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Maturity Models in IS Research

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MATURITY MODELS IN IS RESEARCH

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Abstract

Notwithstanding the relevance of maturity assessments in practice, Information Systems (IS) research has – despite exceptions – yet rarely endeavoured into reflecting and developing theoretically sound maturity models. This paper reports a literature review on maturity models in the IS domain. Specifically, it explores what type of research on maturity models has been undertaken (retrospection) and which potentially useful measures might be pursued in IS for future research (prospection). The paper suggests that research on maturity models is of growing interest; nevertheless, comparably few related articles have been published in the leading IS journals. We see that the Capability Maturity Model (CMM) and its successor CMM Integration (CMMI) dominate studies of maturity. While maturity models have been addressed in prescriptive, descriptive and reflective works, the notions of maturity and maturity models have rarely been conceptualised in detail. In view of that, the paper presents implications for the practice of maturity model application and research thereof.

Keywords: CMM, CMMI, Maturity, Maturity models, Literature review, IS research agenda.

1 INTRODUCTION

A plethora of maturity models have been developed over the last years both by practitioners and researchers (de Bruin & Rosemann & Freeze & Kulkarni 2005). For example, existing maturity models can assist organisations to improve in the domains of business process management (BPM, Rosemann & de Bruin 2005), digital government (Gottschalk 2009), software engineering (Paulk & Curtis & Chrissis & Weber 1993), inter-organisational systems (Ali & Kurnia & Johnston 2008), and knowledge management (de Bruin et al. 2005). It can be expected that organisations will continue to adopt maturity models in order to assess and improve their capabilities (Scott 2007).

Maturity can be regarded "as a measure to evaluate the capabilities of an organisation in regards to a certain discipline" (Rosemann & de Bruin 2005). Maturity models are conceptual models that outline anticipated, typical, logical, and desired evolution paths towards maturity (Becker & Knackstedt & Pöppelbuß 2009). Maturity models are of normative nature (Iversen & Nielsen & Norbjerg 1999) and can be understood as reference models (Herbsleb & Zubrow & Goldenson & Hayes & Paulk 1997). They are used to assess the as-is situation of an organisation, to derive and prioritise improvement measures and to eventually control their implementation progress (Iversen et al. 1999). Maturity models assume that predictable patterns exist in the evolution of organisations (Gottschalk 2009, Kazanjian & Drazin 1989), which are conceptualised in terms of evolutionary stages. These distinctive stages provide a roadmap for improvement to organisations, with each later stage being superior to a previous stage (Mehta & Oswald & Mehta 2007, Subba Rao & Metts & Mora Monge 2003). Advancing on the evolution path then means a step-by-step progression regarding an organisation's capabilities. Therefore, a set of descriptors or benchmark variables that characterise each stage is required (Dekleva & Drehmer 1997, Gottschalk 2009, Subba Rao et al. 2003). They eventually provide the criteria and characteristics that need to be fulfilled in order to reach a particular maturity level and, hence, the foundation for maturity assessment (i.e., a snap-shot of an organisation regarding the given criteria). Based on the results of such an as-is analysis, recommendations for improvement measures can be derived and prioritised in order to eventually reach higher maturity levels.

A well-known maturity model for improving the software development process is the Capability Maturity Model (CMM, Paulk et al. 1993), which was developed by the Software Engineering Institute (SEI) of the Carnegie Mellon University. Adapted from Crosby's (1979) Quality Management Maturity Grid (QMMG), the SEI originally defined five levels of process maturity in software development, namely: initial, repeatable, defined, managed, and optimised (Paulk et al. 1993). In 2001, the SEI released its successor CMM Integration (CMMI). Beside the QMMG and the CMM(I), Maslow's (1954) Hierarchy of Individual Needs and Nolan's (1979) Stage Theory are also regarded as precursors of the many maturity models available today (Gottschalk 2009, Holland & Light 2001).

