Feasibility Study on Implementation of Electronic Invoicing in Public Administration Enterprise

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Abstract. *In this paper we present a case study i.e. the feasibility study regarding the implementation of the electronic invoice (e-Invoice) into the business process of a government agency. Agency processes around 13.000 invoices per year and interesting question arose - will implementation of the existing e-Invoicing framework be feasible? In this case study, business process modelling was first conducted (AS-IS) and detailed statistics and process performance were measured. After that, potential future process was designed (TO-BE) and evaluation is done via BPMN simulation. Results are presented with ROI analysis and some possible problems are discussed.*

Keywords. Electronic invoice, business process modelling, business process improvement, ROI

1 Introduction

This paper presents a study on applicability and profitability of an implementation of electronic invoicing into a government Agency in Croatia (further: the Agency). The Agency issues more than 10.000 invoices per year and receives more than 3.000 invoices. In Table 1. the number of incoming and outgoing invoices per year for last 4 years is shown. As the data in the table shows, the number of invoices, both incoming and outgoing, is increasing through years and shows a clear trend.

In period 2009-2012 there was an average of 12.830 invoices per year. It is an estimation of the management of the Agency that the number of invoices per year will not fall under 13.000 in future years.

Table 1. Number of invoices per year in the Agency

Year	Incoming invoices	Outgoing invoices
2009	2622	9703
2010	2749	8586
2011	3049	10490
2012	3455	10666

Assuming the increasing trend and management's estimations, approximation of 10.000 outgoing invoices was used in this research for both AS-IS and TO-BE simulations and comparison. Incoming invoices were not considered in the cost analysis as their cost in the TO-BE scenario is not significant.

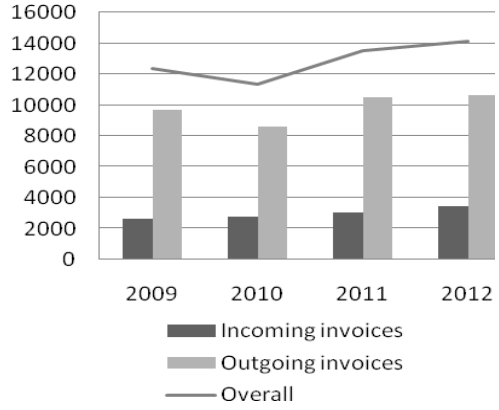

Figure 1. Number of invoices in the Agency from 2009 – 2012

The increasing number of invoices represents a burden on the accounting department since they are severely understaffed. Optimization of business

processes in accounting department in order to avoid new employment and decrease costs of invoices processing were the main drivers for Agency to start considering electronic invoicing as an option.

With respect to the existing technical specification and defined standards for e-invoicing in Croatia [1] the question in this study is whether the introduction of e-Invoice will lower the overall costs of invoice processing in the Agency. All resources that are identified to be used in the process are measured or estimated. These resources include human resources i.e. time spent on particular actions and tasks but also the materials used for the process execution. Beside this cost analysis, entire project implementation is considered and estimations were made regarding the project duration and cost. Return on Investment (ROI) analysis is also conducted. This paper presents the business process model in the current state (AS-IS) and possible future implementation (TO-BE). Business process models were made using the Business Process Modelling Notation (BPMN) and final analysis is performed via a simulation.

In this study several key assumptions were made that are important for reviewing the results of the study. First, authors made an assumption that all invoices in the Agency would be sent and received electronically. This assumption highly affects the calculation and is a very important factor for profitability of investment. Second assumption is that the number of foreign invoices is negligible and therefore will not affect the calculation, since the interoperability of this model with other EU countries was not considered. Some other potential benefits, such as ecological, are not considered in this paper although they are possible [3]. There are possible other benefits that a company could gain by switching to electronic invoicing such as cut down of costs related to claim management [4], paper archiving costs etc.

1.1 Current state of electronic invoicing in the World

As there are numerous studies performed lately about electronic invoice, many benefits of electronic invoices have been recognised and confirmed, and the most important one is the decrease of costs for organisation. This effect is a driver for growing interest on electronic invoicing in both private and public sector. There are other drivers like tax control [12] and logistics processes in Latin America [7], gain in time [8], ecology [9] etc. Electronic invoice development across the globe has numerous initiatives and approaches and implementation of electronic invoices is not on the same level in different parts of the world.

