

E-invoicing: A Catalyst for Digitalization and Sustainability

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Background and Purpose: Digitalization brings a wide range of opportunities for both digital and sustainable transformation. One of the first steps on this journey is the digitization of business documents and digitalization of business processes. The European Commission has recognised the advantages of digitalization, particularly in the context of e-invoicing, which can contribute significantly to economic prosperity and align with public policy goals such as deficit reduction and sustainable development. Despite the successful adoption of e-invoicing in the public sector, the uptake of e-invoicing in business-to-business (B2B) transactions is surprisingly low. This research focuses on Slovenia, a small European country that implemented e-invoicing as mandatory between enterprises and the public sector in 2015.

Methods: To investigate e-invoicing adoption in the wider population, we designed an online survey, which was conducted among 284 organizations in Slovenia. The collected data were analyzed using SPSS 28 software. One sample t-test was used to evaluate the importance of identified advantages, barriers and incentives for e-invoicing usage. Further, we ran an independent sample t-test to identify statistically important differences in the importance of advantages, barriers, and incentives between organizations with lower and higher levels of e-invoicing usage.

Results: The results showed that organizations recognize the benefits of e-invoicing well and perceive them as important. The most important barriers to e-invoicing adoption are related to the business environment, unawareness and lack of knowledge about how to implement e-invoicing. Desired incentives for wider e-invoicing adoption are related to easier and lower costs of technical implementation, provided training and education, including best practices, as well as the availability of government grants and other support measures on the state level, including legislation, public directory of business entities using electronic document exchange and service providers.

Conclusion: The paper provides important information for decision-makers and public administrations to take appropriate measures and incentives to further support wider adoption of e-invoicing and exchange of other e-documents to exploit opportunities of digitalization better.

Keywords: e-invoicing, Adoption, Digitalization, Sustainability, EU, Slovenia

1 Introduction

Today's market conditions, characterised by phenomena such as increasing competition, globalisation, market uncertainty, fast technological development and the rapid growth of start-ups with increasingly digitalized value and business models, are driving organizations towards digital transformation (Nadkarni & Prügl, 2020; Pucihar et al.,

2022; Zammuto et al., 2007). Digital transformation refers to the strategic use of digital technologies and the organizational capabilities that enable their effective use (Kljajić Borštnar & Pucihar, 2021; Pucihar et al., 2021; Tijan et al., 2021; Vial, 2019).

One of the first steps on the digital transformation journey of every organization is to digitise business documents and digitalized business processes (Verhoef et al.,

2021). Business documents are related to the processes of buying, selling, shipping and receiving goods, providing services, receiving and issuing invoices and payments, and all related response messages between organizations. The first endeavours of digitisation of business documents started in the 1980s (then called electronic data interchange - EDI) and later spread to large retail chains, which were among the first to recognise the benefits of exchanging business documents in a standardised electronic format, which enabled automated processing of large volume of business documents in enterprise business information systems (Marolt et al., 2021a). The advantages of digitisation and digitalization are reflected in faster process execution, fewer errors, document accessibility and lower operating costs, which results in reduced costs and increased efficiency (Horák et al., 2020; Marolt et al., 2021b).

The benefits of digitization and digitalization have also been recognised by the European Commission. For example, according to the European Commission's Directorate General for Informatics (DG DIGIT), the use of e-invoicing (exchange of invoices in standardized electronic format) in the public sector can make a significant contribution to economic prosperity (Connecting Europe Facility Stakeholder Management Office, 2019). The use of e-invoicing supports public policy priorities such as reducing the public sector deficit, promoting financial transparency, and promoting sustainable development. It also makes an important contribution to cost reduction and efficiency in the public sector. In addition, it also benefits private sector service providers and creates opportunities for the public sector to act as a catalyst for wider adoption of digital processes common to the private sector (European Commission, n.d.).

Quantitative estimates by the "European e-invoicing initiative" indicate potential savings of around EUR 240 billion over a six-year period in the area of e-invoicing, taking into account that 30 billion invoices are issued and exchanged per year in the European Union (European Commission, 2010). It is important to mention that digitalization and digital transformation bring enormous potential also for sustainability (Jović et al., 2022). The environmental benefits of e-invoicing are very significant, as the EU can reduce CO₂ emissions by 1 million tonnes per year by reducing paper consumption and energy costs for transportation (Veselá & Radiměšský, 2014). This is why the European Commission published a Communication in 2010 entitled "Reaping the benefits of electronic invoicing for Europe". This was followed by Directive 2014/55/EU on electronic invoicing in public procurement (Directive 2014/55/EU of the European Parliament and of the Council of 16 April 2014 on Electronic Invoicing in Public Procurement, 2014). EU Member States have signed up for the mandatory exchange of e-invoices between enterprises and the public sector. It is worth noting that Denmark was the first country to introduce mandatory e-invoicing back

in 2005, followed by Sweden, Finland, Norway, Austria, Italy, Slovenia, Spain and Switzerland, which also belong to the early adopters (Koch, 2017).

Following the introduction of mandatory use of e-invoicing among enterprises and the public sector, there were expectations from various stakeholders that the widespread use of e-invoicing would easily be extended to business-to-business transactions. Enterprises issuing e-invoices to the public sector have the appropriate software solutions to prepare and issue e-invoices, and their employees have acquired the appropriate skills and competencies to carry out these procedures. As e-invoicing to other enterprises is done in the same way and with the same software solutions as to the public sector, it is a big surprise that the use of e-invoicing among enterprises has not grown significantly per se but has only slightly increased in recent years (Bojanc et al., 2020; European Commission, 2022; Koch, 2019). Most of the adoption of business-to-business e-invoicing has come from some of the larger enterprises that have directly invited their suppliers or buyers to use e-invoicing (European Commission, 2021b; European Multi-Stakeholder Forum on E-Invoicing (EMSFEI), 2018; Koch, 2019), while in business-to-business transactions the use of e-invoicing is still scarce.

In this research, we focus on Slovenia, which has joined the mandatory use of e-invoices among enterprises and the public sector as of 1 January 2015, using the national eSLOG standard (Zakon o Opravljanju Plačilnih Storitve Za Proračunske Uporabnike (ZOPSPU-1), 2016). The main purpose of this study was to gain insights into the current situation in the field of business-to-business e-invoicing and identify reasons why e-invoicing has not become more widespread among enterprises (in the context of business-to-business use). In particular, we were interested in understanding the perceived advantages and barriers of e-invoicing and what incentives should be taken to widespread and increase e-invoicing use to fully exploit its potential of increased efficiency, reduced costs and CO₂ emissions. For that purpose, we prepared the survey in cooperation with key Slovenian stakeholders. The survey was conducted among 284 organizations.

