULTURAL MACHINERY: PREPARATION OF A WORK CARD FOR THE MACHINE	0.5000	0.1000	8.8165	YES
AGRICULTURAL MACHINERY: SELECTION OF THE CROPS	0.5000	0.2500	8.8165	YES
AGRICULTURAL MACHINERY: PROCESSING AND REGISTRATION OF FIELD WORK DATA IN THE FIELD DATA BOOK	2.0000	0.5000	8.8165	YES
AGRICULTURAL MACHINERY: ANALYSING OF YIELD DATA	2.0000	0.5000	8.8165	YES
AGRICULTURAL MACHINERY: PERFORMING OTHER WORK ON THE FIELD	1.5000	1.4000	8.8165	YES
AGRICULTURAL MACHINERY: FERTILISING WITH ORGANIC FERTILISERS.	0.5000	0.4000	8.8165	YES
AGRICULTURAL MACHINERY: FERTILISING WITH MINERAL FERTILISERS	0.1600	0.1500	8.8165	YES
AGRICULTURAL MACHINERY: REAL TIME MONITORING OF THE WORK	4.0000	0.2000	8.8165	YES
AGRICULTURAL MACHINERY: PREPARATION OF WORK ORDERS	1.0000	0.1000	8.8165	YES
AGRICULTURAL MACHINERY: DRAWING UP THE FERTILISATION PLAN	0.5000	0.2000	8.8165	YES
AGRICULTURAL MACHINERY: DRAWING UP OF THE CROP ROTATION PLAN	2.0000	0.5000	8.8165	YES
AGRICULTURAL MACHINERY: ANALYSING OF THE SOIL SAMPLE AND RECORDING OF THE NUTRITIONAL INDICATORS OF THE FIELD IN THE DATABASE	1.0000	0.2000	8.8165	YES
AGRICULTURAL MACHINERY: TAKING OF SOIL SAMPLES	1.0000	1.0000	8.8165	NO
AGRICULTURAL MACHINERY: DRAWING UP OF FERTILISING AND CROP SELECTION RECOMMENDATIONS	2.5000	0.5000	8.8165	YES
AGRICULTURAL MACHINERY: THE ENVIRONMENTAL BOARD CHECKS THE COMPLAINTS OF THE PRODUCER'S ACTIVITY WITH THE ENVIRONMENTAL PROTECTION REQUIREMENTS	8.0000	0.5000	8.8165	YES
AGRICULTURAL MACHINERY: THE AGRICULTURAL REGISTERS AND INFORMATION BOARD CHECKS THE COMPLIANCE OF THE PRODUCER WITH THE REQUIREMENTS (FOR SUPPORT)	8.0000	0.5000	8.8165	YES
AGRICULTURAL MACHINERY: PROCESSING OF DEFICIENCIES	16.0000	16.0000	8.8165	NO
E-INVOICE: DRAWING UP THE INVOICE	0.1000	0.0010	15.3074	YES
E-INVOICE: SENDING OF THE INVOICE	0.0200	0.0010	15.3074	YES
E-INVOICE: ISSUING THE INVOICE	0.0500	0.0010	15.3074	YES
E-INVOICE: LIQUIDATION OF THE INVOICE	0.0200	0.0010	15.3074	YES
E-INVOICE: ENTRY OF THE DETAILS OF THE INVOICE IN THE INTERNAL ACCOUNTING SYSTEM	0.1000	0.0010	15.3074	YES
E-INVOICE: ARCHIVING OF THE INVOICE	0.0200	0.0010	15.3074	YES
E-INVOICE: APPROVAL OF THE INVOICE	0.0100	0.0100	15.3074	NO
E-INVOICE: RECEIPT OF THE INVOICE	0.0200	0.0010	15.3074	YES
E-INVOICE: PLANNING OF THE PAYMENT	0.0800	0.0800	15.3074	NO
E-RECEIPT: PRINTING THE RECEIPT	0.0020	0.0010	15.3074	YES
E-RECEIPT: DRAWING UP THE RECEIPT	0.0300	0.0010	15.3074	YES
E-RECEIPT: SENDING THE RECEIPT TO AN E-RECEIPT SERVICE OPERATOR	0.0080	0.0010	15.3074	YES
E-RECEIPT: ISSUING THE RECEIPT	0.0020	0.0000	15.3074	YES
E-RECEIPT: RECEIVING THE RECEIPT	0.0080	0.0010	15.3074	YES
E-RECEIPT: ENTERING THE RECEIPT INTO THE REPORTING OR THE ACCOUNTING SYSTEM	0.0300	0.0000	15.3074	YES
ECMR: LOADING OF GOODS ON THE MEANS OF TRANSPORT	1.0000	1.0000	13.5074	NO

