Information Governance Maturity Model Final Development Iteration

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Abstract. Information Governance (IG) as defined by Gartner is the "specification of decision rights and an accountability framework to encourage desirable behavior in the valuation, creation, storage, use, archival and deletion of information. Includes the processes, roles, standards and metrics that ensure the effective and efficient use of information in enabling an organization to achieve its goals".

Organizations that wish to comply with IG best practices, can seek support on the existing best practices, standards and other relevant references not only in the core domain but also in relevant peripheral domains. Thus, despite the existence of these references, organizations still are unable, in many scenarios, to determine in a straightforward manner two fundamental business-related concerns: (1) to which extent do their current processes comply with such standards; and, if not, (2) which goals do they need to achieve in order to be compliant.

In this paper, we present the third and last iteration of an IG maturity model based on existing reference documents. The development process is based on existing maturity model development methods that allow for a systematic approach to maturity model development backed up by a well-known and proved scientific research method called Design Science Research.

Keywords: Information governance · Maturity model · Measurement

1 Introduction

A maturity model defines a pathway of improvement for organizational aspects and is classified by a maturity level. The maturity levels often range from zero to five, where zero consists on the lack of maturity and five consists of a fully mature and self-optimizing process. Maturity models can be used for assessing and/or achieving compliance since they allow the measurement of a maturity level and, by identifying the gap between the current and pursued level, allow the planning of efforts, priorities and objectives in order to achieve the goals proposed.

The use of maturity models is widely used and accepted, both in the industry and the academia [1]. There are numerous maturity models, virtually one for each of the most trending topics in such areas as Information Technology or Management. Maturity

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Models are widely used and accepted because of their simplicity and effectiveness. They depict the current maturity level of a specific aspect of an organization, for example IT, Outsourcing or Project Management, in a meaningful way, so that stakeholders can clearly identify strengths and improvement points and prioritize what they can do in order to reach higher maturity levels, showing the outcomes that will result from that effort which enables stakeholders to decide if the outcomes justify the effort needed to go to higher levels and results in a better business and budget planning.

The objective of this paper is to develop an artifact (the maturity model) by using a research approach to contribute to the body of knowledge. Therefore, Design Science Research (DSR) [19] was chosen as it combines two perspectives, the practical and scientific dimensions. The maturity model focuses on the IG body of knowledge to define IG maturity levels.

The paper is structured in six sections. First, fundamental terms and concepts will be detailed and will be followed by the outline of the research methodology in Sect. 3. Further on, Sect. 4 presents the findings from a literature review. Section 5 elaborates the main insights of the iterative maturity model development and the maturity model itself. Next, the evaluation of the maturity model is presented in Sect. 6. Lastly, this paper presents conclusions from this work and details research limitations.

2 Foundation

To ensure a common understanding, we explain in this section the key terms and concepts, such as, "Maturity" and "Maturity Model".

To evaluate maturity, organizational assessment models are used, which are also known as stages-of-growth models, stage models, or stage theories [12].

The concept of maturity is a state in which, when optimized to a particular organizational context, is not advisable to proceed with any further action. It is not an end, because it is a mobile and dynamic goal [7]. It is a state in which, given certain conditions, it is agreed not to continue any further action. Several authors have defined maturity, however many of the current definitions fit into the context in which each a particular maturity model was developed.

In [6] maturity is defined as a specific process to explicitly define, manage, measure and control the evolutionary growth of an entity. In turn, in [8] maturity is defined as a state in which an organization is perfectly able to achieve the goals it sets itself. In [9] it is suggested that maturity is associated with an evaluation criterion or the state of being complete, perfect and ready and in [10] as being a concept which progresses from an initial state to a final state (which is more advanced), that is, higher levels of maturity. Similarly, in [11] maturity is related with the evolutionary progress in demonstrating a particular capacity or the pursuit of a certain goal, from an initial state to a final desirable state. Still, in [11] it is emphasized the fact that this state of perfection can be achieved in various ways. The distinction between organizations with more or less mature systems relates not only to the results of the indicators used, but also with the fact that mature organizations measure different indicators when comparing to organizations which are less mature. While the concept of maturity relates to one or more items identified as

relevant, the concept of capability is concerned only with each of these items. In [12] maturity models are defined as a series of sequential levels, which together form an anticipated or desired logical path from an initial state to a final state of maturity. These models have their origin in the area of quality. The Organizational Project Management Maturity Model (OPM3) defines a maturity model as a structured set of elements that describe the characteristics of a process or product [13]. In [14] maturity models are defined as tools used to evaluate the maturity capabilities of certain elements and select the appropriate actions to bring the elements to a higher level of maturity. Conceptually, these represent stages of growth of a capability at qualitative or quantitative level of the element in growth, in order to evaluate their progress relative to the defined maturity levels.

Some definitions found involve organizational concepts commonly used, such as the definition of [15] in which the authors consider a maturity model as a "… a framework of evaluation that allows an organization to compare their projects and against the best practices or the practices of their competitors, while defining a structured path for improvement." This definition is deeply embedded in the concept of benchmarking. In other definitions there appears the concern of associating a maturity model to the concept of continuous improvement.

In [16], the maturity models are particularly important for identifying strengths and weaknesses of the organizational context to which they are applied, and the collection of information through methodologies associated with benchmarking. In [17] it was concluded that the great advantage of maturity models is that they show that maturity must evolve through different dimensions and, once reached a maturity level, sometime is needed for it to be actually sustained. In [18] it was concluded that project performance in organizations with higher maturity levels was significantly increased. Currently, the lack of a generic and global standards for maturity models has been identified as the cause of poor dissemination of this concept.