Numerous statistics and potential savings are available on the cost between paper and electronic invoice. European Commission estimates paper invoice issuing cost to be €1.40 and e-invoice only €0.40 [10], some authors came with similar numbers regarding issuing paper invoice but also calculated costs of manipulation and processing paper invoice for the receiving side which is in range from €9.00 - €20.00, with possible savings of up to 70% with electronic invoicing [11].

European Union made the electronic invoice project part of their technological development strategy "Digital Agenda". European Commission's estimations result that e-invoice could save up to €240 billion over six years[14]. European Union made the first steps towards electronic invoice in 2001 with Directive 2001/115/EC, allowing electronic invoicing in respect of VAT and further amended this regulation with Directive 2010/45/EU. By this legislative act Commission prescribed that all obstacles for electronic invoicing in respect to VAT controls shall be removed in all member states by 1 January 2013 [13] and paper and electronic invoices should be treated equally. European approach is to define components that would make electronic invoice complaint rather than to define the process or technology.

According to the opinion of the European Economic and Social Committee from 2011, the European Commission should focus more on the removal of remaining obstacles to wider adoption of electronic invoice in EU with the biggest obstacles being electronic signature regulation and unequal transformation of e-invoice regulation into national practices in member states if they want to achieve the goal of electronic invoice being the main way of invoicing in EU by 2020. Wider adoption of e-invoice is desirable and should happen as quickly as possible, but should not be mandatory yet. There is an estimation that currently only 5% of invoicing in EU is done electronically despite obvious benefits of this technology. The recommendation of the Committee is that Commission should do more on adopting global standards for e-invoice. [14]

In order to increase usage of electronic invoices and similar electronic services some countries in the EU, like Denmark, started their own projects several years ago. E.g. Denmark registered all public sector institutions in the master registry thus enabling critical mass of clients that improve cost-benefit ratio for SMEs to join and use electronic services [2]. Denmark electronic invoice initiative saved more than €100 million in few years after its implementation [6].

In the United States the use of electronic invoice is still not mandatory. The approach US Department of Treasury took with e-invoice is to provide a platform called Invoice Processing

Platform[1] to enable electronic invoice processing. This platform was made mandatory only for all Treasury suppliers but is open for anyone else to join [12].

In several countries of Latin America, like Brazil or Mexico electronic invoice is mandatory. It is based on government XML schema and has direct connection to tax authorities. In Latin America the approach is to define strict standards for the whole business process, meaning not just XML schema but rather the integration points with tax authorities, standards for processing, printing and archiving of electronic invoices [7].

Croatian legislation follows European Union specification of electronic invoice, in alignment with EU directive that was made in 2009 [5]. The electronic invoice project was developed in Croatia as part of the national strategy for development of e-Business [6].

2 Process AS-IS

2.1 Statistics

The Agency in 2012 processed more than 14.000 invoices, counting pro forma invoices, outgoing invoices and incoming invoices. Invoice data summary is shown in Table 1. We tried to estimate personnel cost involved in the process, the results are shown in table 2.

Table 2. Estimated personnel costs in Agency

Department	**Gross costs and other indirect costs (€)**	**Cost per day (€)**	**Cost per hour (€)**	**Cost per minute (€)**
Administrative office	1580,00	79,00	9,87	0,16
Accounting	1580,00	79,00	9,87	0,16
Director	3289,5	164,48	20,56	0,34

Measuring process activities durations, we obtained daily time duration and financial costs of processing an invoice request. Obtained results are shown in Table 3.

[1]Formerly Internet PaymentPlatform, see https://www.ipp.gov/index.htm

Table 3. Average daily time and financial cost for invoice processing

Department	**Duration (min)**	**Cost (€)**
Administrative office	40	6,4
Accounting office	153,2	24,51
Director	6,8	1,09

2.2 Process description

Figure 2 gives a sequence of activities of the AS IS business process: process starts with an official request from one of the departments of the Agency (1) which is then sent to the accounting department (2). Upon the request (3), clerk in the accounting department fills the required data about the invoice in the existing accounting software (4). After filling the data, clerk prints the invoice (5), signs it (6) and reports the invoice for a signature to a responsible person – in our case to the director (7). Signed by the clerk and director invoice is archived and sent to administrative office for delivery (8). The process of delivering consists of: enveloping (9), signing the postal service (10) and shipping (11).

