

Development of a maturity model for electronic invoice processes

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Abstract The digitalization of invoice processes provides a good opportunity for companies to pare down expenses, optimize administrative tasks, and increase efficiency and competitiveness. But the digitalization is limited by a variety of software solutions, legal uncertainties, heterogeneous demands, lack of know-how, and information system infrastructure incompatibilities. A holistic map of electronic invoice processes is mandatory, especially to demonstrate different levels of process integration and optimization. A maturity model puts this into practice and provides companies with a tool to identify their current situation and to derive recommendations to optimize that situation. In this paper, a maturity model for electronic invoice processes will be developed using exploratory data from focus groups. A theoretical approach that is based on a procedure-model for developing maturity models is applied. Four categories (strategy, acceptance, processes & organization, and technology) are identified and enriched by sub-categories. Future research requires the development of detailed maturity metrics.

Keywords e-business · e-invoicing · e-invoice processes · Maturity model

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Introduction

The digitalization of business processes is an essential method for cutting administrative costs, improving productivity in business processes, and achieving process transparency (EU Expert Group on e-Invoicing 2009). In order to improve efficiency and provide competitive advantages to companies, it is crucial to use information systems (IS) to support internal business processes (Becker et al. 2009; Sandberg et al. 2009) and processes with business partners (Tanner et al. 2008).

Although invoice processes do not create value in the majority of cases, the electronic exchange of invoices is expected to generate significant economic benefits, especially if the electronic invoice (e-invoice) provides structured data for automated processing. E-invoices promise savings of both cost and time, because they reduce manual work, input errors, printing, and transport costs (EU Expert Group on e-Invoicing 2009; European Commission 2010; Sandberg et al. 2009). Further, workflows, process transparency, and traceability are improved by e-invoice processes (Haag et al. 2013). Despite the obvious benefits, the market penetration of e-invoices in the EU is only about five percent for business-to-business (B2B) transactions (European Commission 2010). Barriers to participation are the lack of awareness, lack of business strategy, and lack of adequate IS for process optimization, as well as high investment costs, legal uncertainty, lack of standard e-invoice processes, and heterogeneous demands of the business partners (Haag et al. 2013; Legner and Wende 2006; Sandberg et al. 2009; Tanner et al. 2008). In addition to technical and organizational barriers, there are also legal uncertainties (Kreuzer et al. 2013). Companies need tools and methods to measure possible benefits and to cope with the barriers. They need support in implementing the e-invoice processes, identifying their current situation, and prioritizing improvement. Maturity models fulfill these needs (Becker et al. 2009; de Bruin et al. 2005). The

practical problem relevance is supported by the existence of three best practice maturity models that were proposed by consulting companies (Table 1). The research focus of the current paper is the procedure-model-based development of an electronic invoice processes maturity model (EIPMM) and in particular, the verification and extension of the results with experts from the e-invoice processes domain. The following research question is addressed:

RQ Which basic structure of a maturity model for e-invoice processes is required to support the implementation of e-invoice processes?

First the theoretical background for a maturity model for e-invoice processes is introduced. Then, the research design is explained. A theoretical approach based on a procedure model by Becker et al. (2009) is applied and data from focus groups is analyzed. The four initial phases of the applied procedure model represent the research path and determine the structure of the main section. The current EIPMM is presented, and theoretical and practical implications are derived. Limitations and an outlook complete the paper.

Status Quo and research Gap

E-invoice processes

The invoice is one of the most important documents exchanged between business partners, including public authorities. It links the business processes order, delivery, payment, and accounting. The invoice, including the self-billing (invoicing by supply receiving company), is the core element of the European system of value added tax. Invoices are documents that provide supplies and services invoiced. According to Council Directive 2010/45/EU, companies are only entitled to pre-tax deductions based on an invoice. In 2001, pre-tax deduction based on e-invoices became legal in the EU. E-invoices are invoices that contain all information required by law and are exchanged electronically (European Union 2010). E-invoice processes concern the electronic exchange of invoices between business partners, the accounts payables and receivables including integration of preceding business processes and archiving. E-invoicing is the process of creating and sending an invoice electronically.

Table 1 Overview of best practice maturity models on e-invoices

	POMM Paperless Office (Maturity Model)	CEIMM (Capgemini E-Invoicing Maturity Model)	SEIMG (Spend Matters E-Invoicing Maturity Guide)
Source	Institute of Financial Operations and Perceptive Software 2013	Capgemini 2012	Spend Matters 2011
Focus	Abolishment of paper Large companies	Optimization and cost-savings of e-invoice receipt, consulting project initiation Large companies	Optimization of e-invoicing Large companies
Structure	Maturity levels: 5 (e.g., paper-based; workflow-driven) Two model types: accounts payable and accounts receivable	Maturity levels: 7 (e.g., manual invoice entering; scanning street; portal solution)	Maturity levels: 3 (low, middle, high) Maturity areas: 5 (e.g., organizational structure; technology environment)
Approach	<ul style="list-style-type: none"> •Technology-oriented maturity levels that are described on the basis of process areas of the accounting department (e.g., invoice receipt; inquiries) •No overall aspects (strategic alignment, process integration, etc.) 	<ul style="list-style-type: none"> •Solution-orientated maturity levels that are described on the basis of areas of incoming invoice processing (e.g., processing; throughput time) •No overall aspects (strategic alignment, process integration, etc.) 	<ul style="list-style-type: none"> •Focus of the white paper: invoice automation in accounts payable departments, in early payment and in discount programs •Attempt to address some overall aspects (e.g., two maturity areas stands for process integration with payment and procurement)
Access and usability	<ul style="list-style-type: none"> •Little information, membership required •Website with illustration of model, short initial results report for accounts payable •Online survey, results after registration •Selection of maturity level depends on the mainly applied manner of invoice processing (e.g., manual, imaging) 	<ul style="list-style-type: none"> •Little information: blog article on website with short description and illustrations of the model •Selection of maturity level (= solution) depends on each individual relationship 	<ul style="list-style-type: none"> •Too little information: published white paper on e-invoicing with a table showing the maturity guide •Maturity grid for first assessment
Input for EIPMM	•Overview of solutions and processes used in accounting departments	•Overview of e-invoice solutions used in practice and basic information on processing of incoming e-invoices	•First input for maturity areas

A variety of solutions for e-invoice processes are available, but they differ in functional scope, level of process integration, and technical capabilities. In Fig. 1 the legal, technical, and organizational aspects of e-invoice processes are presented. Administrative tasks are reduced and the efficiency of human resources is improved by adopting more productive tasks (Hernández-Ortega 2012). But business partners are often not ready for e-invoices with regard to process and IS maturity and do not have the know-how required for e-invoicing, or they are just not willing to adopt e-invoice processes (Legner and Wende 2006; Lumiaho and Rämänen 2011; Penttinen et al. 2009).