The paper provides a comprehensive literature review of the field and detailed information about e-invoicing in the EU and Slovenia, including legislative and regulatory frameworks. The survey results include information about e-invoicing use and perceived advantages, barriers and incentives for wider adoption. The results of the survey provide valuable information for decision-makers and policymakers, especially in light of the preparations for the legally mandatory use of e-invoicing between enterprises. Understanding information from the field before the introduction of legislation may resolve many potential problems that might otherwise arise later.

2 Literature review

2.1 Definition of e-invoices

An e-invoice is an invoice that has been issued, transmitted and received in a structured electronic format. As such, it allows the automation of its generation, sending, transmission, reception and processing of the invoice using appropriate (business) information systems and technologies (European Parliament, 2014). Some enterprises use visualised electronic invoice formats such as PDF, JPG, and HTML instead of structured e-invoices (Directive 2014/55/EU of the European Parliament and of the Council of 16 April 2014 on Electronic Invoicing in Public Procurement, 2014; Koch, 2016, 2019). These types of document formats are not considered as e-invoices. The exchange of visual electronic document formats only represents savings for enterprises in terms of printing, postage, intra-organisational routing and archiving. However, it does not allow the automation of processes and procedures.

The e-invoicing has been around for decades (Koch, 2019). As early as the 1980s, large organisations were using EDI (Electronic Data Interchange) as a technology to transfer invoice data. At the time, these systems were point-to-point systems that required significant investment in establishing and maintaining connections between trading partners (Penttinen & Hyytiäinen, 2008). Electronic data interchange (EDI) was initially implemented between enterprises only. Later, the Internet was used as a backbone to transfer e-invoices between individuals, enterprises and government, significantly reducing the cost of implementing e-invoices in organisations (Lian, 2015).

Today, digital transformation and emerging technologies enable new approaches to business performance (Martínez-Román et al., 2020; Nasiri et al., 2020; Tiwari et al., 2023). The transmission of e-invoices based on open standards (e.g. XML) over the Internet has economic and practical advantages over the costly, complex and bilateral EDI exchange systems used previously (Penttinen & Hyytiäinen, 2008; Tanner & Richter, 2018). E-invoicing has become a global phenomenon and has recently been increasingly adopted by governments and organisations as well as medium and large enterprises (Olaleye et al., 2023).

2.2 Benefits of e-invoicing

Recent literature clearly outlines many potential benefits of e-invoicing compared to paper invoicing, both for the economy and society due to increased efficiency and simplicity and for the environment due to reduced paper consumption and CO₂ emissions (Bellon et al., 2022; Hagsten & Falk, 2020; Keifer, 2011; Koch, 2019; Moretto &

Caniato, 2021; Ollo-López & Aramendía-Muneta, 2012; Penttinen & Tenhunen, 2010; Poel et al., 2016; Qi & Che Azmi, 2021; Tiwari et al., 2023; Yip & Bocken, 2018).

E-invoices can be handled and processed more efficiently than paper invoices (Bellon et al., 2022). It offers faster delivery times, shorter payment delays and increased reliability as it reduces administrative errors (Edelmann & Sintonen, 2006; Lumiaho & Rämänen, 2011; Poel et al., 2016). In addition, there is the possibility to automate the processes of issuing, exchanging, receiving, automatically validating and archiving invoices (Poel et al., 2016). It enables for greater efficiency of human resources, as it relieves staff of administrative tasks, allowing them to spend their time on other, more productive tasks. E-invoicing can significantly reduce costs, e.g. reducing printing, postage and operational costs (Berez & Sheth, 2007; Edelmann & Sintonen, 2006; El Hani, 2001; Fairchild, 2004; Haq, 2007; Penttinen & Tuunainen, 2010).

Various studies estimate savings of up to 64% when using e-invoicing (European Commission, 2022; Koch, 2016, 2019). These estimates only consider the financial benefits of e-invoicing. When non-financial benefits are considered, the additional savings are multiplied by the number of e-invoices received and issued. The Billentis report publishes indications of the saving potential through the use of e-invoicing in the public sector of some European countries (Koch, 2016). While no estimates are given for Slovenia, potential savings of around EUR 600-700 million per year are shown for smaller countries such as Austria and Switzerland, and an estimated EUR 6.5 billion per year is given for Germany. The calculations of the estimates are made under two constraints. In the first scenario, only 60% of invoices are exchanged as e-invoices (XML format) and the remaining 40% in visualised electronic formats (PDF format). If each country switched entirely to e-invoicing, the potential savings would be even higher. Another limitation of the estimation is that it only includes data for the public sector.

One of the advantages to be highlighted is also the increased efficiency and traceability of the processes, as the information is obtained in real-time, and it is, therefore, easier to check where the e-invoice is in the billing process (Veselá & Radiměšský, 2014). Electronic invoices enable faster processing and approval cycles. Some suppliers are often willing to offer an additional discount for earlier payment (Keifer, 2011). It can provide a competitive advantage for organisations and make them less geographically dependent (Fairchild, 2004; Keifer, 2011; Koch, 2019; Korkman et al., 2010; Sandberg et al., 2009).

Implementing e-invoices also benefits other partners in the supply chain by increasing the digitalised buyer-supplier relationships, thereby bringing new business-to-business (B2B) opportunities (Rask et al., 2009). It also increases commitment and offers convenience to the supply chain partners and better customer service (Fairchild, 2004;

Penttinen & Tuunainen, 2010; Poel et al., 2016; Sandberg et al., 2009). Tanner and Richter (Tanner & Richter, 2018) emphasise the importance of understanding and involving business partners when developing new systems solutions.

E-invoicing could also prove extremely useful in enabling supply chain finance (SCF), as it enables faster, cheaper processes and innovative solutions (Caniato et al., 2016; Marak & Pillai, 2018, 2021; Wuttke et al., 2013). As traditional credit risk assessment models have become less reliable, modern digital technologies, including e-invoicing, are even more important than before for real-time monitoring of supply chains (Moretto & Caniato, 2021).

