


**Contributions to the Selection and Implementation
of Standard Software for CRM and Electronic Invoicing**

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*No man is an island, entire of itself;
every man is a piece of the continent.*

John Donne

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Abstract

Die kontinuierliche Verbesserung von Prozessen und Systemen ist ein etablierter und praxisrelevanter Forschungszweig der Wirtschaftsinformatik. Die vorliegende Zusammenfassung gliedert sich in zwei Hauptbereiche bestehend auf vier wissenschaftlichen Publikationen.

Im ersten Bereich A wird die Thematik der Auswahl von Customer Relationship Management (CRM) Systemen behandelt. Hierbei geht es zunächst um die Evaluierung eines neu konzipierten Vorgehensmodells zur Auswahl von CRM Systemen, dass den Anbieter- und Softwarevergleich auf eine systematische und auf die individuellen Bedürfnisse des auswählenden Unternehmens zugeschnittene Weise strukturiert. Die Evaluierung des Vorgehensmodells erfolgt durch eine qualitative Fallstudie mit einem Automobilzulieferer und das Modell wird durch Interviews mit Projektbeteiligten vervollständigt und für den Praxiseinsatz optimiert. Um der Frage nachzugehen, wie sich die im Vorgehensmodell zusammengefassten Auswahlkriterien auf den späteren Erfolg des CRM-Systems auswirken, wird in einem zweiten Schritt eine quantitativ-empirische Studie basierend auf einem erweiterten DeLone & McLean IS-Erfolgsmodell mit CRM-Experten durchgeführt. Die hypothetisierten Kausalbeziehungen zwischen den Auswahlkriterien, den moderierenden latenten Variablen und der Zielvariable Systemerfolg wurden für die Umfrage operationalisiert und mittels eines Strukturgleichungsmodells (SEM) überprüft.

Der zweite Bereich B adressiert Forschungsfragen zu elektronischen Rechnungsprozessen. Hierbei wird zunächst ein Reifegradmodell für elektronische Rechnungsprozesse angestrebt. Das Forschungsdesign basiert auf einem anerkannten Vorgehensmodell und das Reifegradmodell wird in vier qualitativ-empirischen und deduktiv-argumentativen Datenerhebungsphasen methodisch rigoros entwickelt. Die Ergebnisse der letzten Iteration, basierend auf drei Fokusgruppen mit Experten für elektronische Rechnungsprozesse, werden im Detail dargestellt. Aus dem Reifegradmodell wird in einem weiteren Schritt die Thematik des Risikomanagements für elektronische Rechnungsprozesse als besonders relevant herausgegriffen. Die Fragestellung nach den Risikofaktoren für elektronische Rechnungsprozesse wird in einer quantitativen Umfrage untersucht. Durch die Anwendung von statistischen Auswertungsverfahren wurden Risikofaktoren identifiziert und sinnvollen Gruppen zugeordnet.

Stichworte: Customer Relationship Management, Systemauswahl, elektronische Rechnungsprozesse, Strukturgleichungsmodellierung, DeLone und McLean IS-Erfolgsmodell, Risikomanagement, Reifegradmodell, Vorgehensmodell.

Continuous improvement of processes and systems is an established and practically relevant research area in information systems research. This doctoral thesis presents four selected publications from two research areas.

In the first part A, selection of Customer Relationship Management (CRM) systems is addressed. The objective is to evaluate a newly developed process model for CRM systems selection (CRMSS) that structure the comparison of vendors and software and considers individual requirements of a company. The evaluation of the process model is conducted in a single case study with an automotive supplier. The model is enhanced through interviews with project members and is optimized for practical implementation. To approach the question on the impact of the CRMSS criteria on CRM system success the subsequent research step is a quantitative survey with CRM experts based on an extended DeLone and McLean (D&M) IS success model. Hypotheses about the causal relations between selection criteria, the moderating latent variable and the dependent variable information systems success is operationalized in a questionnaire and analyzed with the help of structural equation modeling (SEM).

The second part B focuses the research on electronic invoice (e-invoice) processes. First, a maturity model for e-invoice processes (EIPMM) is developed. Building on a process model four iterative design-oriented and qualitative-empirical phases are completed. The results of the last iteration based on focus groups are presented. As part of the EIPMM, risk management is further researched in a quantitative study. Risk factors for e-invoice processes are identified and grouped after applying statistical analysis techniques.