In practice, the application of maturity models continues to increase in quantity and breadth; software companies and consultancies have yet presented a multitude of maturity models (e.g., Hewlett-Packard 2007, Sun 2005). IS research has paid some attention to the concept of maturity models, too. In particular, the impact of the CMM's key processes on software development productivity and quality has been examined (Jiang & Klein & Hwang & Huang & Hung 2004, Phan 2001, Ramasubbu & Mithas & Krishnan & Kemerer 2008). Moreover, the CMM has influenced and informed the development of many new maturity models in IS research (e.g., Crawford 2006, de Bruin et al. 2005, Luftman 2003). However, more fundamental research on maturity models has only scarcely been undertaken in the IS domain, e.g., on how to develop and evaluate theoretically sound maturity models or on what makes maturity models useful for practitioners (de Bruin et al. 2005, Rosemann & de Bruin 2005). Especially with regard to the growing importance of maturity models in practice, we thus need to assess our understanding and reflection of this phenomenon. In the first instance, we should examine what insights on maturity models IS research currently provides and the extent to which future IS research is potentially able to contribute to tackling the substantial theoretical and practical challenges related to maturity models. Consequently, this paper seeks answers to the following research questions (RQ):

RQ 1: What is the current state of research in IS on maturity models? Specifically:

a) How widely is the concept of maturity models spread in IS research?

b) What methods do IS researchers apply to explore the phenomenon of maturity models?

c) What type of research on maturity models is carried out in the IS domain (prescriptive, descriptive or reflective research)?

d) What knowledge and theories do IS researchers build on for exploring the phenomenon of maturity and/or building maturity models?

RQ 2: What are potentially fruitful avenues for future IS research on maturity models?

The paper is organised as follows. In the next section, we set out the methods and data of an in-depth literature search and analysis in the IS domain (section 2: literature review design). Following the appraisal of the contributions on maturity models we could identify in our literature search (section 3: results), we discuss implications for theory and practice and in particular point to directions for future research on maturity models in the IS domain (section 4: discussion). The final section draws some conclusions and considers the research limitations (section 5: conclusions and limitations).

2 LITERATURE REVIEW DESIGN

2.1 Literature Review Scope

Against the background of our research questions, we first set out to investigate the role that maturity models play in research. More specifically, we make an attempt to assess the quantity of research efforts in this field as well as to search for pivotal academic works on maturity models published in the IS domain. By analysing these works in detail, we explore what type of research on maturity models has yet been undertaken in IS research (retrospection) and identify potentially useful measures for future IS research in the field (prospection).

As documentations of literature reviews often differ significantly in both structure and format (Webster & Watson 2002), we seek to define the review scope prior to analysing the literature. Here, we refer to a taxonomy of literature reviews proposed by Cooper (1988). It distinguishes six substantial review characteristics: (1) goal, (2) focus, (3) perspective, (4) audience, (5) organisation, and (6) coverage. In short, the research objective (ad 1) of this study is particularly to analyse the design of prior IS research on maturity models (ad 2) in a preferably neutral way (ad 3) for both scholarship in general and IS researchers in particular (ad 4). For analysing the results gained from the literature search, the review is primarily organised in a methodological manner (ad 5). Finally, since the review explicitly focuses on IS research, its coverage (ad 6) is restricted to selected volumes of major IS journals, and can thus hardly be labelled exhaustive. Nevertheless, we hope that the literature search process underlying this study – as described in the following – provides arguments to consider the review representative for the IS domain.