Maturity model for E-invoice processes

Current research on e-invoices reflects the complexity and diversity of the e-invoice landscape (Fig. 1). Earlier research focused on electronic data interchange (EDI) (Kioses et al. 2007), but current research focusses on identifying drivers and barriers that affect the dispersion of e-invoices exchange. In this context, theoretical models are evaluated (e.g., Hernández-Ortega 2012; Hernandez-Ortega and Jimenez-Martinez 2013) or requirements based on surveys are derived (e.g., Cuylen et al. 2013a; Haag et al. 2013). Some of this acceptance research focuses on small and medium-sized enterprises (SME) (e.g., Lumiaho and Rämänen 2011; Sandberg et al. 2009), and on governmental participation (Arendsen and Wijngaert 2011; Kreuzer et al. 2013). Another research stream addresses interoperability issues and business models (e.g., Beck et al. 2002; Gómez-Pérez et al. 2012; Kivijäri et al. 2012; Penttinen et al. 2008).

Maturity models are conceptual models that evaluate and compare the maturity within a selected discipline (de Bruin et al. 2005; Mettler et al. 2010), e.g., software engineering (Paulk et al. 1993), e-business (Prananto et al. 2001), business processes (Weber et al. 2008), business process management (de Bruin et al. 2005), and knowledge management (de Bruin and Rosemann 2005). They establish a sequence of maturity levels (de Bruin et al. 2005) and define specific characteristics, competencies, and capabilities of a certain domain that must be fulfilled (Becker et al. 2010). Maturity models support companies in identifying their as-is situation, so they can determine an improvement path and control the progress of optimization (Becker et al. 2010; Pöppelbuß et al. 2011). Maturity models help to realize competitive advantages and to identify strategies for cost reduction, quality improvement, and reduction of time to market (Becker et al. 2010; de Bruin et al. 2005; Mettler et al. 2010). In the domain of e-invoices, maturity can be defined as the level of capability for designing, establishing, and using e-invoice processes.

The three best-practice maturity models (Table 1) focus mainly on accounts payable departments.

The maturity levels of POMM are technology-oriented and support the goal of paperless accounting processes. The maturity levels of CEIMM are solution-based with the goal of optimizing invoice receipt. These maturity levels are not designed in a sustainable way as emerging technologies will require changes in maturity levels. Only SEIMG makes an attempt to include process integration aspects. In the other two models, the process integration is evident through the brief descriptions of the maturity levels. Currently, there is no maturity model that deals with the entire electronic invoice process and includes process integration aspects.

Fig. 1 Implementation strategies and options for e-invoice processes (further development and enrichment of Legner and Wende 2006)

Organizational layer	Business relation	E-invoice models	Software	Business process
	<ul style="list-style-type: none"> • Business-to-Business (B2B) • Business-to-Consumer (B2C) • Business-to-Government (B2G) 	<ul style="list-style-type: none"> • Direct model • Seller-direct • Buyer-direct • Consolidator model 	<ul style="list-style-type: none"> • ERP system • Invoicing/billing software • Accounting software • Document management system • Workflow systems • Office software 	<ul style="list-style-type: none"> • Process integration • Manual • IS supported • Fully automated • In-house • Outsourcing • Service provider
Technical layer	Transmission protocol	Transmission medium	Data format	Message standard
	<ul style="list-style-type: none"> • SMTP • FTP / S-FTP • HTTP/HTTPS • x.400 • AS2 • .. 	<ul style="list-style-type: none"> • Email • EDI • File transfer • Service provider • Portal • .. 	<ul style="list-style-type: none"> • Structured (EDIFACT, XML,...) • Unstructured (PDF, TXT,...) 	<ul style="list-style-type: none"> • Neutral (EDIFACT, ebXML, OASIS UBL,...) • Industry specific (ISO 20022, GS1 XML,...) • Proprietary (SAP iDoc,...) • Country specific (Finvoice, OIOXML,...)
Legal layer				
<ul style="list-style-type: none"> • Authenticity • Integrity • Legibility • Storage format and storage period • Corresponding legal requirements (e.g., for accounting) 				

Research design and methodology

IS researchers have suggested various guidelines for maturity model design (Pöppelbuß et al. 2011) addressing the lack of documentation of the development method and empirical model validation (Solli-Sæther and Gottschalk 2010). Such a systematic model development helps “develop a model that is highly (generalizable) and enables standardization” (de Bruin et al. 2005). Becker et al. (2009) introduced an eight-stage procedure model for the development of maturity models that “leads to improved documentation and to more profitable results than an intuitive procedure” (Becker et al. 2009; Fig. 2). The model helps researchers to overcome methodological

shortcomings, while practitioners can increase the acceptance of their models by adopting this academic approach and evaluation method (Pöppelbuß et al. 2011). The four initial phases (A-D) of the procedure model were applied to design the EIPMM and are described in section “Development and Design”. The final four stages will be conducted when the development of the maturity model is ready for final evaluation, as phases E through H are concerned with making the model available to the predefined user groups and evaluating the project outcomes.