The process of filling up the pro-forma invoices is the same like filling the invoices, so it will be considered like the same processes. There are some special cases when the official request does not come from the outside department but it is requested from informal channels.

Table 4. Activities duration in AS-IS business process

Activity	**Average duration**
Processing	5 min
Invoice printing	20 sec
Creating invoice order	0 sec
Invoice archiving	20 sec
Enveloping	30 sec
Shipping	0 sec
Invoice signing	10 sec
Invoice signing by the responsible person	10 sec
Transcribe invoice items from request to accounting software	3 min
Signing the postal service	30 sec
Receiving of order for Invoice	0 sec

Table 5. Resources allocation in AS-IS business process

Resource	Used in activity	Duration (sec) / Quantity (pcs)	Cost (€)
Envelope	Enveloping	1 pcs	0,02
Paper	Invoice printing	1 pcs	0,04
	Invoice archiving	1 pcs	0,02
Administrative officer	Enveloping	30 sec	0,08
	Signing postal service	30 sec	0,08
Accounting clerk	Transcribe invoice items from request to accounting software	3 mins	0,48
	Invoice printing	20 sec	0,05
	Signing invoice	10 sec	0,02
	Archiving invoice	20 sec	0,05
Director	Signing invoice	10 sec	0,05
Registered mail fee	Shipping	1 pcs	1,25

Total cost for creation, processing and shipping of one invoice is €2,12. For year 2012 and the total of 10.666 outgoing invoices the total cost was €22.611,92.

3 Process TO-BE

3.1 Process description

The TO-BE business process model is made accordingly to the framework given in [1]. Figure 3 depicts the flow of the TO-BE business process. After the automatic initiation in the case of incoming invoices and manual initiation for outgoing, the e-Invoice draft is being populated with the data from the accounting software (1) which is then sent to the syntax and semantics check (2). If the draft is validated positively, the canonical hash of the e-Invoice is made (3). Hash is being encrypted with the private and public key and in that way e-Signature is generated (4). e-Signature is then sent (5) to the timestamp confirmation at the authorized authority (6). Timestamp, e-Signature and e-Invoice draft together form the e-Invoice that can be sent to a client (7). e-Invoice is being stored in the application within the Agency. We considered the manual initiation for outgoing invoices as not cost significant.

3.2 Cost analysis

The biggest cost in this implementation is the cost of e-invoice processing by the authorized authority. Cost per invoice is estimated based on the current pricelist of the authorized authority which states that one trusted verification equals €0,007. Amortization of the hardware equipment we estimate to be approximately €1315,00 per year. Per outgoing invoice that is €0,12. Following the estimated budget requirements for software development project, system maintenance is estimated to approximately €3947,00 per year i.e. €0,37 per invoice.

4 Business Process Improvement and Simulation

Comparing the results from the simulation of the business process we can notice significant cost savings in the reengineered i.e. TO-BE business process compared to the AS-IS process. Cost savings can be achieved in the employees' time and due to the costs of their salaries. Also, cost reductions are possible in the materials used (paper, toners etc.) and posting costs (envelopes and post fees). Table 6 shows aspects of the potential cost savings considering projection of 10.000 invoices. Table 7 shows costs that are present in the TO-BE scenario.

Table 6. Savings in TO-BE business process

Subject	Savings per year (€)
Envelopes	200,00
Paper (paper, toner etc.)	400,00
Accounting clerks' work	1.755,56
Administrative officers' work	6.723,78
Director's work	621,35
Postal costs	12.500,00
TOTAL	**22.200,69**

Table 7.Costs of the TO-BE business process

Subject	Costs per year (€)
Timestamp verification	70,00
Hardware amortization	1315,00
Software maintenance	3.947,00
TOTAL	**5.332,00**