2.2 Database Search

In order to assess academic interest in maturity models, we applied a keyword search in ten scientific databases, namely: *ACM Digital Library, AIS Electronic Library, EBSCOhost, Emerald, IEEE Xplore, INFORMS, ProQuest, ScienceDirect, SpringerLink,* and *Wiley InterScience*. We restricted our analysis to the time period 1994–2009. The search phrase we applied in all searches was ‘maturity model.’ For excluding irrelevant papers, i.e., those pieces that contain our search term, but do not deal with maturity models (e.g., when referencing a maturity-related paper in the bibliography), we primarily searched within the papers’ abstracts (i.e., a full text search was not applied). However, this was not possible in all cases (e.g., *ProQuest* only allows to search within ‘citation and abstract’ at the same time) and this is why we also tracked the search fields we could query in each database. Moreover, since the databases provide access to a range of sources that cannot be labelled scientific (i.e., rather business-

oriented magazines), we further tracked the considered publication type (e.g., journals, proceedings or transactions).[1]

All in all, we could discover more than 1,000 academic articles probably dealing with maturity models published during the past fifteen years. Our literature count reflects an increasingly growing interest in the topic during the more recent past; especially in the time period 2005–2008 (see Figure 1). That being said, our results suggest that the theme of maturity models is not only increasingly absorbing industrial but also scientific interest.

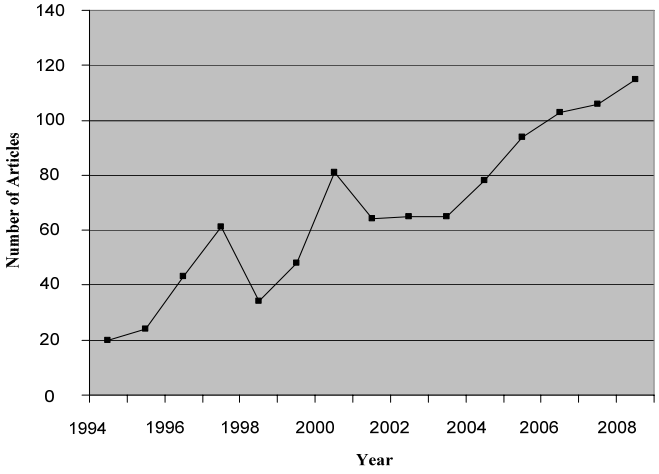

Figure 1. Results from database search

Given that the queried databases provide access to a great many of scientific outlets from a variety of different disciplines, the question emerges in how far maturity models are developed and researched in the IS domain specifically. For that reason, we conducted a journal search in the IS domain that is summarised in the following subsection.

2.3 Journal Search

In our journal search, we initially focused on the *Senior Scholars' Basket of Journals* shared by the *Association for Information Systems (AIS)*.[2] This list contains six major IS journals plus two additional journals of similar quality which were all considered in our literature search. However, when searching for abstracts containing the term 'maturity model' we could only identify four different articles published in these eight seminal IS outlets (Dekleva and Drehmer 1997; Mathiassen and Sørensen 1996; Mehta et al. 2007; Ramasubbu et al. 2008). Therefore, we subsequently extended our analysis by the list of the 19 'pure IS journals' as identified by Walstrom and Hardgrave (2001). Following this strategy, our search resulted in 20 articles that focus on maturity models.[3] These papers provide a valuable foundation for now exploring the methods that IS researchers apply for studying the phenomenon of maturity, the type of research that is carried out in the IS domain (prescriptive, descriptive or reflective research), and the theories IS research builds upon for developing and/or researching maturity models.

[1] Please note that, due to page limitations, we can herein only briefly touch upon the literature search strategy. However, we would be delighted to provide interested readers with further information on our literature search upon request via e-mail. The database search was conducted in March 2009.

[2] http://home.aisnet.org/displaycommon.cfm?an=1&subarticlenbr=346

[3] Note that we separated the following three papers out: a book review by Gray (1996), a teaching case by Mehta et al. (2007) and a guest editorial by Antonucci & Corbitt & Stewart & Harris (2004).