Keywords: Customer Relationship Management, system selection, electronic invoice processes, structural equation modeling, DeLone und McLean IS success model, risk management, maturity model, process model.

Management Summary

The presented thesis recapitulates four selected research publications from two distinct research areas, namely CRM system selection criteria, process, and IS success and electronic invoice process maturity and risk. The topics share a mutual research design based on merger of results from a model-based qualitative study with survey-based quantitative results (see Figure 1).

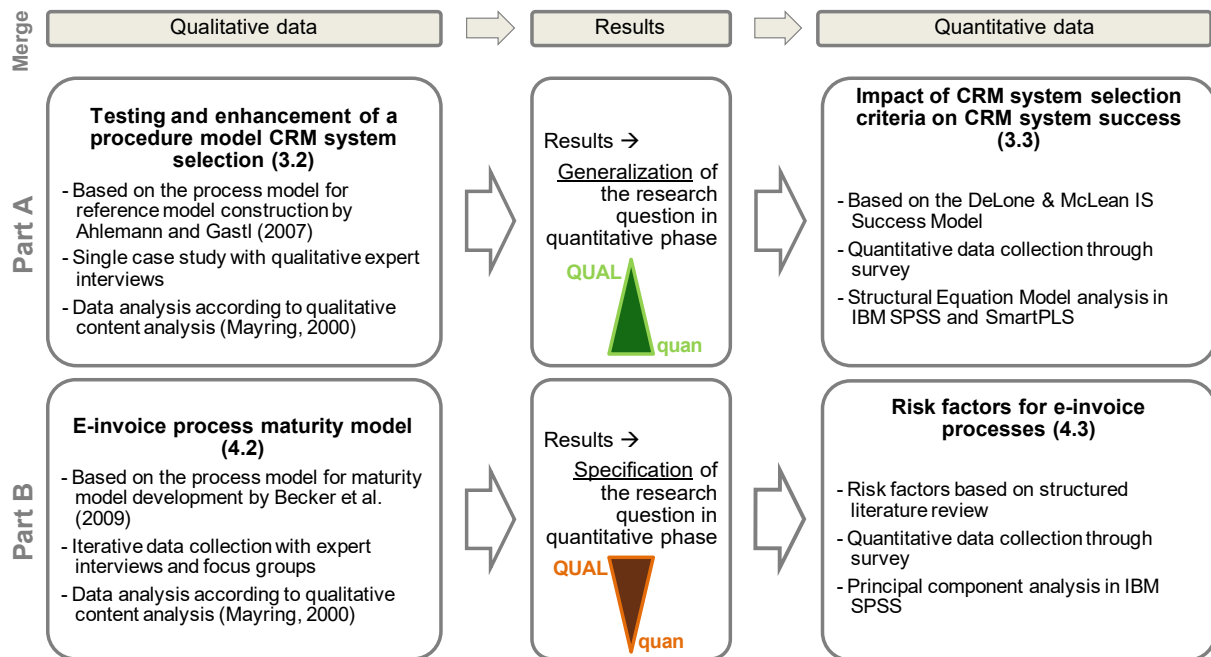


Figure 1. Classification of presented publications

Customer Relationship Management system selection – a process model and systems success

The importance of CRM as a management concept and strategy has been steadily increasing and so have been the investments in CRM software (Lee et al., 2014, Chen and Popovich, 2003). CRM integrated the various customer touch points whether electronic (e.g. e-mail, internet etc.) or physical (e.g. retail store) into a single information system (Chen and Popovich, 2003). It aims at collecting and sensibly using refined information about the (potential) customers and optimally responding to their needs (Farquad et al., 2014). Richards and Jones (2008) define CRM „as a set of business activities supported by both technology and processes that is directed by strategy and is designed to improve business performance in an area of customer management”. A recent survey by Gartner from 2014 indicates once more that the budget for CRM system is to increase fourth year in a row, this time by an average of 2.5 percent (Gartner, 2014a). This backs up the importance of sound decision making and procedural guidance for the investments in CRM system selection. The

suggested CRM system selection (CRMSS) process model was rigorously developed based on the meta model by Ahlemann and Gastl (2007). Their proposed five main phases are adopted to develop the CRMSS process model by means of empirical inquiries. For the final validation a single case study with an automotive supplier company is conducted and insights and enhancements to the model are extracted from semi-structured interviews with participating team members (see Figure 2).