For the government, e-invoicing can greatly contribute to financial compliance and increase tax collection (Krysovaty et al., 2021; Olaleye et al., 2023; Skare et al., 2023). There is a positive influence of perceived benefits and trust in e-government on e-invoice adoption. E-invoice adoption also has a positive influence on the efficiency of tax compliance (Qi & Che Azmi, 2021).

The positive effects of e-invoicing were also evident during the Covid-19 pandemic. The process of issuing, transmitting and processing e-invoices is very independent from a geographical point of view, so it perfectly aligns with social distancing and isolation regulations of COVID-19 and allows organizations to avoid major problems with both the issuance, processing and payment of invoices, despite the hectic situation. However, the COVID-19 pandemic has disrupted the introduction and implementation schedule and deadlines of electronic invoicing in various countries worldwide. Covid-19 has slowed down the speed of implementation, regulations, and legislation (Moretto & Caniato, 2021; Olaleye et al., 2023).

E-invoices are also convenient for consumers, providing an easier way to pay and reducing the likelihood of forgetting to pay the invoice (Poel et al., 2016).

Finally, e-invoices bring several environmental benefits such as reduced paper consumption, increased energy efficiency, generated carbon savings and reduced greenhouse gas emissions (Mirabella et al., 2011; Moberg et al., 2010; Poel et al., 2016; Pohl et al., 2019) (Veselá & Radiměský, 2014). Data shows that paper invoices are responsible for 10% of all trees cut down worldwide (Ruisaho, 2014). Global deforestation is a major problem because trees absorb greenhouse gases, contributing to climate change and global warming. In addition to the trees that are cut down, paper invoices have a negative impact on CO₂ emissions. Paper invoices produce, on average, four times more CO₂ than e-invoices (Federation of Finnish Financial Services, 2010). This difference is partly due to the amount of saved paper and the delivery automation; however, most of the difference results from improved work efficiency due to time savings and consequent emissions savings.

Although the technology may also cause some carbon emissions, the switch to e-invoicing reduces the overall environmental impact of invoice processing. It should

be noted that e-invoices present only one type of business document. The effects are multiplied by using other electronic documents such as quotations, purchase orders, despatch advice, etc. In addition to reducing paper consumption, organizations that send and receive electronic documents also help to reduce fossil fuel pollution by cutting down on post-mail deliveries.

Artificial Intelligence (AI) has revolutionised business operations and sectors and will majorly impact e-invoicing. With AI, e-invoicing systems can analyse and extract relevant information from e-invoices to predict payment behaviour, optimise invoice delivery times for faster payments and even automate responses to invoice queries. Using machine learning (ML) algorithms, AI-enabled e-invoicing systems can significantly increase the efficiency, accuracy and productivity of e-invoicing systems, as they can process huge volumes of invoices instantaneously while ensuring much higher accuracy than manual processes through process automation (Malladhi, 2023).

In addition to improving the efficiency and processing of e-invoices, AI can detect and prevent potential fraud and make the invoicing process resilient to errors and oversights. Through deep cognitive insight, pattern analysis and anomaly detection, AI can instantly and with high accuracy detect fraudulent invoices, differences in amounts or discrepancies in customer data and raise the alarm (Bruin, 2023).

2.3 E-invoicing impediments

The lack of progress in e-invoicing adoption in recent years might imply that, despite the recognised benefits of adoption, other key factors for organisations are preventing the uptake of e-invoicing from keeping pace with expectations (Hagsten & Falk, 2020). The low adoption rate of e-invoices could indicate that the diffusion is still at an early stage of the process, dominated by factors that prevent enterprises from using e-invoices, such as high costs, lack of system compatibility, increasing frequency of errors and organisational inertia (Haag et al., 2013; Marinagi et al., 2015).

The main reason for the slow adoption rate of e-invoicing in enterprises was related to the lack of demand and resistance to change in financial administration. The level of knowledge and expertise was found to be low, which resulted in a longer adoption time (Edelmann & Sin-tonen, 2006; Salmony & Harald, 2010). Buyer fragmentation could be another reason for the difficulty in adopting such technology (Keifer, 2011). Perhaps the disinterest in e-invoicing is related to how it is perceived and who will benefit from its use (Hernandez-Ortega, 2012). According to Capgemini (Capgemini, 2009), the benefits are wide-ranging but potentially greatest for the demand side (buyers), while the environmental benefits may seem abstract.

Empirical studies in Finland (Edelmann & Sintonen, 2006), Sweden (Hagsten & Falk, 2020; Sandberg et al., 2009), Spain (Hernandez-Ortega, 2012), Germany (Haag et al., 2013), the Czech Republic (Veselá & Radiměřský, 2014), Belgium (Poel et al., 2016) and Netherlands (Arendsen & van De Wijngaert, 2011) show that, in addition to cost, the key factors for e-invoicing adoption are firm size, system compatibility, customer requirements, frequency of errors, usability, information deficit, knowledge, efficiency, and underlying ICT infrastructure.

2.4 E-invoicing in Europe

In 2010, the European Commission published a Communication entitled “Reaping the benefits of electronic invoicing in Europe”, which called on Member States to introduce e-invoicing and to overcome the problems arising from the lack of interoperability of existing e-invoicing systems (European Commission, 2010).

European Directive 2014/55/EU on electronic invoicing in public procurement was adopted to remove market and trade barriers resulting from different national rules and technical standards (Directive 2014/55/EU of the European Parliament and of the Council of 16 April 2014 on Electronic Invoicing in Public Procurement, 2014). In addition to reducing paper-based transactions and simplifying, streamlining and automating e-commerce, the main objective of the Directive was to introduce a single European standard for e-invoicing developed by CEN (CEN, 2017). The European e-Invoicing Standard EN 16931 ensures interoperability between different Member States and supports cross-border public procurement and e-commerce. According to the Directive, contracting authorities and contracting entities ensure the receipt and processing of electronic invoices that comply with the European electronic invoicing standards.

E-invoicing has become a common practice for public administration organisations among EU countries thanks to Directive 2014/55/EU (European Commission, 2023). However, although e-invoicing provides a lot of benefits, the rate of adoption has been slow and currently, only a small percentage of enterprises in Europe use e-invoicing (Arendsen & van De Wijngaert, 2011; Edelmann & Sintonen, 2006; Poel et al., 2016). Several previous studies have paid attention to e-invoicing adoption, from the business level (Hagsten & Falk, 2020; Hernandez-Ortega, 2011; Vreck & Magdalenic, 2011) to understanding individual user acceptance of e-invoicing (Lian, 2015).