3 RESULTS

3.1 Analysis Overview

A defining criterion of research is that it draws from and/or contributes to the existing body of scientific knowledge (Hevner & March & Park & Ram 2004). Following this view, we analysed both the input and output of IS research on maturity models. Our analysis of the above-mentioned articles suggests that maturity models are predominantly developed for and applied in organisational improvement endeavours (e.g., software engineering, project management or IT-business alignment). However, the analysed papers pursue different research objectives and, consequently, feature distinct types of contributions to IS research. In order to provide an overview about different approaches to maturity models available in the IS domain, we summarise the research methods applied in 20 relevant research articles, the type of contribution provided, and the theoretical knowledge they refer to.

3.2 Research Methods

The choice of the research method influences the way in which a researcher collects and understands data (Myers 1997). One of the most common distinctions is between qualitative and quantitative research methods. Roughly speaking, quantitative research methods include empirical studies such as survey methods and laboratory experiments, as well as formal and numerical methods. Qualitative research methods include, for instance, action research, case study research, and grounded theory. Qualitative data sources embrace observations, interviews and questionnaires, documents and texts, as well as the researcher's impressions and reactions (Myers 1997).

In IS research, a wide range of research methods is applied and this is also the case for research on maturity models. Both qualitative and quantitative studies on maturity models can be identified. As for the former, six of the reviewed articles gathered qualitative data in case studies and action research projects (Drinka & Yen 2008, Holland & Light 2001, Iversen et al. 1999, Khaiata & Zuelkarnan 2009, Magdaleno & Cappelli & Baiao & Santoro & Araujo 2008, Phan 2001). As for the latter, another six studies refer to quantitative data collected in survey studies or to historical data (Ashrafi 2003, Dekleva & Drehmer 1997, Huang & Han 2006, Jiang et al. 2004, Ramasubbu et al. 2008, Vitharana & Mone 2008). Mathiassen and Sørensen (1996) as well as Purvis, Santiago and Sambamurthy (1998) conducted critical reviews of existing works and models. As for the residual six articles, we could not determine the applied research method (Becker & Gibson 1997, Crawford 2006, Luftman 2003, Saulnier & Landry & Longenecker Jr. & Wagner 2008, Scott 2007, Urwiler & Frolick 2008). In most of these six articles, new maturity models are suggested and described. The underlying development and research process, however, is not made transparent.

3.3 Types of Contribution

In order to categorise the contribution types of the articles under analysis, we will refer to an analysis framework that distinguishes between prescriptive, descriptive and reflective research. This framework was developed by Hansen, Rose and Tjørnehøj (2004), who applied it to the field of software process improvement (SPI). According to its originators, the framework is also applicable to any other applied academic field (Hansen et al. 2004). Based on the three notions of prescription, description and reflection, the evolution of an academic field exhibits a circular logic: First, (theoretically derived) prescriptions are carried out. Second, the resulting experiences are described in order to generate a better understanding of the domain. Third, these insights are used to generalise them to theory, which could then again provide the basis for better prescriptions. Hansen et al. (2004) note that their basic framework should be extended by two additional research types – 'descriptive/prescriptive' and 'descriptive/reflective' – since descriptive work may also include prescriptive elements ('lessons learned') or reflective theoretical frameworks. Accordingly, we categorised the 20 articles on maturity models into the following five types (Hansen et al. 2004):

P: *Prescriptive contributions* specify how organisational improvements could or should take place. Such prescriptive statements are typically based on normative models (i.e., maturity models).

D: *Descriptive contributions* report on experiences of improvement programs and maturity model applications (e.g., success stories, statistical surveys and case studies).

D/P: *Descriptive/prescriptive contributions* are largely descriptive in nature but also feature prescriptive parts (e.g., 'lessons learned').

D/R: *Descriptive/reflective contributions* are primarily descriptive but also include reflective elements (e.g., theoretical frameworks derived from case studies).

R: *Reflective contributions* include discussions and criticisms of the core assumptions of maturity models or focus on building theoretical frameworks.