All iterations are presented in Fig. 2. Currently the research presented here is within phase D in the fourth iteration. In this iteration, the revised model was discussed and extended with

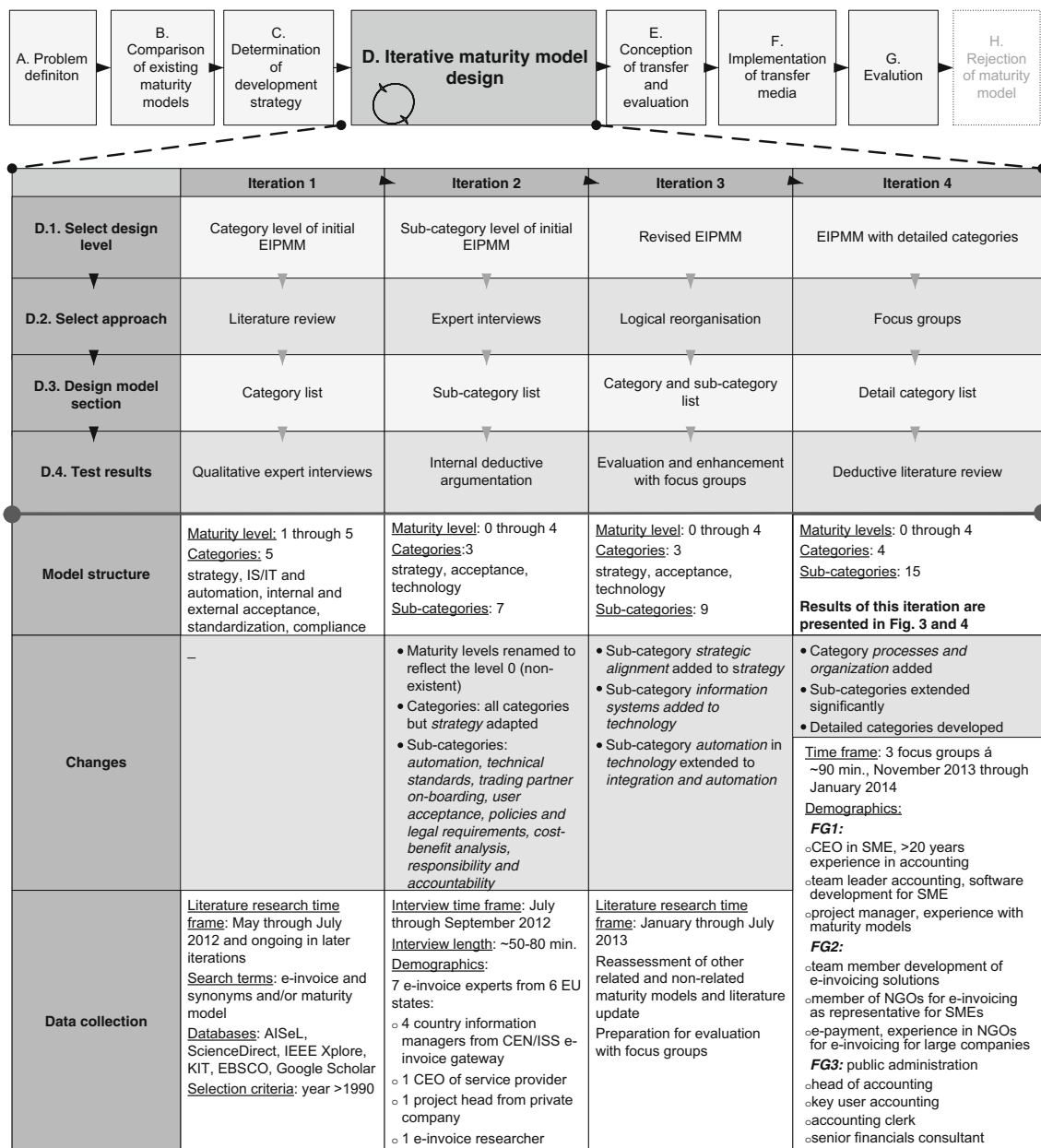


Fig. 2 Research design according to Becker et al. (2009)

the help of exploratory focus group interviews (Tremblay et al. 2010). This method was selected to be able to cover individual perspectives on e-invoice processes while new categories, sub-categories, detail categories, and metrics can emerge from the group discussion (Krueger and Casey 2009). The often observed influence of the moderator of focus groups on the research outcome was considered to be subordinate as the revised EIPMM (iteration 3) served as basis for discussion. One author was the moderator and the other author was an observer, who can “guard against the encroachment of personal views” (Tremblay et al. 2010). Focus groups are recommended to be conducted until saturation is reached and no new insights are expected from further focus groups (Krueger and Casey 2009). Tremblay et al. (2010) state that at least one pilot and two exploratory focus groups should be planned.

Three focus groups were conducted consisting of 3–4 experts on e-invoice processes, since smaller focus groups require a greater participation of each member (Tremblay et al. 2010). One group consisted of a CEO in a SME with practical accounting experience, a team leader in accounting software development, and a project manager with knowledge of business process management and maturity models. The other group included a software developer for e-invoice solutions, a representative of SME in committees on e-invoices, and one team leader with comprehensive knowledge of e-payment, e-invoice processes, and requirements of large companies. The third group consisted of one manager, one consultant and two accounting system key users. These group members were engaged in public administration accountancy.

Two authors coded the transcripts in two phases. In the deductive coding phase, existing categories and sub-categories were enriched, while in the inductive coding phase new categories, sub-categories, detail categories, and examples for metrics were extracted. After each interview, the EIPMM was adjusted to test consensus among groups (Krueger and Casey 2009).

Finally, the sub-categories of the EIPMM were tested through a deductive literature review by reassessing their internal homogeneity and external heterogeneity. The data that had already been collected, including literature and the transcripts of the expert interviews, was checked once more and assigned to the sub-categories. Finally, the authors discussed the assignment and whether the sub-categories had to be restructured or renamed.

Electronic invoice processes maturity model

Development and design

Phase A: problem definition The first step in the development process was the *problem definition*, the result of which was the purposes of the EIPMM (see Cuylen et al. 2013b).