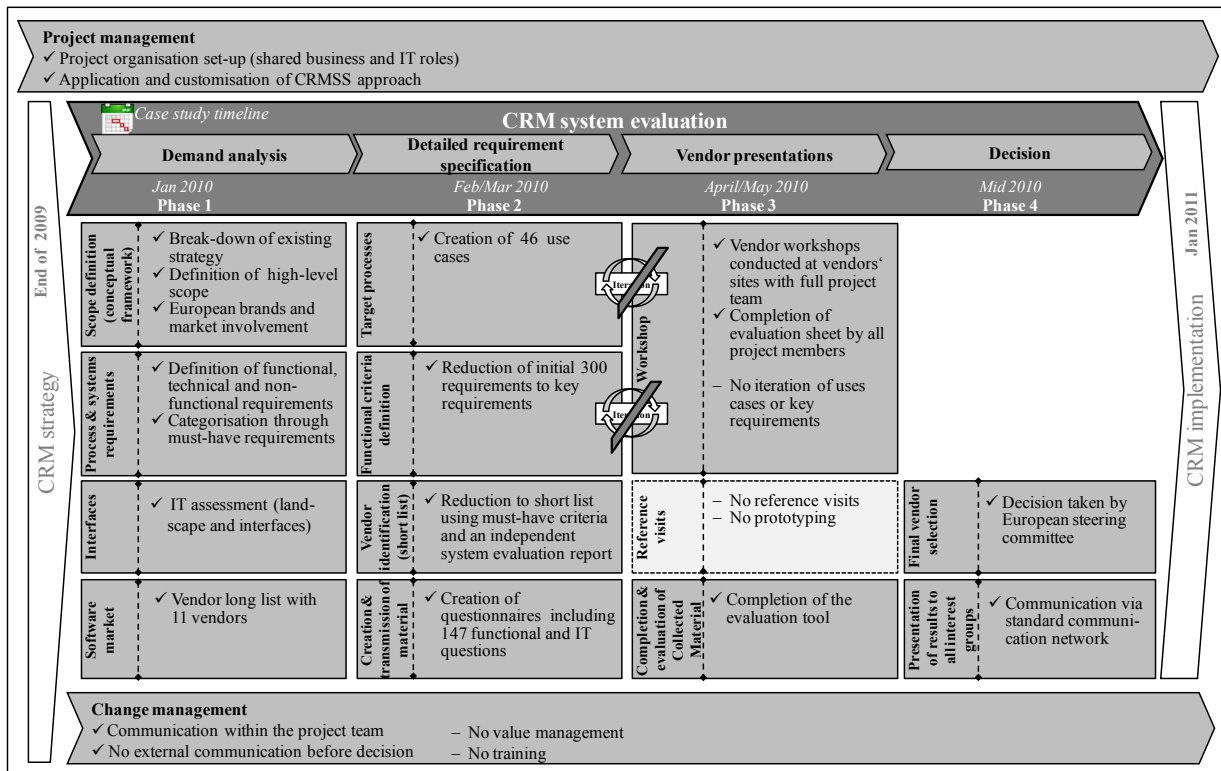


Figure 2. Consolidated results of the applied CRMSS Process Model

Research results of the single case study with an automotive supplier showed that the CRMSS process model is practically applicable. An applicability check by Rosemann and Vessey (2008) was conducted to evaluate practical applicability of the model. Rosemann and Vessey (2008) argue that “applicability checks could be conducted on emerging IS research outcomes” and “improve future research by incorporating learnings into revisions to theories or models”. According to the three applicability categories (importance, accessibility, and suitability) the CRMSS model was judged positively by the interviewed project representatives in the case company. Enhancements to the model were introduced (see Table 1). The CRMSS process model contributes to IS research by applying the methodology by Ahlemann and Gastl (2007), thus proving its feasibility and effectiveness in terms of the research results. It shows how their meta model can be applied in the research discipline by following the recommended phases and customizing them to meet the specific requirements of the topic. In practical terms, this research gives guidance for

systematically selecting CRM systems and presents a portfolio of IT project-oriented phases, roles, and deliverables (see section 3.2).