A typical example of prescriptive work is the presentation of new maturity models. This, however, is rarely subject to major IS journal publications. Within our set of 20 papers, new maturity models were only proposed in four articles (Crawford 2006, Holland & Light 2001, Luftman 2003, Urwiler & Frolick 2008); none of those was published within the *Senior Scholars' Basket of IS Journals.*

Furthermore, we were not able to identify any purely descriptive work. However, there are contributions that combine descriptive and prescriptive elements, e.g., the case study by Drinka and Yen (2008) that concludes with prescriptive 'lessons learned.' Similarly, the articles by Magdaleno et al. (2008) and Khaiata and Zualkerman (2009) feature prescriptive parts (in terms of new methods that can be applied to BPM and IT-business alignment). Besides, we also identified contributions that integrate descriptive and reflective elements. Frequently, such works provide practice-oriented case narratives combined with theoretical work. Phan (2001), for example, compares the SPI activities outlined in the CMM with practices of *IBM* and *Microsoft*.

Concerning reflective contributions, the analysed articles on maturity models examine statements of relationships, i.e., causal explanations and testable propositions, between the application of maturity models and improvement success (Ashrafi 2003, Jiang et al. 2004, Mathiassen & Sørensen 1996, Ramasubbu et al. 2008). In addition, such contributions reflect on existent maturity models by identifying gaps in these models (Purvis et al. 1998) or by enhancing them through additional theoretical support (Huang & Han 2006, Vitharana & Mone 2008).

3.4 Justificatory Knowledge

The CMM, its predecessor Software Process Maturity Framework (SPMF) and its successor CMMI, play a dominant role in the IS publications under review. They provide the basis for research in 15 of the 20 articles under analysis. In particular, all reflective contributions in this study refer to one of these models. For instance, the effectiveness of applying the CMM is examined in empirical studies (Ashrafi 2003, Ramasubbu et al. 2008, Vitharana & Mone 2008). In prescriptive works, the CMM or related models are frequently transferred to fields beyond software engineering, e.g., IS education (Drinka & Yen 2008), project management (Crawford 2006) or IT-business alignment (Luftman 2003). All together, it appears that only few studies in IS research build on any other maturity models apart from the CMM family (e.g, Magdaleno et al. 2008).

Besides existent maturity models, we can identify articles that refer to other forms of justificatory knowledge, such as guidelines, standards and methods. Examples include ISO 9000 (Ashrafi 2003), Bootstrap (Iversen et al. 1999), the Information Systems Management Architecture developed by *IBM* (Purvis et al. 1998), or the Project Management Body of Knowledge (PMBOK) Guide (Crawford 2006). Moreover, our analysis suggests that studies on maturity models seldom refer to theories or theoretical statements of relationships (i.e., causal explanations or testable propositions). In some cases, however, theories are adapted which could be regarded similar to the notion of maturity models like Maslow's Hierarchy of Needs (Urwiler & Frolick 2008) and Nolan's Stage Theory (Holland & Light 2001). In the field of IS education, both learning paradigms and theories can inform the research

on maturity models (e.g., Drinka & Yen 2008, Saulnier et al. 2008). Dekleva and Drehmer (1997) applied the Rasch Calibration Psychometric Model to examine whether actual software development practices follow the ones prescribed by the SPMF.