The aim of EIPMM is a comprehensive representation of e-invoice processes in companies, addressing relevant organizational, process-oriented, technological and legal components (Cuylen et al. 2013b). The requirements that a maturity model for e-invoice processes must fulfill were determined taking this objective into account (Cuylen et al. 2013b, Table 2). Three best-practice models for e-invoices (Table 1) were developed by consulting companies in order to support the implementation of e-invoice processes. These models have each a specialized focus and do not take the entire e-invoice process into account. However, these models indicate a need for a general maturity model that assesses a company’s capability of designing, establishing, and using e-invoice processes.

Phases B and C: comparison of existing maturity models and determination of development The next two steps were the comparison of existing maturity models and the determination of the design strategy (Cuylen et al. 2013b). The relevant maturity models were selected and then compared on basis of the requirements previously defined.

There was no maturity model that explicitly addresses e-invoice processes in a generalized, comprehensive, and detailed manner. The before-mentioned three best practice models were excluded from the comparison because the data collection and analyses procedure was not documented. Additionally, they differ completely in structure and content (Table 1) and cannot be combined to contribute more depth to the practical perspective. Later in iteration 3 and 4 the generalizable content was incorporated into the EIPMM. For the final comparison (Table 2) the most popular maturity models for business processes (Pöppelbuß and Röglinger 2011) and e-business were considered: Business process maturity model (BPMM), business process management maturity model (BPMMM), process and enterprise maturity model (PEMM), and stages of growth maturity model for e-business (SOGE).

SOGE provides detailed information about IS for each maturity level that might be adapted and enhanced for e-invoice processes. BPMM does not include IS aspects at all while BPMMM and PEMM do address IS in a merely general way. For example, they do not mention internet technologies and deployment strategies. The documentation of BPMM is rather detailed. The improvement path is described extensively and a lot of information for management processes and the overall aspects is given. The maturity levels 2 to 5 are specified by process areas that have to be established to reach a certain maturity level. PEMM has two maturity grids that contain statements for each maturity level, for each process enabler and for each enterprise capability. The assessment “is done by evaluating to what degree the statements in the cells are correct” (Pöppelbuß and Röglinger 2011). SOGE has a maturity grid that contains descriptions for each category and maturity level. Each category can be evaluated

Table 2 Final comparison of maturity models (enrichment of Cuylen et al. 2013b)

Basic information	Business Process Maturity Model (BPMM)	Business Process Management Maturity Model (BPMMM)	Process and Enterprise Maturity Model (PEMM)	Stages of Growth maturity Model for E-Business (SOGE)
Source	Weber, Curtis, Gardiner, 2008	de Bruin, Rosemann, 2005	Hammer, 2007	McKay, Marshall, Prananto, 2000
Domain	BPM	BPM	BPM	E-business
Purpose of use	Descriptive, prescriptive, comparative	Descriptive, prescriptive, comparative	Descriptive, prescriptive, comparative	Descriptive, prescriptive
Maturity components	Five maturity levels (initial, managed, standardized, predictable, innovating); Different process areas for level 2-5	Five maturity levels (initial state, defined repeatable, managed, optimized); Categories (strategic alignment, governance, methods, IT, people, culture)	Four maturity levels; Separation of five process enablers (design, performers, owner, infrastructure, metrics) and four enterprise capabilities (leadership, culture, expertise, governance)	Six maturity levels (no presence, static on-line presence, interactive on-line presence, internet commerce, internal integration, external integration); Seven categories (strategy, structure, systems, staff, style, skills, superordinate goals)
Requirement				
Overall aspects	→Overarching objectives of a company including technical, organizational, and human aspects			
	●	◐	◐	◐
Management processes	→Support for implementation of e-invoice processes in terms of process optimization and transparency incl. managerial aspects, e.g. planning, control, training			
	●	◐	○	○
Improvement path	→Support for process optimization in terms of maturity levels and provided information for improvement			
	●	◐	◐	◐
Detailed IS aspects	→Due to many different kinds of e-invoices and transmission standards			
	○	○	○	●
All industries	●	●	●	●
All sizes of company	●	●	●	●
Legend ○ not fulfilled ◐ partially fulfilled ● fulfilled				

individually. The architecture of BPMMM enables a separate maturity assessment for different categories (success factors), capability areas and, in a future version of the model, detailed questions (Pöppelbuß and Röglinger 2011). The comparison revealed that each model contains aspects that can be transferred to a maturity model for e-invoice processes (Cuylen et al. 2013b). De Bruin and Rosemann (2005) suggest to identify categories in complex domains to gain “a deeper understanding of maturity, without which the identification of specific improvement strategies is difficult.” Sub-categories are also recommended for complex domains (de Bruin et al. 2005).

The synthesis and further development of the compared models and the three best practice models of e-invoices were recommended as the development strategy for an EIPMM. The first development step is to identify the framework of an EIPMM. Then, an assessment tool shall be developed iteratively: a simple tool that is easily applicable and a more profound tool including different perspectives and a higher degree of detail.

Phase D: iterative maturity model design This research aims initially at developing a framework. Different levels

must be considered when implementing e-invoice processes (Fig. 1). Therefore, a hierarchical structure of categories and sub-categories is suitable. The first level of BPMMM consists of categories that provide “insights into how process performance can actually be improved rather than measured” (de Bruin and Rosemann 2005). The categories of BPMMM referring to strategy, IS, and acceptance (BPMMM: culture) are suitable for EIPMM. Legal conformity and standardization were added according to the literature. The five identified categories and the five maturity levels of BPMMM were adapted to e-invoice processes.

In the second iteration, this first model was discussed with experts (Cuylen et al. 2013b). As a result of the expert interviews, the categories were reduced to three with in total seven sub-categories providing more detailed assessment information. The sub-categories are comparable to the idea of capability areas that support the measurement of the BPMMM. The five maturity levels were revised and started now with 0 “non-existent”. Maturity levels define the evolution path and can be used to reflect capabilities that are associated with development milestones, and in a later research stage to define maturity measurement.