Table 1. Overview of roles and deliverables derived from the case study

Phase	CRMSS Task	CRMSS selected activities	Roles	Deliverables	Additional deliverables
Phase 1: Demand analysis	Scope definition	Definition of functional high-level scope, system portfolio and IT architecture, available budget, time planning and economic demands, risk management, exit strategies	Steering committee, project management	✓ Business and IT strategy documents ✓ Categorization criteria	+ Exit strategies
	Process & system requirements	Define main functionality, create business processes, non-functional requirements	Template keeper (per business unit)	✓ High level process definition ✓ Initial requirements list ✓ Selection criteria	+ Business operations plan + Roll-out plan
	Interfaces	Analysis of all affected systems, technical requirements and restrictions	IT project manager	✓ Architectural Assessment	
	Software market	Standard and industry solutions, consulting support	IT project manager	✓ Vendor long list	+ Vendor assessment
Phase 2: Detailed requirement specification	Target process	Define high level target processes	Template keeper, business experts, IT and business key users	✓ Key requirements ✓ Decision criteria and weights	
	Functional criteria definition	Account management, call centre, campaign management, contact & customer management, customer service, field service, industry specifics, internet, lead & opportunity management, relationship management, reporting, sales management	Template keeper, business experts, IT and business key users	✓ Evaluation sheet	
	Vendor identification	Company and CRM project overview, requirement specifications, total cost calculation	Business project manager, IT project manager	✓ Criteria for vendor short list ✓ Vendor short list	
	Creation & transmission of material	Functional fit list, questionnaire for stakeholders	Business project manager, IT project manager, template keeper, business experts, IT and business key users	✓ Use cases ✓ Questionnaire ✓ Prototype	+ Company and project overview + Detailed standardized scope of expectations
Phase 3: Vendor presentation	Workshops	Workshop planning and organization	Business project manager, IT project manager, template keeper, business experts, IT and business key users	✓ Evaluation sheet (filled out)	+ Interview guideline for reference visits
	Completion & evaluation of collected material	Collection of relevant material	Business project manager, IT project manager	✓ Evaluation tool	+ Cost calculation
Phase 4: Decision	Final vendor selection	Stakeholder management	Steering committee		
	Presentation of results to all interest groups	Stakeholder communication	Project management	✓ Presentation	
Change management		Initiating IT and business transformation, communication, value management, training	Business project manager	✓ Communication package	+ Stakeholder analysis + Business assessment
Project management		Project organization, implementation methodology set up	Business project manager, IT project manager	✓ Project plan ✓ Project organisation chart	+ Resource plan + Business case

This research publication by Ina Friedrich, Lubov Kosch, and Michael H. Breitner titled “A practical test of a process model for customer relationship system selection with an automotive supplier” which is published in the proceedings of the European Conference on Information Systems 2012 (see Appendix A4).

The list of selection criteria which are part of the CRMSS model are further investigated in a study of CRM system success. The criteria and their impact on later CRM systems success after implementation of the chosen system are evaluated using the DeLone and McLean (D&M) IS success model (DeLone and McLean, 1992, 2002, 2003 and 2004). The latter version of the model is extended by the relevant CRM selection criteria and a survey is completed to empirically test hypothesis of causal relations between selection criteria and system success mediated by the latent viable of the D&M IS success model. With the help of structural equation modeling (SEM) hypothesis are rejected or not rejected establishing a first insight into the relationship between CRM system selection and success (see Figure 3).