Source	*Contribution / research question*	*Research method*	*Journal*	*Reference to model*	*P*	*D/P*	*D*	*D/R*	*R*
Becker & Gibson (1997)	Presentation of an Information Abstraction Model and an integrated CASE toolset for its practical use	n/a	JEUC	CMM	X				
Crawford (2006)	Development of a project management maturity model	n/a	ISM	CMM	X				
Luftman (2003)	Presentation of a maturity model for IT/business alignment (SAMM)	n/a	ISM	CMM	X				
Saulnier et al. (2008)	Proposal of an approach consistent with CMMI for learner-centred assessments	n/a	JISE	CMMI	X				
Scott (2007)	Propositions for the IS organisation of the future, amongst others: maturity models as a trend that requires new capabilities	n/a	ISM		X				
Urwiler & Frolick (2008)	Presentation of a hierarchy of progressing IT maturity	n/a	ISM	Maslow's Hierarchy of Needs	X				
Drinka & Yen (2008)	Experiences in implementing a curriculum redesign using the CMM	Case study	JISE	CMM		X			
Khaiata & Zualkernan (2009)	Development and application of a survey instrument for measuring IT/business alignment based on Luftman's SAMM	Case study	ISM	SAMM		X			
Magdaleno et al. (2008)	Application of the CollabMM in an explanatory study in oil production processes	Case study	ISM	CollabMM		X			
Holland & Light (2001)	Determination of ERP system maturity for 24 organisations, illustration of one organisation for each stage	Multiple case study	DATA BASE	Nolan's Stage Theory				X	
Iversen et al. (1999)	Development and application of an alternative technique to CMM and Bootstrap	Action research	DATA BASE	CMM				X	
Phan (2001)	Review of software development practices at *IBM* and *Microsoft*	Multiple case study	ISM	CMM				X	
Ashrafi (2003)	Investigation of the impact of SPI methodologies on software quality	Survey study	I&M	CMM					X
Dekleva & Drehmer (1997)	Do actual software engineering practices follow the SEI software process maturity model?	Survey study	ISR	SPMF					X
Huang & Han (2006)	Development of a decision model to help CMMI adopters choose a suitable improvement path for their SPI efforts.	Analysis of historical data	I&M	CMMI					X
Jiang et al. (2004)	Is there a relationship between the implementation of the CMM activities and software project performance?	Survey study	I&M	CMM					X
Mathiassen & Sørensen (1996)	Explication of the strengths and limits of the CMM for CASE introduction	Literature review and synthesis	ISJ	CMM					X
Purvis et al. (1998)	Which IS functions are excluded by the CMM?	Mapping of models by two authors	JEUC	CMM					X
Ramasabbu et al. (2008)	Development of a learning-mediated model of offshore software project productivity and quality	Survey study	MISQ	CMM					X
Vitharana & Mone (2008)	Development and validation of an instrument to measure critical factors of software quality management	Literature review; survey study	IRMJ	CMM					X

Table 1. Results from literature analysis (ordered by type of contribution)

During the course of our analysis, we could not find exhaustive definitions of ‘maturity’ or ‘maturity model.’ However, as the CMM frequently serves as a blueprint for designing maturity models, it seems as if these notions are implicitly defined by the prototype this model provides.

Table 1 gives an overview over the results of our literature analysis, in particular taking into account research methods, types of contribution and justificatory knowledge. In the following section, we discuss the results gained from the literature analysis. Here, we focus on the current state of maturity model research in IS and the implications for theory and practice.

4 DISCUSSION

4.1 Status-Quo of IS Research on Maturity Models

As maturity models are typically normative in nature, one might expect research in the field to be mainly prescriptive. Indeed, we could identify such ‘typical’ prescriptive contributions in our study (Crawford 2006, Luftman 2003, Urwiler & Frolick 2008). Our literature analysis, however, suggests that contributions on maturity models are not only prescriptive, but also reflective, and further combine descriptive with prescriptive or reflective elements.

Most of works we labelled prescriptive did not disclose details on research methods applied to achieve their normative findings. Correspondingly, the rigour of these works can hardly be judged. While we could not identify any purely descriptive work, there are contributions that can be considered both prescriptive and descriptive, e.g., articles that suggest methods for measuring and improving maturity in certain domains and report on their application (Khaiata & Zuelkarnan 2009, Magdaleno et al. 2008). Frequently, practical experiences gained from case studies or action research projects are not only used for describing existing maturity models but also for reflecting on their applicability (e.g., applicability checks, comparison with other approaches, Holland & Light 2001, Iversen et al. 1999, Phan 2001). Finally, articles that study the relationships between maturity levels of existing models and output criteria (e.g., quality or productivity) can be considered reflective in nature. Here, research in particular involves gathering and analysing quantitative empirical data (Ashrafi 2003, Dekleva & Drehmer 1997, Jiang et al. 2004, Ramasubbu et al. 2008) or historical data (Huang & Han 2006).