ECMR: PICKING AND PACKING OF THE GOODS AT THE PLACE OF DEPARTURE (WAREHOUSE)	0.5000	0.5000	13.5074	NO
ECMR: DETERMINING OF THE POSSIBILITIES FOR TRANSPORT AND ORDERING THE TRANSPORT	0.2500	0.2500	13.5074	NO
ECMR: DRAWING UP OF THE CONVEYANCE DOCUMENT	0.1000	0.1000	13.5074	NO
ECMR: THE CONSIGNMENT IS UNLOADED AT THE WAREHOUSE	0.5000	0.5000	13.5074	NO
ECMR: THE CONSIGNMENT IS ACCEPTED AT THE DESTINATION	0.5000	0.0167	13.5074	YES
ECMR: THE DETAILS OF THE CONSIGNMENT (E-CONVEYANCE DOCUMENT) ARE MADE AVAILABLE TO THE ENTITLED PARTIES	1.0000	0.0000	15.3074	YES
ECMR: THE POLICE CHECKS THE FIXING OF THE LOAD	0.0833	0.0833	12.9181	NO
ECMR: THE POLICE CHECKS THE DELIVERY DOCUMENTS AND PERMISSIBILITY OF THE HAULAGE OPERATION	0.1667	0.0167	12.9181	YES
ECMR: DOCUMENTATION OF VIOLATIONS	0.5000	0.5000	12.9181	NO
ECMR: DRAWING UP TRANSPORT STATISTICS BASED ON CONVEYANCE DOCUMENTS	0.001158711	0.0006952265	12.9181	YES
ECMR: REGISTRATION OF LOCATION COORDINATES	0.0167	0.0100	13.5074	YES
ECMR: HAULAGE FROM THE POINT OF ORIGIN TO THE DESTINATION	1.0000	0.9500	13.5074	YES
XBRLGL: ENTRY OF SOURCE DOCUMENTS INTO THE ACCOUNTING SYSTEM	1.0000	1.0000	15.3074	NO
XBRLGL: SUBMISSION OF REPORTS TO THE TAX AND CUSTOMS BOARD	1.0000	1.0000	15.3074	NO
XBRLGL: SUBMISSION OF REPORTS TO STATISTICS ESTONIA	1.0000	1.0000	15.3074	NO
XBRLGL: FILLING IN OF THE EKOMAR REPORT IN ESTAT	0.5000	0.5000	15.3074	NO
XBRLGL: COMPLEMENTATION OF A PRE-FILLED EKOMAR REPORT IN ESTAT	0.1667	0.1667	15.3074	NO
XBRLGL: DRAWING UP THE VALUE ADDED TAX RETURN	0.0833	0.0833	15.3074	NO
XBRLGL: COMPLETION OF THE ECONOMIC TRANSACTION	1.0000	1.0000	15.3074	NO
XBRLGL: ENTRY OF ACCOUNTING ENTRIES	1.0000	1.0000	15.3074	NO
XBRLGL: DRAWING UP OF TSD AND TSD INF	0.0833	0.0833	15.3074	NO
XBRLGL: ANALYSING OF REPORTS 1	1.0000	1.0000	15.3074	NO
XBRLGL: ANALYSING OF REPORTS 2	1.0000	1.0000	15.3074	NO
XBRLGL: MONITORING OF TAX RECEIPTS	1.0000	1.0000	15.3074	NO
XBRLGL: PUBLISHING OF STATISTICAL DATA	1.0000	1.0000	15.3074	NO
XBRLGL: SENDING NOTICES TO THE SUBMITTER OF THE REPORT	1.0000	1.0000	15.3074	NO
ECONOMIC FORECASTS: RECEIPT AND ENTRY INTO THE INTERNAL SYSTEM OF THE REPORT	8.0000	8.0000	15.3074	NO
ECONOMIC FORECASTS: ANALYSIS OF REPORTS	8.0000	8.0000	15.3074	NO
ECONOMIC FORECASTS: DEVELOPMENT OF AN INTERMEDIATE LAYER OF ECONOMIC FORECASTS	8.0000	8.0000	0.0000	NO
ECONOMIC FORECASTS: THE USER ESTABLISHES THE SOURCE DATA OF THE FORECAST FOR THE SYSTEM (FIELD OF ACTIVITY AND PERIOD)	0.0167	0.0167	23.0486	NO
ECONOMIC FORECASTS: THE USER GETS ACQUAINTED WITH THE FORECAST AND USES IT FOR THE CHECKING AND ASSESSMENT OF OTHER FORECASTS	160.0000	1.0000	23.0486	YES
ECONOMIC FORECASTS: THE SYSTEM CALCULATES AND DISPLAYS THE FORECAST	160.0000	0.0333	23.0486	YES
ECONOMIC FORECASTS: MACHINE-LEARNING BASED 'TRAINING' OF THE MODEL	8.0000	8.0000	0.0000	NO