The CRM selection criteria were incorporated into the widely acknowledged D&M IS success model (DeLone and McLean, 2004). Thus, this research contributes to the evaluation of this theoretical model in the context of CRMSS. DeLone and McLean (2003) have called for their model to continuously “be tested and challenged”. The

extended D&M IS success model adheres to the postulate that “selection of IS success dimensions and measures should be contingent on the objectives and context of the empirical investigation, but, where possible, tested and proven measures should be used” (DeLone and McLean, 2003). Quantitative data was surveyed among CRM experts. Although the original model paths could be again supported, new insights were obtained on the relationship between CRM selection criteria and their possible impact on CRM system success. The study showed that a certain selection criteria have an impact on the quality dimension and some directly on net benefits (see section 3.3). This is a practically relevant research result as it gives an idea which phases and aspects of the CRMSS process model are of higher importance for a sustainably positive IT project outcome. It is therefore decisive to individually adapt the CRMSS process model and correctly interpret the selection criteria for the specific case at hand. For example, the task *functional criteria definition* as part of *phase 2: detailed requirements specification* in the CRMSS process model has direct and highly significant impact on net benefits. These activities (functional criteria), the associated roles (template keeper and business experts), and the deliverable (evaluation sheet) have to be regarded as key issues and have to attributed sufficient budget, time and organizational priority within the CRMSS project.

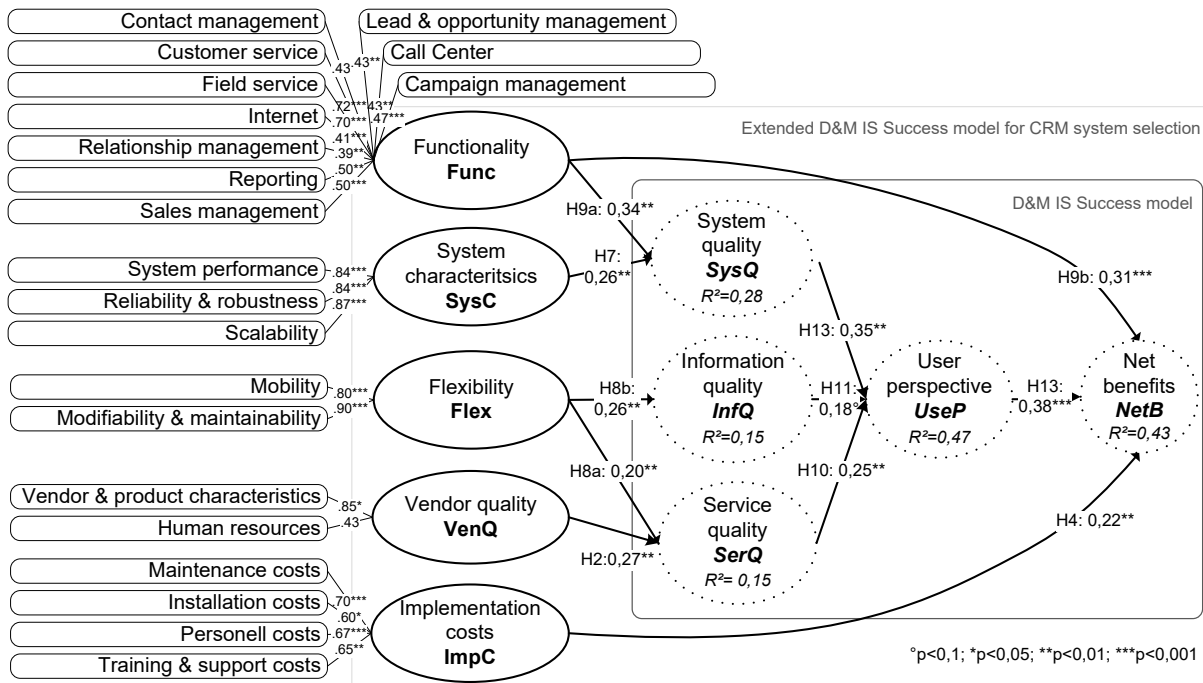


Figure 3. PLS-SEM results of the extended DeLone and McLean IS success model for CRMSS criteria

This research publication by Lubov Kosch, Halyna Zakhariya, and Michael H. Breitner titled “Beeinflussen Auswahlkriterien den Erfolg eines CRM- Systems? –

eine Strukturgleichungsmodellierung basierend auf dem DeLone und McLean IS-Erfolgsmodell (in German)“ which is published in the proceedings of the International Conference on Wirtschaftsinformatik 2013 (see appendix A3).