In the third iteration, the data collected from the expert interviews, as well as the literature on e-invoicing and maturity models were reassessed by the authors. The changes to EIPMM are presented in Fig. 2.

The focus of this research is the fourth iteration that has the objective of discussing the categories and to develop detailed categories for the sub-categories. The detailed categories describe relevant issues for e-invoice processes and a basis for assessment. The measurement of each maturity level per sub-category is not a focus of this iteration.

According to the focus groups, the descriptions of the maturity levels are revised, and the new category *processes & organization* was introduced that provides a more diversified perspective on operational issues of process reorganization, compliance and risk assessment. This category can be compared to the category “governance” in BPMMM that was considered as less significant in the initial model. The *strategy* category is revised significantly reflecting a more diversified top-management perspective on e-invoice processes. The sub-category *strategic alignment* is replaced by four sub-categories referring to internal commitment, willingness to invest, process aspects, and business partner involvement. The *acceptance* category is changed to show a wider definition of acceptance from internal and external acceptance to characteristics of the business, political and cultural environment.

EIPMM contains five maturity levels (Fig. 3). Similar to BPMMM (de Bruin and Rosemann 2005), higher maturity levels of EIPMM are not always suitable for all companies. For some companies lower maturity levels are more suitable.

Most maturity models are not strictly evolutionistic, but rather reflect milestones of the continuous improvement process (Andersen and Henriksen 2006).

According to the experts, companies shall consider the categories (strategy, acceptance, processes & organization, and technology) when they implement and operate e-invoice processes. This concept of categories corresponds with BPMMM as mentioned earlier.

The current iteration presents a major milestone in the evolution of the EIPMM from iteration 3 to 4 (Fig. 4). Iteration 4 is completed by the following section “Model Description” that is based on the collected data from all iterations, especially from the empirical data of the focus groups.

Model description

In this section, each of the four categories is presented with its sub-categories and examples of detailed categories. Revealing aspects of the focus groups interviews are cited and briefly discussed.

Technology category The *technology* category measures the use and the progressiveness of IS during implementation and operation of invoice processes, to what degree the human interaction can be excluded, and to what extent companies apply technical standards. For some experts, it is a key factor, because without suitable IS, companies are not able to benefit from reduced expenses. For others it is not important because there are sufficient service providers offering suitable