4.2 Implications for Theory

Maturity research in IS has as yet heavily adopted the CMM and its successor CMMI. However concerning articles that suggest new maturity models, the CMM blueprint often provides little else than basic terminology and vocabulary, especially regarding the naming of the maturity stages. Against this background, the blueprint provided by the CMM is frequently adopted and populated by domain-specific content. Such approaches rarely describe the application of scientifically rigorous methods and the origin of newly developed contents. As for articles revolving around reflection, the concept of maturity often stays loosely defined, transitively adopting vague and scientifically under-determined conceptualisations from existing maturity models. Here, we interpret that IS research has not yet fully exploited the potential of research on maturity models, a concept widely used and of great relevance to IS practice. IS research could address these shortcomings in, for instance, the following areas:

Designing maturity models. Following Hevner et al. (2004), designing artefacts, such as maturity models, requires the researcher to apply scientific research methods in a rigorous manner. This implies that elements of maturity models might not only be taken from prior, rather normative studies, but could also be reasoned empirically. As for the IS articles under analysis, such an empirical approach to designing maturity models has only scarcely been taken (exceptions can be found in, e.g., Holland and Light 2001 and Rosemann and de Bruin 2005). Here, for example, IS research could empirically (re-)explore the dimensions and stages of maturation (e.g., what is an empirically evident path of evolution instead of ’initial, repeated, defined, managed, and optimised?’). We expect that, depending on the specific phenomena under investigation, such paths could differ significantly from yet dominant

conceptualisations in the CMM, which were originally developed for software engineering. Further related questions are whether there might be multiple paths of maturation (Teo & King 1997), or how situational characteristics can be taken into account in the deployment of a maturity model (Mettler & Rohner 2009). Since organisation-specific circumstances may hinder the applicability of a particular model in its standard form (Iversen et al. 1999), it is argued that maturity models need to define configuration parameters in order to allow for their situation-appropriate use (Mettler & Rohner 2009).

Validating maturity models. Maturity models should be considered complete and accurate with regard to their scope (de Bruin et al. 2005). Yet, newly proposed maturity models are hardly tested for validity. For example, Crawford (2006) and Urwiler and Frolick (2008) do not provide sufficient information on if and how their models have been validated. Similarly, though Luftman (2003) claims that his model has been successfully tested in more than 50 companies, he does not provide further information on the validation process either. Exceptions can be found in Holland and Light (2001), who used semi-structured interviews to validate a-priori constructs of ERP evolutions. So far, such reflective and critical work could almost only be identified for the CMM (including SPMF and CMMI). In order to validate maturity models and according assessment instruments, de Bruin et al. (2005) propose application in case studies, incorporating surveys and interviews, discussion in focus groups, and pretesting of survey instruments in pilot groups. To ensure the relevance of maturity models for practice, researchers are further advised to conduct applicability checks with practitioners (Rosemann & Vessey 2008). Moreover, the application of more sophisticated empirical methods as used in Dekleva and Drehmer (1997) is also valuable to test hypothesised maturity models. A further approach to empirically test a staged progression model can be found in Kazanjian and Drazin (1989). Such empirical validations could underpin the rigour of maturity models.

Critical perspective on maturation. Although IS research has already explored some critical issues of maturity models in reflective contributions, it could potentially benefit from a further extension of the critical perspective. In the tradition of failure-explaining studies (see, for instance, Bartis & Mitev 2008, Lyytinen & Robey 1999), maturity model research in IS could explore the question of why certain paths towards maturity are not taken and why firms fail in their efforts to achieve higher maturity stages (or capabilities related to these). Such approaches to IS research on maturity models could yield insights into actual challenges that organisations face during maturation. Precisely, an interesting question is not only what factors promote (facilitators) but also what factors inhibit (barriers) the development from one stage to the next (Subba Rao et al. 2003). These results could be regarded as a necessary element for a realistic assessment of a firm's maturation potential.