Electronic invoice processes – a maturity model and risk management

The European Commission (2014) defines e-invoicing as “electronic transfer of invoicing information (billing and payment) between business partners (supplier and buyer)“. They also estimate the annual saving for EU business at around 64.5 billion Euros when the e-invoicing initiative is successfully launched based on the Single Euro Payment Area (SEPA). The benefits for users are manifold: cost reductions for printing and postage, error rate decrease, improvements in process transparency and processing times (Ibi Research, 2013, Salmony and Harald, 2010). The efforts of the European Commission, national governments and many other non-government organizations since many years, however, have not yet promoted e-invoicing in the business-to-business (B2B) area to the expected level of application. According a global study on e-invoicing from 2012 by Basware GmbH only about 15 (outbound) to 16 (inbound) percent of companies already send or receive 50 and more percent of total invoices electronically. Although the number increased from 2011 to 2012, it is still quite low for small and medium sized companies (14 percent) and large companies (19 percent) alike.

In order to support business planning to implement e-invoice processes or wanting to improve on the automation scale, a comprehensive electronic invoice process maturity model (EIPMM) is developed applying the procedure model for maturity model for developing maturity models by Becker et al. (2009). The main objective of the maturity model is to provide a generalized and standardized approach for companies of different industries and sizes to be able to efficiently adopt e-invoice processes and reap the benefits more swiftly. The EIPMM model was developed iteratively. Becker et al. (2009) argue that their procedure model provides “a methodologically well-founded development and evaluation of maturity models”.

For the time being, the last iteration included qualitative, explorative focus group interviews resulting in a maturity model with four main categories (technology, process and organization, acceptance, and strategy), 15 sub-categories and detailed categories which should be measured by five maturity levels from *0:non-existent* to *4:continous improvement* (Figure 4). These categories represent a systematic process for the implementation and operation of e-invoice processes and for decision making. From the theoretical perspective and similar to the earlier argumentation on meta model application, the EIPMM contributes to the objective of rigorous maturity model design (Becker et al., 2009) by showing the applicability of the suggested process model in a specific domain. At the same time, in comparison to the available

best-practice maturity models (see Appendix A8), the EIPMM development process is documented in a transparent and reproducible manner supporting the hypothesis that a structured model-based result leads to “more profitable results than an intuitive procedure without recourse to a reference manual” (Becker et al., 2009).