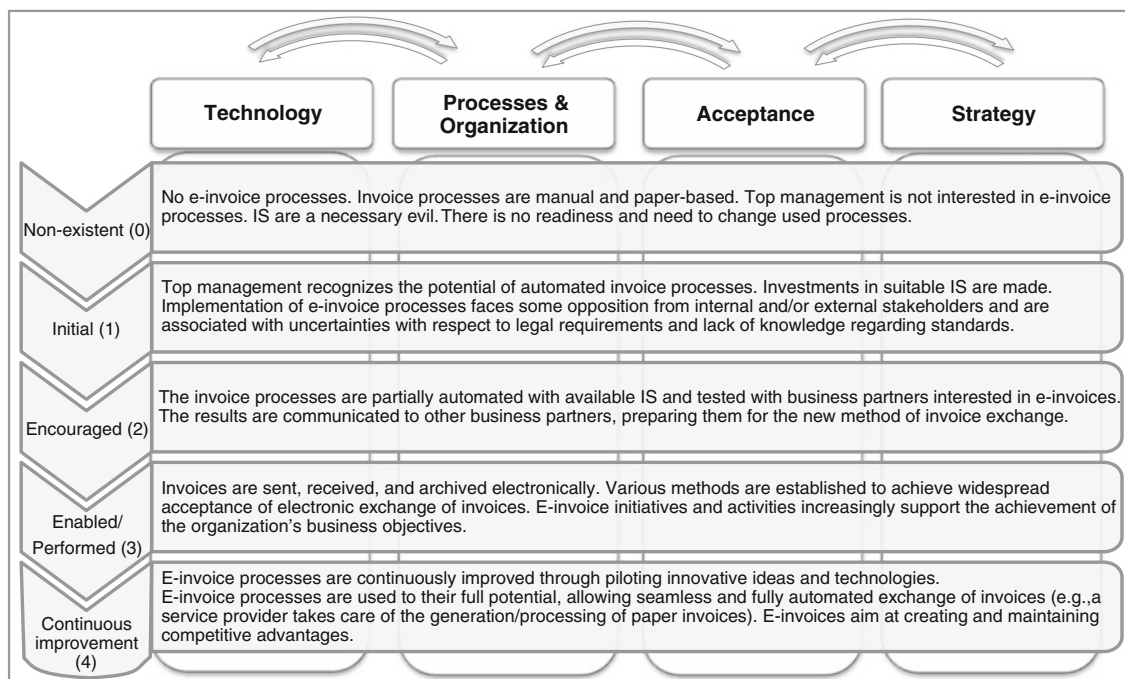


Fig. 3 The EIPMM maturity level descriptions

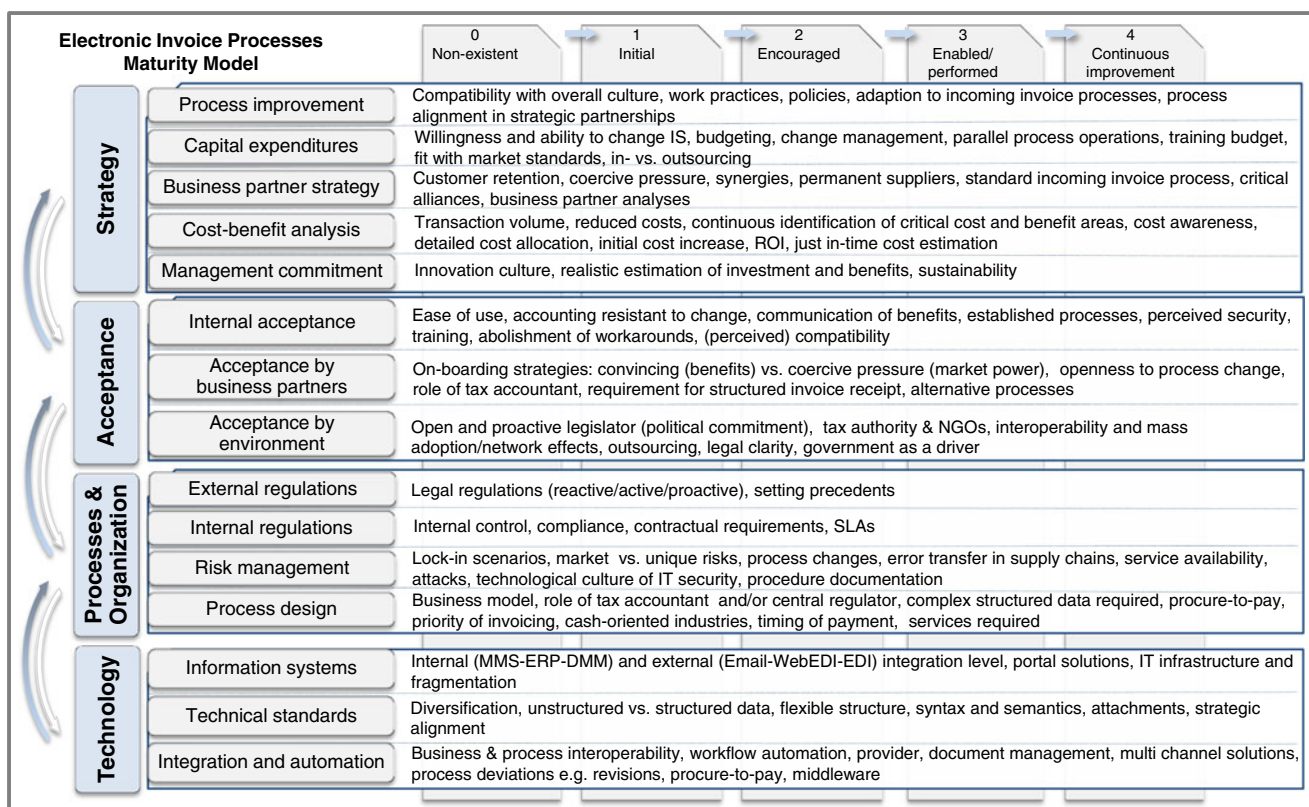


Fig. 4 The current EIPMM

solutions. Some experts pointed out that the fragmentation and integration of IS within a company must also be considered.

The sub-category *information systems* assesses the IS infrastructure for e-invoice processes and determines whether the current IS are capable of transmission, receiving, and processing of e-invoices. It evaluates whether there is a system to archive documents electronically or whether there is a workflow system for electronic approval and circulation of documents within a company. Security aspects result from the invoice transmission based on “authentication and non-repudiation of origin and receipt, confidentiality and privacy” (Hernández-Ortega 2012) and from “technological culture” (Hernández-Ortega 2012) of a company, like security policies, as well as legal requirements like the electronic storage of e-invoices.

The sub-category *technical standards* describes to what extent companies apply technical standards like message standards of e-invoices and standards for the transmission (Fig. 1). The highly fragmented landscape of technical standards increases the complexity of the e-invoice issue for the individual company. Automated exchange requires standardized structured data because only the use of the same data structure results in optimized processes for a company (EU Expert Group 2009). Diversification by the use of different standards can be a short term solution towards more automation in form of better import and export functionality of the internal

systems. The complexity and importance of technical standards are illustrated by one expert:

“[...] the lack of standards is the factor that slows this whole adoption down [...] Companies don’t know what to do and it’s too costly for them to do all this mapping between different formats and different standards, not knowing which one to use.”

The sub-category *integration and automation* measures the level of automated exchange and processing of e-invoices and describes the cross-linking to other internal and external (e. g., with providers) processes and systems through middleware. According to the experts, the whole procure-to-pay cycle should be considered. One expert explained this:

“The focus is on electronic invoicing, but for many trade relations, the whole order-to-pay cycle should be taken into account. [...] Invoicing is just something at the end of the line that you then do after you automated electronic orders and electronic delivery.”

For the buyer party the objective of exchanging e-invoices is the direct processing of invoice data in payment and accounting systems (Cuylen et al. 2013a; Kivijäri et al. 2012;). There are different maturity steps for processing e-invoices,

starting with manual processing, moving through IS support for capturing invoice data from PDF invoices, and ending with full automation. Integration means that e-invoice solutions are seamlessly embedded in the existing IS and business process architecture.

Processes & organization category The category *processes & organization* assesses to what extent regulations ensuring e-invoices processes have been adopted and defined, risks considered, and processes designed. This category includes methods and instruments to facilitate the integration of business partners and to define roles to enable the exchange and processing of invoices (EU Expert Group 2009).

The sub-category *external regulations* assesses the adoption of procedures that ensure legal conformity for the e-invoice processes. Depending on the company's business relations, international laws and different external regulations must also be considered (Keifer 2011). The lowest maturity levels represent companies with a reactive position according to external regulations. These companies carefully maintain the laws according to the prevailing legal situation, meaning they are waiting for more precisely formulated laws. At the middle maturity levels are the companies that have an active position with regard to external regulations. According to the focus groups these companies maintain the laws and have for example a documentation of their processes. The highest maturity levels represent proactive companies that operate within legal scope. One expert assumes that especially SME are either not aware of legal issues or they are unsure about the interpretation of laws:

“SMEs feel insecure in these matters; they tend to adhere to what the legislator has clearly approved. Larger companies say that they have met the legal regulations and they take advantage of the full scope of legally acceptable actions. This is in accordance with a company's know-how and its ability to react in a possible discussion during an external audit or with the financial authorities.”

The sub-category *internal regulations* implies responsibility and accountability to all relevant stakeholders, compliance (e. g., documented instructions for invoice processing), and policies of the company. The processes and the division of tasks with service providers such as tax consultants or solution providers are determined. Service level agreements exist and are enforced (EU Expert Group 2009).