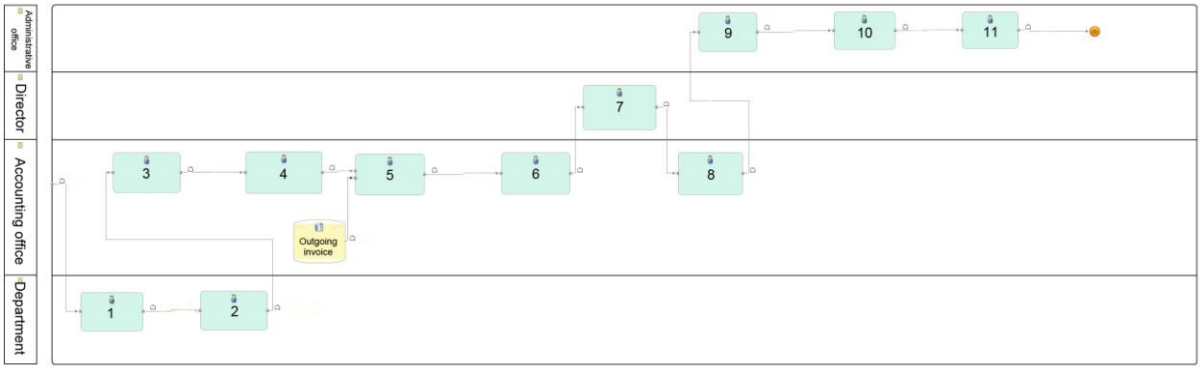

Figure 2. Business process model of the AS-IS business process

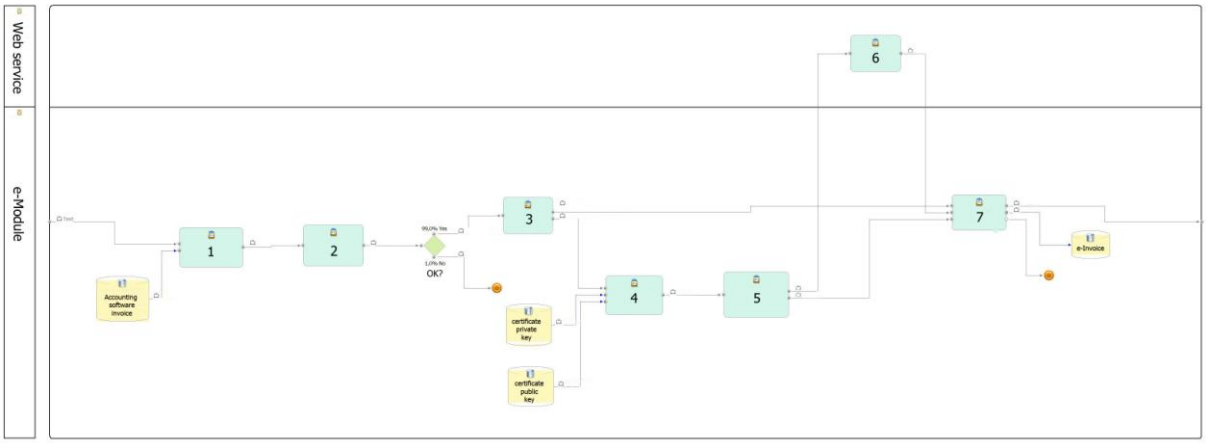

Figure 3. Business process model of the TO-BE business process

Beside these yearly costs, there are initial implementation costs. For the sake of this paper, and based on the authors' experience, detailed estimates of the implementation project activities were made. Considering space limitations, detailed project description is out of the scope for this paper but gross figures are as follows. Estimate on project duration is 110 man/days and considering current IT market conditions in Croatia, costs of the implementation are somewhere around €40.000,00. Authorization authority imposes additional costs for each legal entity using the e-invoice processing system. Those include legal entity registration, yearly subscription for the smart card with certificate, yearly subscription for application certificate or server and timestamp verification. Overall yearly costs imposed by the authority are approximately €300.

4.1 ROI analysis

The new TO-BE process savings are defined in Table 6. Most of the savings are related to personnel cost/time and inventory savings. Although the new process causes expenses for hardware, software and e-invoice authorization it is obvious that yearly costs are far below the costs in AS-IS business process.

As we can see in Figure 4 the initial costs in TO-BE business process cause the delayed return of investment. Break-even point is met in after the 29th month of TO-BE process implementation.