The main drivers of e-invoicing adoption are regulatory framework, government mandates, customer demand, and supplier innovation (Keifer, 2011). While organisational readiness can play a key role in e-invoicing adoption (Penttinen & Tuunainen, 2010; Sandberg et al., 2009), external pressure, such as supplier and customer requests and regulations, can also be strongly associated with the

decision to adopt e-invoicing (Hagsten & Falk, 2020).

Compatibility and usefulness are the most important aspects related to the adoption, while perceived usability is essential for continued use (Hernandez-Ortega, 2012). E-invoicing may also be more attractive for enterprises with a large or growing number of invoices (Hernandez-Ortega, 2012). Larger enterprises may have a higher need to simplify their systems and processes and find it easy to implement an e-invoicing system, and their smaller counterparts face difficulties in adopting it due to high investment and integration costs (Fairchild, 2004; Penttinen & Hyytiäinen, 2008; Poel et al., 2016; Sandberg et al., 2009).

However, the low adoption rate in European countries is likely to change in the near future as more and more European countries are announcing the introduction of mandatory e-invoicing for all enterprises. Italy is the sole country within the EU with mandatory business-to-business e-invoicing as of January 1, 2019. Poland and Romania will introduce mandatory e-invoicing in 2024, with France, Spain, and Germany expected to follow, but they have yet to announce a rollout timeline (VAT Update, 2023). As a result of mandatory business-to-business e-invoicing in Italy, tax revenue increased by €3.5 billion in 2019. Of this, €2 billion came from additional VAT revenue, €945 million from detecting fraudulent input tax credits, and €580 million from direct taxation (OpenPeppol, 2021).

In December 2022, the European Commission published its long-awaited proposal for legislative changes to the “VAT in the digital age - ViDA” initiative (Proposal for a COUNCIL DIRECTIVE Amending Directive 2006/112/EC as Regards VAT Rules for the Digital Age, 2022). The ViDA proposal includes mandatory e-reporting and e-invoicing for intra-EU transactions. Intra-EU transactions refer to commercial transactions between different countries of the European Union. The ViDA proposal makes e-invoicing the default invoicing method. Unstructured electronic formats, such as PDF, will also no longer be considered e-invoices from a tax point of view.

2.5 E-invoicing in Slovenia

According to the European Commission’s DESI 2022 (The Digital Economy and Society Index), Slovenia ranks fourth among Member States in the e-invoicing category (European Commission, 2021a). DESI is an index summarising important indicators of digitalisation development in EU Member States and their digital competitiveness. The index for the e-invoicing indicator, which was only 2.33% for Slovenia in 2015, has jumped to 58.4% in 2022 due to the introduction of the legally mandatory use of e-invoices for business-to-government transactions.

The beginnings of standardisation of business electronic documents in Slovenia date back to 2001, when the Chamber of Commerce and Industry of Slovenia, on

the initiative of enterprises, launched the eSLOG project “Electronic Commerce of the Slovenian Economy” (Slovenian National eBusiness Centre., 2023). The project involved experts from more than 90 large enterprises. It resulted in the development of an eSLOG standard for electronic business documents, which today includes purchase orders, despatch advice, payment reminders, statements of account and invoices in XML format. It is important to note that eSLOG documents are widely supported in enterprise business information systems. Many service providers enable electronic document exchange between business partners.

A key step towards the wider use of e-invoicing in Slovenia was the mandatory e-invoicing to the public sector as of 1 January 2015. Since then, the issuer is obliged to issue an invoice to the public sector user in eSLOG format and may attach a visualisation of the invoice in PDF or other formats and annexes. The exchange of e-invoices with public sector users shall occur exclusively through the single entry and exit point of the Republic of Slovenia’s Public Payments Administration (PPA). Issuers may choose to send e-invoices via an e-invoicing service provider that has signed a contract with the PPA. In contrast, smaller issuers may enter invoices manually on the PPA’s online portal (Uprava Republike Slovenije za javna plačila, 2023).

A key advantage of the Slovenian e-invoicing ecosystem is that business software solution providers have integrated e-invoicing exchange services offered by service providers into their software solutions. This enables their end-users to fully automate the processes for sending and receiving e-invoices and other business electronic documents, as they do not need to use additional software solutions to copy manually, import or export documents but instead perform legally compliant all processes through existing software solutions already in use in the enterprise.

Despite all these achievements and positive effects of the e-invoicing ecosystem in Slovenia, which enables easy issuance, sending, exchange, receipt and processing of e-invoices, the mass use of e-invoices among enterprises has not yet occurred. However, a change in this area is expected in the future. The government has announced that it will draft a proposal for a law on the exchange of e-invoices and other e-documents, following the example of other European countries, which will make the exchange of e-invoices mandatory for all business entities. As the introduction of this law is likely to take some time, it is important to better understand the current status of business-to-business e-invoicing and the reasons for it now.

3 Research method

To analyse the development and current status of e-invoicing in Slovenia, a questionnaire was prepared in coop-

eration between the Slovenian National eBusiness Centre, the Slovenian Chamber of Commerce and Industry, the ICT Horizontal Network, the Digital Innovation Hub of Slovenia and the Faculty of Organisational Sciences of the University of Maribor. The questionnaire was prepared based on a literature review and the participation of domain experts in the field of digital business and digital transformation, e-invoicing and eSLOG standards.

Our research aimed to investigate e-invoicing adoption in a wider range of enterprises, so we chose the survey method. We decided to conduct an online survey, which allows us to capture and obtain the views of a wider population in a relatively short time and in an economical way (Lefever et al., 2007). In addition, this way of data gathering makes it faster and easier to prepare the data for subsequent statistical analysis (Bakla et al., 2013).

The questionnaire consisted of 22 questions divided into the following sections: organisation demographics, e-invoicing usage, perceived advantages, barriers and incentives to e-invoicing usage and respondents’ demographics. Prior to distribution, the questionnaire was tested with 10 domain experts and adjusted where needed.

The survey was distributed to their members by digital transformation supporting organisations and associations (Digital Innovation Hub Slovenia, Chamber of Commerce and Industry, e-invoicing service providers).

In the survey, we used the definition of the size of an enterprise following the European Commission’s regulations, meaning micro-enterprises with 1-9 employees, small enterprises with 10-49 employees, medium-sized enterprises with 50-249 employees, and large enterprises with more than 250 employees, respectively.