The sub-category *risk management* assesses to what extent the lock-in effects, the effects of integration, and other risks are considered. Companies have to reduce risks and maximize chances (Kivijäri et al. 2012). Market risks include the lock-in with a service provider (creating switching costs) (Penttinen et al. 2008). Unique risks result from technical complexity of

e-invoice processes (Kivijäri et al. 2012) or the question of reliability of transmission. One expert explained this:

“Perhaps we recognize that suddenly the people are reflecting the uncertainty of e-mail systems in a new manner. Meaning how can I assure that the received invoice is not a fake invoice and I am not a target of any attacks.”

The sub-category *process design* assesses to what extent the basic processes of the whole purchase-to-pay cycle are supported, and what quality the processes have. Various ways of exchanging invoices exist: e.g., paper invoices by mail, e-invoices as attachment to an email, digital invoices created from scanning a paper invoice using optical character recognition, e-invoices as structured data (EDIFACT or XML) (Keifer 2011). Then, there are companies that have no payment process because all their invoices are paid by debit credit. Others write no invoices because all their customers pay in cash. Another important aspect in the organization of internal processes is the absence of parallel – paper-based and electronic – processes. Further the relationships with business partners including the organizational integration of service providers, central regulators, and tax consultants are considered.

Acceptance category The *acceptance* category measures to what extent the e-invoice processes have been accepted by internal stakeholders and by business partners, as well as how mature the environment is according to e-invoice processes. The sub-category *internal acceptance* refers to the acceptance of exchanging and processing e-invoices by all internal stakeholders. This implies being aware of the benefits and using electronic documents for document exchange within the company, as well as understanding the complexity of the topic. Sales managers are able to promote the electronic exchange of invoices to the customers. But they are also aware of expenses and costs for implementing e-invoice processes. Companies must consider that the benefits of e-invoices processes are not derived from the first use but from continuous use. Companies that habitually use e-invoices perceive efficiency, security, and trust more often (Hernandez-Ortega and Jimenez-Martinez 2013). One expert explained:

“There might be some companies that have optimized internal processing, so that they are fully aware of the benefits and their strategy [...], and they use electronic invoices for circulation within the company, but then they have not any buyers and suppliers on board, so there might be some companies that would score five on internal acceptance and one on external acceptance.”

The acceptance by the business partner is required by law. There is still the problem that some business partners do not accept the use of e-invoices (Haag et al. 2013). One expert explained that in Austria, nearly 50% of all companies are outsourcing their accountancy, especially to tax consultants who are the representatives of the SMEs and therefore they are consulted on business decisions and strategies (Cuylen et al. 2013a). The sub-category *acceptance by business partners* assesses the willingness for exchanging e-invoices by the company's business partners including the acceptance by their tax consultants, sponsors of public organizations or other service providers. One expert explained:

“There, you would have a clear measure [...] what percentage of the trading partners are in. And then you would have these different kinds of strategies, persuasion strategy and enforcement strategy.”

The sub-category *acceptance by environment* assesses whether the environment of a company fulfills the requirements for e-invoicing, meaning the expectations of the companies towards legal regulations. Legal requirements need to be easy to understand and clearly formulated so that no interpretation is necessary (Cuylen et al. 2013a; EU Expert Group 2009). One expert explained that in Austria there is no obligation to store the e-invoice in an electronic archive system. The invoice recipient can choose to store the invoice electronically or in paper form. For this expert the reasons to reject e-invoices are reduced and therefore the environment in Austria is more mature than e. g., in Germany. The maturity of the environment depends also on the level of mass adoption, and the commitment and behavior of the government and the public administrations. The critical mass of e-invoice adopters is essential because the absence of potential exchange partners impairs the adoption and results in higher costs (Haag et al. 2013).

Strategy category The *strategy* category assesses to what extent e-invoice issues have been aligned with the overall business strategy and describes strategic decisions related to the implementation of e-invoice processes. According to the majority of the experts, strategy is a key factor for the implementation process. Having a clear direction and the willingness to use e-invoices is essential. One expert explained this:

“I think it's a basic necessity. Because everything starts from the strategy and as soon as you have a clear picture you can go forward with whatever details are required to implement this.”

The sub-category *process improvement* addresses the process alignment in strategic partnerships, compatibility with the overall strategy and culture of the organizations as well as

policies. Many companies continuously control their value-added processes but not their administrative processes. It is a strategic decision to invest in e-invoice processes. Especially the incoming invoice processes are more efficient when the invoice data is in a structured electronic format (Kivijäri et al. 2012). But in order to benefit from it, companies have to adapt their incoming invoice processes. That assumes further that the e-invoice processes are compatible with the companies' business processes, policies, and culture (Hernández-Ortega 2012). One expert explained:

“[...] this maturity model stimulated the company, in contrast to understanding of invoicing, digital invoice processing as a topic per se, to really attend specifically to where this issue produces costs or vice versa where are the benefits. [...]“

The sub-category *capital expenditure management* assesses the control and decision process of investments. It is closely related to all sub-categories within *strategy* but can also include specific aspects, e.g., when the investment is externally driven by legal requirements or discontinuation of IS by software vendors. In this context, companies have to decide between using an in-house solution and outsourcing. The willingness and ability to change is measured. The implementation of e-invoice exchange with one business partner implies already administrative efforts, user training, and system adaptation (Kivijäri et al. 2012). Further, it includes decisions whether the higher costs due to parallel invoice processes are supported. The experts also indicate that IS has to be adapted.

The sub-category *business partner strategy* measures to what extent e-invoice issues have been aligned to strategic decision of partnerships. There is the persuasion strategy, meaning that business partners are shown the benefits and are convinced to participate. A sound cost-benefit analysis should be part of this activity. For example, in this context a company reveals that the paper-based invoice process with one partner causes a lot of cost. The EIPMM support the discussion with this partner whether an e-invoice process might be more efficient. The contrary strategy is to force the business partners to participate through the company's market power. Further, one expert explained:

“If you receive electronic invoices, it's usually from one supplier. All the other suppliers still send paper invoices. You need to have a mixed procedure within your company.”