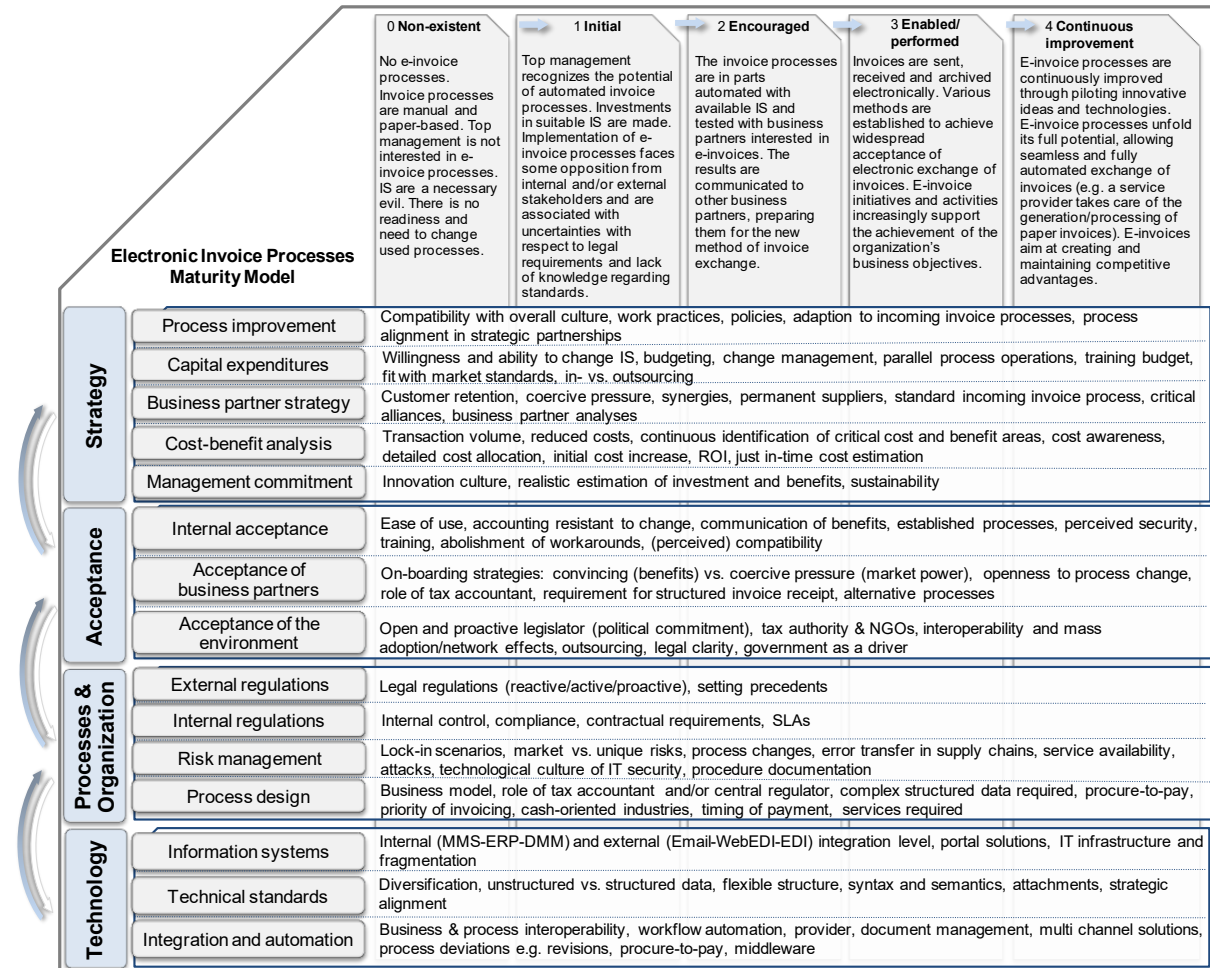


Figure 4. The current Electronic Invoice Processes Maturity Model

From the practical point of view, the EIPMM helps to provide the overall picture of the issue around e-invoicing. As most benefits occur when the procure-to-pay process is fully automated with seamlessly integrated e-invoice processes (European Commission, 2010), it makes sense to examine the maturity-oriented concept. The EIPMM shall provide information whether all possible and convenient opportunities for them are implemented and used. The EIPMM raises awareness for the e-invoice processes and shows how processes can be improved. It presents critical success factors affecting the decision as to how invoice processes should be managed. The e-invoice issue is not only a question between paper-based and electronic invoice but more of how processes are designed. The EIPMM is a valuable tool, not only for evaluation of internal capabilities, but also for discussions with partners.

This research publication by Angelica Cuylen, Lubov Kosch, and Michael H. Breitner titled “Design and Discussion of a Maturity Model for Electronic Invoice Processes“ is submitted to the Electronic Markets Journal and is currently conditionally accepted in the third revision (see Appendix A8).

As part of the maturity model categories risk management showed to be of major importance. Therefore, a study on risk factors associated with e-invoice processes is required.

Risk management for e-invoice processes, according to the conducted structured literature review, is the first study to identify and analyze critical risk factors of e-invoice processes. A quantitative study surveying experts on e-invoicing was conducted to evaluate theoretically developed risk factors. The analysis revealed ten dimensions of risk factors that need to be considered. The 37 identified and statistically significant factors are an initial approach for the practical risk management for e-invoice processes (see Table 2).

Table 2. Risk Dimensions and Factors – Rotated Factor Loadings and Descriptive Statistics