The survey was carried out via the online service Ika.arnes.si between 18 April and 2 May 2023, and it reached 1638 respondents, of which 901 started the survey. In total, 284 (17%) respondents completed the survey.

The collected data were transferred to SPSS 28 software to perform frequency analysis and descriptive statistics to calculate shares of different categories of e-invoicing usage. Further on, we ran one sample t-test to evaluate the importance (on a 5-point Likert scale from 1 being “not important at all” to 5 “very important”) of identified advantages, barriers and incentives for the usage of e-invoicing. If the variable mean value was not statistically significantly lower than 4 (with a confidence level of 95%), we confirmed the importance of the evaluated variable. After the assessment of which advantages, barriers and incentives are important to organisations for e-invoicing adoption, we ran an independent sample t-test to identify if there are any statistically important differences about important advantages, barriers and incentives between organisations with lower and higher extent of e-invoicing usage.

4 Survey Results

4.1 Descriptive statistics

284 representatives of organizations from 75 different locations in Slovenia and 19 different industries took part in the survey. The size structure of the participating organisations in terms of number of employees was 117 (41.2%) micro, 115 small (40.5%), 45 medium-sized (15.8%) and 7 (2.5%) large organisations. The respondents were employed in the following positions: 62 (22.2%) executive directors, 26 (9.2%) finance managers, 12 (4.2%) IT managers, 51 (18%) accounting managers, 31 (10.9%) other business managers, 18 (6.3%) IT officers and 77 (27.1%) employees in other positions.

An analysis of the sending and receiving of invoices by invoice format and organizations size shows that the majority of micro (89.7%), small (90.4%), medium (86.7%) and large (85.7%) organisations still receive paper invoices. A slightly smaller proportion of micro (73.3%), small (73.9%), medium (86.7%), and large (71.4%) organisations still send paper invoices. A similar proportion of organisations that receive and send paper invoices also receive and send them in PDF format via e-mail. A much smaller proportion of organisations receive (39.7% of micro, 45.2% of small, 40% of medium-sized, 42.9% of large organizations) and send (28.4% of micro, 27% of small, 24.4% of medium-sized and 28.6% of large organizations) invoices in PDF format with e-signature.

The most commonly used standard for e-invoices is the national eSLOG format, which is used for receiving (65.5% of micro, 71.3% of small, 77.8% of medium and 57.1% of large organisations) and sending e-invoices

(76.7% of micro, 78.3% of small, 86.7% of medium and 85.7% of large organisations). Other e-invoicing standards, such as EANCOM, EDIFACT, and UBL, are used less and more in large organisations (28.6% for receiving and 14.3% for sending e-invoices).

Furthermore, we analyzed shares of sending and receiving of e-invoices by partners, which shows that organisations exchange e-invoices mostly with suppliers 85.2% and customers 82.7%. A slightly lower share of e-invoices is exchanged with the public administration, 70.4%, which is reasonable as not all organizations do business with public administration, where e-invoicing is obligatory. A lower share of e-invoices is exchanged with logistics providers (28.5%), retailers (37.7%) and consumers (20.4%). The results also showed that organisations exchange e-invoices much more with domestic partners (54,2%) than exchange with foreign partners (14,6%).

We also analysed the proportion of e-invoices received and sent compared to other invoice forms (Figure 1). The results showed that, on average, organisations receive 18.3% and send 23.22% of invoices in eSLOG format and receive only 0.9% and send 0.82% of e-invoices in other e-invoicing standards. The highest average proportion of invoices received, 40.73%, and 36.62%, sent, are in paper format. Furthermore, the average proportion of 4.36% of invoices received and 5.34 of invoices sent is in PDF format with e-signature. On average, organizations receive 35.71% and send 33.99% of invoices in PDF format.

We were also interested in how organizations generate e-invoices. The majority of organisations use an ERP (Enterprise Resource Planning) solution for generating e-invoices, 57.8%, 27.4% use a dedicated software application, 22.6% use the PPA portal, 17.8% use a web application, 13.5% have developed their custom e-invoicing software

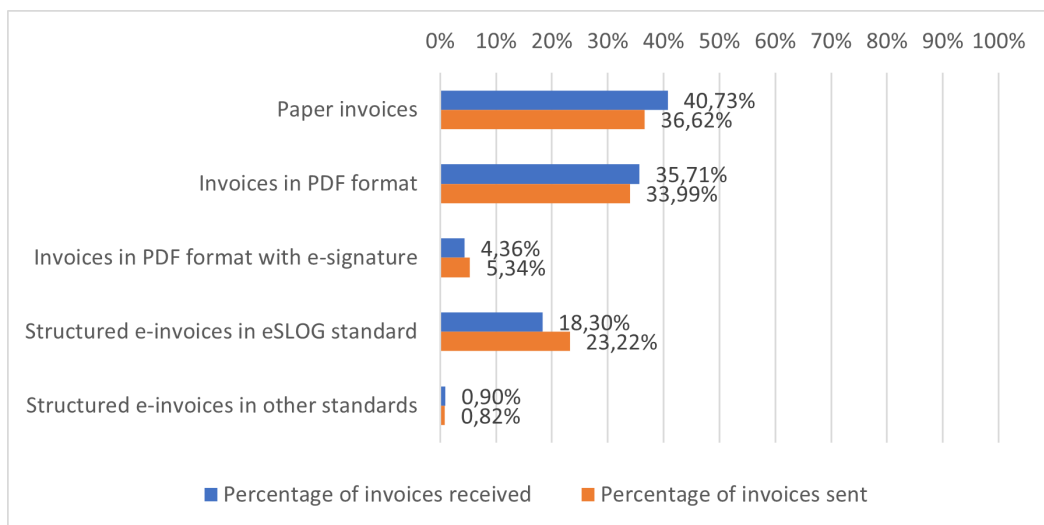


Figure 1: Percentages of invoices received and sent by the form of occurrence

solution, 11.5% use a business partner software solution, and 4.4% use a web service from a business partner.

4.2 Advantages, barriers and Incentives for e-invoicing adoption

To analyse the importance of e-invoicing usage advantages, barriers and incentives for adoption, we performed a one-sample t-test to test the statistical significance of importance (test value 4 – meaning important on a 5-point Likert scale) for each defined variable. With one sample t-test, we tested if the mean values of variables statistically significantly differentiate (at 95% confidence level) and are lower from value 4 as defined criteria for importance on a 5-point Likert scale.