The sub-category *cost-benefit analysis* assesses the company's cost awareness. For example the calculation of costs caused by both paper-based and electronic invoices enables analysis of the cost savings that are achieved with automated invoice processes. E-invoice processes have monetary

costs like implementation and operation costs, as well as intangible costs like losing a customer. Some companies have no benefits from e-invoice processes because the number of exchanged invoices is too small so that implementation, operation and maintenance costs are not compensated (Penttinen et al. 2009; Haag et al. 2013). According to the majority of the experts, companies should analyze the costs for the invoice processes in detail. Only then is it possible to be aware of the cost savings and to decide whether e-invoices are worthwhile for the company. One expert explained this:

“Electronic invoicing is usually sold as a cost savings measure. But in many companies [...] don’t know how many invoices they send, they don’t know how much one invoice costs in the whole cycle, not for sending invoices and certainly not for receiving invoices. [...] And if you don’t know the present costs, you can’t make a cost saving.”

Finally, the fourth sub-category of strategy *management commitment* assesses the involvement of top management and to what extent the top management has an innovative culture. One expert explained the necessary involvement of the top management:

“I think it is very important to have internal acceptance. But it’s more a management question because if your management says, this is how we will do business, then that’s how you do business.”

Top management shall provide a framework that makes the implementation of e-invoice processes possible. According to one expert, e-invoice processes might be the top management’s statement for environmental sustainability by reducing the footprint with paperless processes.

Theoretical and practical implications

Pöppelbuß et al. (2011) state that “further research is still needed to establish maturity models as a field of IS research that is not only of high practical relevance but also of theoretical value”. This research contributes to the theoretical process maturity research stream by tapping into a well-established (Mettler 2010) but heterogeneous research field. In IS research, maturity models are referred to as both, theories and IT artifacts (Pöppelbuß et al. 2011). According to Becker et al. (2009), the EIPMM is an IT artifact in terms of the design science paradigm (Hevner et al. 2004). This is largely based on the immature state of the e-invoice topic in IS research (Cuylen et al. 2013a; Mettler 2009). The current EIPMM provides a comprehensive framework of e-invoice processes and the basis for a tool-based e-invoice process evaluation.

This research combines qualitative-empirical and conceptual approaches in order to propose a new maturity model. According to Pöppelbuß et al. (2011), only 10 out of 76 identified papers from the IS research field used the same approach and only a relatively small part was attributed to empirically grounded maturity model development. Maturity model development based on a procedure model is especially useful when the maturity model should not only be theoretically sound and empirically grounded but also practically relevant (Pöppelbuß et al. 2011). According to Pöppelbuß et al. (2011), there is a need for maturity model research that examines the “diffusion and exploitation of technology in a certain market”. This research contributes exactly to this demand.

From a practical perspective, the current EIPMM extends the knowledge of e-invoice processes and relevant issues for implementation and process improvement. It can be used as a checklist to identify strengths and weaknesses of e-invoice processes. Most of the economic benefits arise “from the full process automation and integration from order to payment between trading parties” (European Commission 2010). All experts (iteration 2 and 4) confirmed the usefulness of such a model. They highlighted that it is a suitable tool for management and research to understand the complexity and the different opportunities for e-invoice processes. The EIPMM is not only a valuable tool for evaluation of internal capabilities, but also for discussions with partners. When the business partners are very heterogeneous with regard to technical capabilities then the company can analyze and evaluate the different requests independently from its own maturity level. Solutions with high level of integration are often not profitable when only a few invoices are exchanged electronically. So, business partners can describe their situation and plan their collaboration based on the EIPMM. Companies shall be aware of the different kind of existing e-invoice solutions, and the impact these solutions have on their business processes, IS architecture, and relationship with business partners. This is already supported by the current EIPMM.

Politicians and interest groups can use the EIPMM to identify issues that have to be improved so that companies are able to obtain higher maturity and achieve it easier. Tax authorities can use it to get an overview of the possible implementations used by companies.

Limitations

The small number of interviewed experts is a limitation to the generalizability of the research results. Another limitation is that so far no practical validation of the EIPMM exists. The usefulness of the EIPMM is only discussed and confirmed by experts according to the domain expert evaluation method (Salah et al. 2014). This research is also limited to the selection of German experts. Generalizability is supported by the

structured model development (de Bruin et al. 2005) and the research design. At the same time, the chosen development approach is a limitation as another one may lead to other results. The experts were interviewed in focus groups which fostered constructive discussion. Focus group “technique is particularly useful as an exploratory method” (Tremblay et al. 2010). As recommended by Tremblay et al. (2010) three groups were conducted. The selected experts are decision-makers, key users, project managers, participants of e-invoice committees, and software developers. This is representative of the variety of e-invoice stakeholders and provides an adequate sample.

Conclusions and outlook

An explorative discussion within focus groups was conducted in order to identify the basic structure of a maturity model that supports the implementation of e-invoice processes. The research question is answered as follows: the EIPMM consists of the categories technology, processes & organization, acceptance, and strategy. Each category has sub-categories that are evaluated by five maturity levels. The categories guide a systematic process for the implementation and operation of e-invoice processes and for decision making. Although strategy is the basis for decisions and change management, in the discussion with business partners it can be easier to start discussions based on the technology used and the established processes. The sub-categories allow a detailed assessment of the categories and a holistic approach.

In order to provide comfortable support for assessment, descriptions and metrics for each sub-category shall be determined in future iterations of the maturity model. Best practices and practicable examples shall support the explanation of the maturity levels of each sub-category and how the metrics are applied. Further empirical inquiries addressing requirements for each sub-category are needed. The final EIPMM shall not only be a benchmark tool but also a map of best practices. Companies decide for each category and sub-category which maturity level fits best for them. An empirical validation of the EIPMM with companies of several EU countries will ensure model stability and identify differences within the sub-categories. The final EIPMM shall be classified (Mettler et al. 2010; Pöppelbuß and Röglinger 2011) and provided to the previously defined target groups in a suitable manner.

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