Theoretical approaches to maturation. Until now, maturation – the process of becoming more mature – has been understood rather vaguely as a term that is associated with development towards the better. Here, however, more fundamental approaches could shed new light on what constitutes maturity, the process of maturation and the concept of maturity models respectively. For instance, the notion of path-dependency could be applied to explain causal relationships between maturation events in time (Zhu & Kraemer & Gurbaxani & Xu 2006). Other approaches such as punctuated socio-technical change (Lyytinen & Newman 2008) or evolutionary theory (Vaast & Binz-Scharf 2008) might fill this research gap as well. Here, specific maturity stages could be explained and interpreted against the background of environmental and organisational dynamics rather than as a (normatively) given fact. For instance, one might ask why collaborative efforts in BPM (maturity stage five in Rosemann & de Bruin 2005), have developed as a consequence of the interplay between organisational genetics and impulses from its environment. Moreover, many domains described in maturity models might be understood as dynamic capabilities (Eisenhardt & Martin 2000, Teece & Pisano & Shuen 1997, Winter 2003), however, such theory perspective is not yet to be found in studies of maturity and maturity models. Our results show that a thorough and rigorous discussion of maturity models in IS research requires conceptualisations and analytical perspectives that are better grounded in theory.

4.3 Implications for Practice

Our study discovers a variety of approaches and perspectives on maturity models. For instance, new maturity models are developed, application scenarios are described or the effectiveness of maturity models for certain tasks is assessed. Also, maturity models are developed for dissimilar domains, e.g., SPI, project management or BPM. Here, the objectives underlying the application of maturity models include (self-)assessment, documentation, improvement, or benchmarking. Against this background, IS practice might better understand the variety of maturity model research that already exists. Also, understanding the multi-facettedness and complexity of the phenomenon could be regarded as a first step towards developing a set of practically applicable questions that maturity models are concerned with. Moreover, we argue that the CMM has heavily impacted both research and practice. We acknowledge that we might lose the advantage of drawing heavily from a model that is widely known among practitioners, when developing theories, conceptualisations, methods, and models of maturity independently from the CMM. Against this background, new approaches might need efforts to build similar credibility among practitioners and real value added will need to be proven plainly.

5 CONCLUSIONS AND LIMITATIONS

We set out to examine the status-quo of maturity model research in IS and conducted a comparative literature review in the IS domain. An introductory and wider-ranging database search complemented the more detailed journal search. Our study yielded the following key insights: 1) Maturity models are a theme of growing importance in the IS discipline. 2) Comparably few articles have been published in the leading IS journals. 3) Maturity models have been addressed in prescriptive, descriptive and reflective work. 4) Maturity and maturity models have rarely been conceptualised in detail and can be regarded as scientifically under-determined. 5) The CMM and its successor CMMI have as yet largely shaped studies of maturity. 6) Despite the great potential for applying empirical methods, theory and critical perspectives, these opportunities have not yet been fully seized in IS research. Against this background, we identify maturity model research in IS as a study field of great relevance to practice that still bears a wide range of research potential to be exploited.

These findings are, however, beset with certain limitations. As for our literature review, we examined a considerable set of IS journals. While we believe that the extent of search is well capable to provide a solid depiction, we see potential to extend the literature search to other than the selected journals. Additionally, we regard it as a potentially fruitful avenue for future research to systematically take into account conference publications, too. We expect that there will be a great body of knowledge published in conference proceedings and that a contrasting of conference and journal articles could well provide valuable insights. Especially, we expect conference articles to yield a broader basis of IS research on maturity models and a greater share of prescriptive work compared to journal publications.

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