The T-test for e-invoicing usage advantages (Table 1) confirmed that organizations perceive all investigated advantages as statistically important, except “improved cash flow and finances”. The following e-invoicing advantages were considered as important (in ranking order): business process automation, faster processing of invoices, faster delivery of invoices, improved business effectiveness, reduction of employee time, reduction of costs, business process tracking, increase of productivity, lower error rate, better relationships with customers and suppliers, better business process compliance.

Furthermore, we ran one sample t-test (Table 2) to identify statistically significant barriers to e-invoicing usage. Results have shown the following barriers as significantly important (in ranked order): suppliers do not send e-invoices, customers do not receive e-invoices, unawareness of the benefits of using e-invoices, and lack of knowledge to implement e-invoicing.

T-test of the importance of e-invoicing usage incentives is shown in Table 3. The analysis shows the extent to which organisations (1 strongly disagree - 5 strongly agree) agree with the incentives given for e-invoicing. The one sample t-test shows that the following incentives would most likely encourage organisations to adopt e-invoicing (results in ranking order): reduced initial costs of implementing e-invoicing, increased awareness of the benefits of e-invoicing, business software providers integrating e-invoicing into their solutions, customer requirements for the use of e-invoicing, education on e-invoicing, digitalization financial grants, incentives from the government and institutions, calls for tenders for digitalization, publicly presented examples of good practice, public directory of business entities for the exchange of e-invoices, government to legislate mandatory e-invoicing for all companies, public catalogue of service providers and their solutions.

Table 1: T-test of means for the importance of e-invoicing usage advantages

e-invoicing usage advantages	Test Value = 4						
	t	df	Significance		Mean Difference	95% Confidence Interval of the Difference	
			One-Sided p	Two-Sided p		Lower	Upper
Business process automation	8.924	269	<.001	<.001	.481	.38	.59
Faster processing of invoices	8.575	272	<.001	<.001	.469	.36	.58
Faster delivery of invoices	8.499	274	<.001	<.001	.451	.35	.56
Improved business effectiveness	6.818	256	<.001	<.001	.362	.26	.47
Reduction of employee time	5.590	270	<.001	<.001	.314	.20	.42
Reduction of costs	4.789	273	<.001	<.001	.296	.17	.42
Business process tracking	4.968	271	<.001	<.001	.287	.17	.40
Increase of productivity	4.336	267	<.001	<.001	.269	.15	.39
Lower error rate	4.407	271	<.001	<.001	.268	.15	.39
Better relationships with customers and suppliers	-.357	255	.361	.722	-.023	-.15	.11
Better business process compliance	-.525	261	.300	.600	-.034	-.16	.09
Improved cash flow and finances	-2.728	249	.003	.007*	-.196*	-.34	-.05

* p-value is lower than .05 at a confidence level of 95%, and the mean value is lower than 4

Table 2: T-test of means for the importance of e-invoicing usage barriers

e-invoicing usage barriers	Test Value = 4						
	t	df	Significance		Mean Difference	95% Confidence Interval of the Difference	
			One-Sided p	Two-Sided p		Lower	Upper
Suppliers do not send e-invoices	-.402	244	.344	.688	-.024	-.14	.10
Customers do not receive e-invoices	-.599	242	.275	.550	-.037	-.16	.08
Unawareness of the benefits of using e-invoices	-1.925	239	.028	.055	-.112	-.23	.00
Lack of knowledge to implement e-invoicing	-1.885	241	.030	.061	-.124	-.25	.01
The complexity of implementing e-invoicing	-4.643	237	<.001	<.001*	-.311*	-.44	-.18
High costs of e-invoicing IT implementation	-4.263	226	<.001	<.001*	-.330*	-.48	-.18
Information security concerns	-7.584	237	<.001	<.001*	-.534*	-.67	-.40
Lack of management support	-7.779	229	<.001	<.001*	-.652*	-.82	-.49
Limited IT capabilities in the organisation	-8.740	230	<.001	<.001*	-.688*	-.84	-.53
Low level of e-business adoption	-8.265	220	<.001	<.001*	-.729*	-.90	-.55
Not aware of e-invoicing providers and solutions	-13.314	223	<.001	<.001*	-1.112*	-1.28	-.95

* p-value is lower than .05 at a confidence level of 95%, and the mean value is lower than 4

After assessment of which advantages, barriers and incentives (Table 1-3) are important for organizations for e-invoicing adoption, we aimed to identify if there are any statistically important differences in opinions between organizations with lower and high extent of e-invoicing usage. We defined criteria for a greater extent of e-invoicing usage by average percentage (20%) with added standard deviation (22%) of e-invoicing usage. The calculated criteria for a higher extent of e-invoicing usage was set to 42%. This criteria formed two distinct groups of organizations with different extents of e-invoicing usage. A lower e-invoicing usage group consists of 186 organizations, and a higher extent of e-invoicing usage group consists of 41 organizations.

To compare two groups with lower and higher extent of e-invoicing usage, we ran an independent T-Test with Levene's test for equality of variances to test if the assumption on the homogeneity of variances was violated (Table 4).

Independent T-test identified statistically significant and practical important differences between the two compared groups with a confidence level of 95%. Organiza-

tions with greater e-invoicing usage perceive the following advantages as more important than those with lower e-invoicing usage: higher business process automation, reduced employee time and increased productivity. Furthermore, organizations with a greater extent of e-invoicing usage perceive as a more important incentive that software providers integrate e-invoicing into their business information systems than those with lower e-invoicing usage.

Organizations with lower usage of e-invoicing reported higher integration costs with existing systems as a more important barrier than those with higher e-invoicing usage.

5 Discussion

The survey results have shown that paper and PDF invoices are still the predominant format for exchanging invoices. 40.73% of invoices are received, 36.62% are sent in paper format, 40.70% of invoices are received, and 39.33% are sent in PDF format (with or without e-signature). In all structured electronic formats, 19.20% of invoices are received, and 24.04% are sent, with the vast ma-

jority of these invoices exchanged in the eSLOG standard. This distribution also aligns with the findings in the Billentis reports, where PDF and paper are the dominant formats for exchanging invoices (Koch, 2016). As expected, medium-sized and large enterprises receive the highest number of e-invoices, as they are generally better IT-supported for receiving e-invoices. In contrast, many smaller enterprises, especially micro-enterprises, lack the IT solutions and expertise to deal with e-invoices. The higher proportion of structured e-invoices sent than received is because 70.4% of the organisations surveyed exchange invoices with the public sector, for which eSLOG invoice format is mandatory. Although 81.1% of the respondents indicated sending e-invoices in a structured eSLOG format, these represent only 23.22% of all exchanged invoices. This confirms our study's assumption that although many organisations have the technological and organisational support to send e-in-

voices, they do not use this method of exchange to a large extent for various reasons.