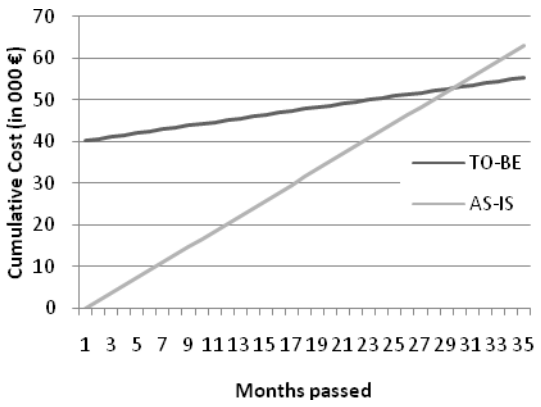

Figure 4. ROI comparison between TO-BE and AS-IS business process

5 Discussion

This paper presented a case study of business process engineering, in which the goal was to design a process of issuing and receiving

electronic invoices. The AS-IS and TO-BE processes are modelled and the simulation is executed to calculate the potential time and cost savings, so we and estimate feasibility of the process reengineering. Simulation showed significant cost savings in both time and actual financial cost. Despite of the encouraging results of the simulation, one must keep in mind possible problems in implementing such a solution. For e-invoice implementations to be successful and meaningful, so-called network effect is needed i.e. all involved parties must support the new proposed e-invoicing process. That means that all clients and partners of the Agency should support the new procedures and implement e-invoicing in their institutions and unfortunately currently this is not the case.

6 References

[1] Brumec, J, i dr. Projekt: Istraživanje generičkog procesnog modela tvrtke, identifikacija priključnih točaka za elektroničko poslovanje te tehničke i funkcionalne specifikaije e-Modula za njihovu implementaciju - Prilog 1 III. E-RAČUN. Varaždin: Fakultet organizacije i informatike, 2009.

[2] Brun, M. H., Lanng, C. (2006). Reducing barriers for e-business in SME's through an open service oriented infrastructure. Proceedings of the 8th international conference on Electronic commerce: The new e-commerce: innovations for conquering current barriers, obstacles and limitations to conducting successful business on the internet (pp. 403–410). New York, NY, USA: ACM. doi:10.1145/1151454.1151519

[3] Hernandez-Ortega, B. (2012). Key Factors for the Adoption and Subsequent Use of E-Invoicing. Academia-Revista Latinoamericana De Administracion, (50), 15–30.

[4] Pfaff, D, Skiera, B, Weitzel, T. (2004). Financial chain management. Wirtschaftsinformatik, 46(2), 107–117.

[5] Specifikacija elektroničkog računa, MINGORP, Povjerenstvoza e-Račun, Zagreb, prosinac 2009.

[6] Vanjak, Z., Mornar, V., & Magdalenić, I., Deployment of e-invoice in Croatia, 348–354.

[7] Lewin, S. (Invoiceware International) (2012). Latin America E-invoicing: Five Key Differences with the US and Europe. Gtnews, 4. October 2012

[8] Wendel, M., & Cokesic, V. (2005). Business Value of Electronic Invoicing. Retrieved from http://hdl.handle.net/2077/1100

[9] Nedbal, D. (2012). An Examination of the Economic Value and Contribution to Energy Efficiency of SaaS Solutions: The Case of E-Invoicing. Services Economics (SE), 2012 IEEE First International Conference on (pp. 1–8). doi:10.1109/SE.2012.7

[10] Hurley, M. (Ricoh), (2012). E-invoicing as a Stimulus for European Businesses, Gtnews, 25 September 2012.

[11] Brennan, P., Kumar, V., & Jain, N. (2008). Electronic invoicing: How to Increase e-Invoicing B2B Transactions. Infosys - Enterprise Payments | FINsights, 49–54.

[12] Taylor, N. (GXS), (2013), New E-invoicing Rules to Spur Adoption in 2013. gtnews, 7 January 2013.

[13] Council Directive 2010/45/EU of 13 July 2010, Official Journal of the European Union, 22.7.2010., L 189/1- 8

[14] Opinion of the European Economic and Social Committee on the 'Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions — Reaping the benefits of electronic invoicing for Europe', Official Journal of the European Union, 29.10.2011., C 318/105-108