Risk Dimension	Included Risk Factor	Rotated Factor Loadings	Risk Probability		Risk Value		One-way ANOVA mean
			Mean	SD	Mean	SD	
Strategy	Disruption or contravention due to legal ignorance	,713	2,604	1,084	2,563	1,097	2,738
	Disruption or contravention due to different international legal regulations	,637	2,848	1,026	2,721	1,081	
	Not acting in accordance to law due to a lack of knowledge within the company	,633	2,654	,993	2,655	1,066	
	Master data that is relevant for invoices is lacking quality	,558	2,733	1,059	2,724	1,117	
	Lack of knowledge of additional costs (implementation, operation,...)	,544	2,865	1,053	2,828	,955	
	Dependency on customer	,521	2,781	1,028	2,759	,976	
Process	Too few business partner are using electronic invoices	,805	3,198	1,125	3,080	1,059	3,079
	Lack of willingness by suppliers to change process	,742	3,057	,984	3,011	1,006	
Organization	Additional expenses due to parallel invoice processes (entry of invoice data in web portals, paper-based and electronic invoices,...)	,601	2,981	1,215	2,908	1,007	
	Electronic archive is lacking or is not legally compliant	,691	2,781	1,209	2,977	1,198	
System	Lack of adequate information systems within the company (slow internet connection, software solutions do not suit electronic invoices,...)	,598	2,566	1,121	2,402	1,005	2,614
	Sunk costs (e.g. printing of electronic invoices, operating parallel processes,...)	,566	2,705	1,055	2,709	1,016	
	Error proneness due to lack of experience of service provider	,542	2,467	1,029	2,558	1,001	
	Lack of functionality in service offers	,534	2,538	,968	2,494	1,031	
	Adoption of too many standards	,737	2,868	1,155	2,647	1,088	
Standard	Use of different service offers due to lack of interoperability of service systems (web portals,...)	,635	3,125	1,146	2,871	1,044	2,835
	Use of parallel systems due to lack of interoperability of information systems	,629	2,875	1,077	2,885	1,028	
	Dependency on standard being used	,542	2,781	,980	2,694	1,012	
	Selection of a standard that is not future-proof	,524	2,575	1,014	2,698	1,085	
	Loss of invoice (spam filter, errors in archiving,...)	,818	2,226	1,035	2,345	1,055	
Security	External threat to invoice (spying out of content, deletion of invoice file, falsified sender or receiver...)	,741	2,094	,921	2,345	1,087	2,250
	Lack of data integrity in invoice processes (falsified data)	,642	2,133	,889	2,483	1,109	
	Lack of readability in invoice processes (visual representation of invoice)	,517	2,115	1,008	2,161	,951	
Environment	Reputation loss due to non-adaption of electronic invoices	,805	2,743	1,092	2,644	1,000	2,833
	Not exploiting competitive advantage due to non-adoption of electronic invoices	,785	2,876	1,053	2,713	,939	
	Adoption due to external pressure from business partners or government	,726	2,885	1,036	2,871	,910	
Process	Error proneness of financial accounting	,814	1,991	,834	2,198	,892	2,296
	Error proneness of the control procedure of the payment process	,671	2,067	,862	2,310	,968	
	Error proneness of the control procedure of the inbound invoice process	,655	2,264	,939	2,287	,875	
	Incomplete adoption of the business processes	,620	2,857	,945	2,802	,905	
Acceptance	Lack of acceptance by top management	,802	2,619	1,095	2,655	1,098	2,615
	Lack of willingness for internal and external process changes inside the company	,558	3,198	1,099	3,035	,951	
	Lack of acceptance of new processes by staff	,545	2,802	1,018	2,793	1,058	
Change Management	More difficult cash payment process	,781	1,971	,955	2,128	,968	2,123
	Irreversibility of process changes	,526	2,283	,778	2,400	,928	
Project Management	Lack of comprehensive process and IT know-how of consultant	,626	2,613	1,065	2,701	,990	2,755
	Lack of strategic planning	,533	2,896	1,112	2,897	1,012	

This research provides support especially for companies that are starting to implement e-invoice processes. However, companies that decline e-invoice process can use these results as a starting point to reconsidering their decision. Further, this research can support companies that are trying to convince their business partners to implement e-invoice processes. Finally, the results can be used as basic frameworks for consultants, organizations or other stakeholders to analyze and design e-invoice processes and solutions. The analysis of risk factors is relevant because as the adoption rate of e-invoicing is rather low (European Commission 2010). Further, this research highlighted the importance of a risk assessment for e-invoice processes due to the fact that nearly half of the contacted experts taking part in the survey were interested in the results of the study.

This research publication by Angelica Cuylen, Lubov Kosch, and Michael H. Breitner titled “Why are Electronic Invoice Processes Risky? - Empirical Analysis and Discussion of Risk Factors“ which is published in the proceedings of the European Conference on Information Systems 2015 (see Appendix A7).

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