In addition to the assessment of the current state of e-invoicing adoption in organizations in Slovenia, we also identified statistically significantly important advantages (Table 1), barriers (Table 2), and incentives (Table 3) for e-invoicing perceived by survey respondents. It is noticeable that respondents perceived the majority of e-invoicing usage advantages as necessary. The most important advantages are business process automation, faster processing of invoices, faster delivery of invoices, improved business effectiveness and business process tracking. Significantly recognized were the reduction of employees' time, reduction of costs, and lower error rates, which led to increased productivity. There were only two benefits that were not recognized as statistically important. The first is "improved cash flow and finances", which is understandable,

Table 3: T-test of means for the importance of e-invoicing usage incentives

e-invoicing usage incentives	Test Value = 4						
	t	df	Significance		Mean Difference	95% Confidence Interval of the Difference	
			One-Sided p	Two-Sided p		Lower	Upper
Reduced initial costs of implementing e-invoicing	6.805	254	<.001	<.001	.353	.25	.46
Increased awareness of the benefits of e-invoicing	6.070	256	<.001	<.001	.307	.21	.41
Business software providers integrate e-invoicing into their solutions	5.485	246	<.001	<.001	.304	.19	.41
Customer requirements for the use of e-invoicing	4.306	253	<.001	<.001	.228	.12	.33
Education on e-invoicing	4.378	255	<.001	<.001	.227	.12	.33
Digitalization financial grants	3.266	246	<.001	.001	.219	.09	.35
Incentives from the government and institutions	1.724	248	.043	.086	.112	-.02	.24
Calls for tenders for digitalization	1.523	243	.065	.129	.102	-.03	.23
Publicly presented examples of good practice	.653	245	.257	.514	.041	-.08	.16
Public directory of business entities for the exchange of e-invoices	.434	242	.332	.665	.029	-.10	.16
Government to legislate mandatory e-invoicing for all companies	-.739	248	.230	.461	-.052	-.19	.09
Public catalogue of service providers and their solutions	-1.810	242	.036	.071	-.119	-.25	.01
Competitors use e-invoicing	-2.771	253	.003	.006*	-.189*	-.32	-.05

* p-value is lower than .05 at a confidence level of 95%, and the mean value is lower than 4

Table 4: Independent T-test for comparing groups with high/low e-invoicing usage

		Levene's Test for Equality of Variances		t-test for Equality of Means							
		F	Sig.	t	df	Significance		Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
						One-Sided p	Two-Sided p			Lower	Upper
Business process automation	Equal variances assumed	18.447	0.000*	2.701	225	0.004	0.007	0.402	0.149	0.109	0.695
	Equal variances not assumed			4.332	146.866	0.000	0.000*	0.402	0.093	0.218	0.585
Reduction of employee time	Equal variances assumed	7.352	0.007*	1.490	225	0.069	0.138	0.240	0.161	-0.078	0.559
	Equal variances not assumed			2.033	96.065	0.022	0.045*	0.240	0.118	0.006	0.475
Increase of productivity	Equal variances assumed	2.203	.139	-2.113	219	.018	.036*	-.297	.141	-.574	-.020
	Equal variances not assumed			-2.156	67.697	.017	.035	-.297	.138	-.572	-.022
High integration costs with existing systems	Equal variances assumed	.604	.438	2.251	194	.013	.026*	.476	.212	.059	.894
	Equal variances not assumed			2.112	52.411	.020	.039	.476	.226	.024	.929
Software providers integrate e-invoicing	Equal variances assumed	10.397	.001*	-2.700	210	.004	.007	-.373	.138	-.645	-.101
	Equal variances not assumed			-3.573	101.437	<.001	<.001*	-.373	.104	-.579	-.166

* p-value is lower than .05 at confidence level 95%

as e-invoicing is about business process simplification and optimization rather than payment and financial discipline. Respondents also did not recognize “better relationships with customers and suppliers” as an important benefit of e-invoicing. This might be related to an invoice being the last business document in the buyer-supplier business transaction process. Many other activities and factors lead towards sustainable and trustworthy buyer-supplier relationships (from the quality of products and services to trustworthy business operations and cooperation).

Surveyed organizations recognized the important barriers: suppliers do not send e-invoices, customers do not receive e-invoices, lack of knowledge about the benefits of using e-invoices and lack of knowledge to implement e-invoices. The first two barriers are related to the business

environment of an organization. If business partners are not using e-invoicing or any other e-document or particular information technology, this also impacts the organization itself. Lack of awareness and knowledge have always been the most important barriers to adopting information technology or business innovation. Therefore, different stakeholders in the country's entire ecosystem (including policymakers) need much effort and many incentives to raise awareness of digitalization opportunities and support their implementation.

Respondents are encouraged to consider almost all incentives that could support the broader adoption of e-invoicing (see Table 3). Incentives are related to government funding schemes, some already in place through the Digital Innovation Hub of Slovenia and other programs. It is

also crucial to provide legislation for mandatory e-invoicing between enterprises. In addition, a public directory of business entities for exchanging e-invoices and a public catalogue of service providers and solutions on a national level would be beneficial. In addition, training, education, and learning from best practices have been recognized as important to obtain needed knowledge for e-invoicing implementation. Implementing e-invoicing in business ecosystems and supply chains is also considered a significant incentive. Finally, without proper information technology and service infrastructure, wider e-invoicing adoption is impossible.

We also examined how more advanced organizations with a greater extent of e-invoicing usage are perceiving e-invoicing usage benefits, barriers and incentives compared to those with lower use of e-invoicing (see Table 4). We can conclude, as expected, that those organizations with higher e-invoicing usage perceive business process automation, reduction of employee time and increase of productivity as more important advantages compared to those with lower e-invoicing use. This can be explained by the fact that organisations with a higher extent of e-invoicing are more aware of the advantages of e-invoicing because they recognise these usage advantages in their work.

E-invoicing reduces the need for manual data entry, validation, and reconciliation, saving time and resources for both the sender and the receiver of the invoice. E-invoicing frees up employees from tedious and repetitive tasks related to invoice processing, such as printing, mailing, scanning, filing, and archiving. This can increase employee satisfaction and productivity and reduce labor costs and errors. E-invoicing is one of the important catalysts for digitalization and sustainable development for enterprises and economies. By adopting e-invoicing, businesses can improve their efficiency, profitability, customer satisfaction, and environmental impact. All these benefits contribute not only to more profitable but also to more sustainable business operations.

We can conclude that e-invoicing adoption is also cost-sensitive. Therefore, we find that a good practice approach is for software providers to integrate e-invoicing into their business solution, as organizations with higher e-invoicing usage point out. Most e-invoices (57.8%) are prepared with enterprise resource planning (ERP) solutions, ranging from global vendors such as SAP and Dynamics NAV to various Slovenian ERP vendors. All major Slovenian ERP business software solution providers have integrated the services of e-invoicing providers into their software solutions. This has enabled organizations to automate the sending and receiving of e-invoices and to perform the entire e-invoicing process within a single software solution without unnecessary manual copying, importing or storing of documents. The cost sensitivity of implementing e-invoicing should be considered, especial-

ly for micro and small organisations, as they have fewer staff, IT support and financial resources available. For enterprises that only issue a few invoices per year, various online e-invoicing portals are available. An example is the unrestricted use of the PPA (national) web portal for generating and issuing e-invoices to the public sector (limited to 100 hundred invoices per year), used by almost a quarter of the respondents.

Organizations with lower e-invoicing usage perceive the barrier of high integration costs with existing systems as more important. Thus, this might be the reason for lower e-invoicing usage. Given the integrations already made in the software solutions available to organisations, there is also a lack of knowledge to implement e-invoicing in these organisations, which was also identified as one of the more important barriers (see Table 2) that can be addressed by raising awareness. The survey participants identified increased awareness of the benefits of e-invoicing and reduced initial costs of implementing e-invoicing as the two most important drivers (Table 3).

6 Conclusions

In this paper, we present an insight into the development of e-invoicing in the small EU country Slovenia. We present the efforts of various stakeholders who have advocated and contributed significantly to establishing and expanding e-invoicing in Slovenia. In the theoretical part of the paper, we also describe important regulations, legislation, and policies in Slovenia and the EU that have significantly impacted this field's evolution. The current situation of e-invoicing in Slovenia is based on an established ecosystem, which ensures interoperability for electronic document exchange. However, we still have enormous opportunities to improve digitalization of e-invoices and other business documents, processes and entire business models.

It is important to note that we also show the significant advantages of electronic document exchange in terms of generating significant time and financial savings and reducing environmental impact. Considering the large number of invoices exchanged (approximately 30 billion invoices exchanged per year), there is a huge potential to reduce CO2 emissions by 1 million tonnes per year by reducing paper consumption and energy costs for transportation. The numbers are impressive; however, the huge potential of digital transformation of enterprises and societies and its impact on sustainable development and sustainability has not yet been entirely revealed.

In the main part of the paper, we present the survey results on developing e-invoicing among organisations in Slovenia. 284 organisations participated in the survey, whose representatives fully responded to the online questionnaire. The findings of the survey show that despite the

legal regulation and mandatory exchange of electronic invoices with the public sector, e-invoicing has not yet been widely extended to business-to-business transactions. Most enterprises still exchange invoices in paper and PDF format to a large extent.

To encourage further digitisation of business processes and digital transformation of organisations, we have identified the need for legislation supporting the mandatory exchange of e-invoices in a standardised format for all business entities. This type of legal regulation of mandatory exchange of e-invoices between organisations has already been introduced in some European countries (Italy and Serbia), and several countries are preparing to introduce it (Belgium, France, Poland, Spain and Romania). We expect this regulation to be introduced in Slovenia in the near future as well. This will ensure the widespread use of e-invoicing and the resulting benefits, increased competitiveness of organisations and significant environmental impact.

The widespread use of e-invoices among organisations is also the basis and potential for further development of digitalization and digital transformation of enterprises. With the comprehensive digitisation of all business documents, related business processes can also be digitalized. This results in increased productivity and, thus, the competitiveness and sustainability of not only the individual organisation but also the entire economy in Slovenia.

An important role in these endeavours will also be played by the national registry of e-invoice recipients, which was established in April 2018 under the Readiness of Slovenian e-invoicing (ROSE) measure, in line with the European Directive 2014/55/EU. The register contains structured information on how e-invoices are received by each (organization) recipient's system. Currently, the registry is maintained by the National eBusiness Centre, which operates within the Chamber of Commerce and Industry. In the future, it would be necessary to establish this register on a national level and ensure cross-border interoperability.

SMEs supporting organizations (chambers of commerce, IT service providers, educational institutions, various associations for digitalization and innovation hubs) will continue to play an important role in sharing knowledge about opportunities for digitisation, digitalization, and digital transformation. It will be crucial to ensure adequate co-funding and appropriate solutions for different types of organisations. Micro and small enterprises are particularly vulnerable in this respect. Therefore, appropriate services will have to be provided for their specific needs.

The results of our study provide important information on the development of the use of e-invoicing and the opportunities for further development of the electronic exchange of other business documents. It provides important information for decision-makers and public adminis-

trations to take appropriate measures and incentives and support establishing the appropriate ecosystem for digital transformation in the country. The paper also contributes to a better understanding of the advantages, barriers and incentives of e-invoicing and digitisation of other business documents for practitioners on their path to digital and sustainability transformation.

However, like any research, also our research has limitations. The most significant limitation stems from the sampling method, as the survey mainly involved organisations that have already taken specific steps in digitalization. To balance the results, we compared them with the national digitalization results conducted annually by the Statistical Office of the Republic of Slovenia (based on EUROSTAT). Nevertheless, we did not detect any major discrepancies. Where any were detected, we aimed to provide reasonable explanations from observation and expert knowledge in the field. The limitations also provide opportunities for future research. Gathering data from various sources with different research methods and approaches is important to get deep insights and better understand the field's evolution. In our case, the following research opportunity will be after the adoption of mandatory e-invoicing between all business entities, which will happen in the next few years. Observing the digitalization achievements of other business documents and processes will also be interesting.

Acknowledgement

The University of Maribor, Faculty of Organizational Sciences and the authors acknowledge the financial support from the Slovenian Research and Innovation Agency (research core funding P5-0018).

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