3 Research Methodology

The development of maturity models in the IT and IG domains is not new and has been quite popular in recent years. As an example, in [20], the authors have identified more than 100 maturity models, and in [21] even more are identified. However, one major issue can be identified in most these maturity models, which is the lack of disclosure of the development process used to develop them. This leads to a weakness in this research area, which is the lack of contributions regarding how to develop these models. Despite this fact, we have identified some development methods and procedures for maturity models, such as, the general design principles from Roglinger et al. [12], the DSR perspective on maturity models by Mettler [11], the development guidelines from Maier et al. [22], and the procedure model based on DSR [24] from Becker et al. [23], which are quite popular among scholars based on their respective citation counts. To develop the maturity model presented in this paper we decided to apply the development procedure of Becker et al. [23] as it is based on DSR and as result it offers a sound methodological foundation, which is suitable for application in the research approach. This

development procedure gives a stringent and consistent approach to the DSR guidelines of Hevner et al. [24].

As depicted in the procedure model in Fig. 1 the first steps focus on the problem identification. In this step the research problem is identified and detailed, the practical relevance of the problem is specified and the value of the artifact is justified. This step is followed by the comparison with existing maturity models. This second step is based on the problem identification of the first step and analysis of existing maturity model in the IG domain, which leads to the identification of weaknesses in these models. We conducted a literature analysis, which was based on an extensive online search to find existing maturity models focused on the IG domain. Thus, the analysis of the maturity models was performed according to their functionality.

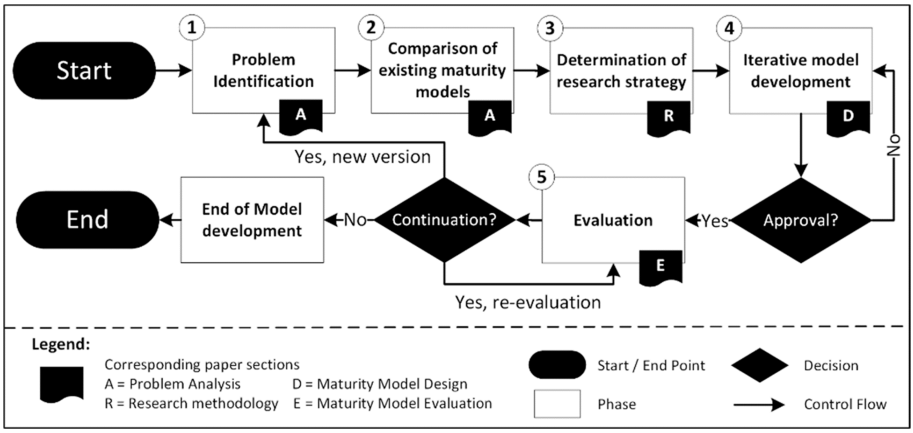

Fig. 1. Maturity Model Development Procedure Model of the research approach based on Becker et al. [23]

The next step deals with the determination of the research strategy outlined in this section of the paper. This is followed by the iterative maturity model development. In this step, we used model adoption techniques, such as, configuration, instantiation, aggregation, specialization and analogy [25] to incorporate the ISO14721, ISO16363 and ISO20652 in the maturity model. This allowed us to create a rigorous maturity model regarding both the structure and content. In the last step, evaluation, we combined the steps of Becker et al. [23], conception of transfer and evaluation, implementation of transfer media, and evaluation, into step 5. All steps will be conducted, but to match the structure of this paper we made this change.

4 Problem Analysis

This section presents the several maturity models from the Information Management, Records Management, IG and Digital Preservation domains that can influence the development of the maturity model proposed in this paper. Each Maturity Model is

presented starting with the maturity model name, attributes and maturity levels. These attributes further detail the maturity model by decomposing certain aspects of the maturity model domain. The synthesis of the analyzed maturity models is presented in Table 1.

Table 1. Synthesis of the analyzed maturity models

Maturity model	Attributes		Maturity levels
	Name	Number	
Asset Management Maturity Model [2]	Dimensions/Category	4	Initial; Repeatable; Defined; Managed; Optimizing
Digital Asset Management (DAM) Maturity Model [3]	Categories/Dimensions	4/15	Ad-Hoc; Incipient; Formative; Operational; Optimal
Information Governance Maturity Model [4]	Principles	8	Sub-standard; In Development; Essential; Proactive; Transformational
Digital Preservation Capability Maturity Model (DPCMM) [26]	Domains/Components	3/15	Nominal; Minimal; Intermediate; Advanced; Optimal
Brown Digital Preservation Maturity Model [27]	Process Perspective	10	No Awareness; Awareness; Roadmap; Basic Process; Managed Process; Optimized Process
Preservica Digital Preservation Maturity Model [28]	–	–	Safe Storage; Storage Management; Storage Validation; Information Organization; Information Processes; Information Preservation

5 Maturity Model Design

In accordance to the maturity model development procedure of Becker et al. [23] a new maturity model should be developed, if no existing or the advancement of an existing one can address the identified problem. So, based on the findings of our literature analysis there is no maturity model which acceptably fulfills our needs. Therefore, we decided to develop a new maturity model.

The newly developed maturity model, presented in Fig. 2, adopts established structural elements, domains and functions of the best practice of maturity models analyzed in Sect. 4 and is based in relevant references form the Digital Preservation and Archival Science domains, namely ISO 14721, ISO 16363 and ISO 20652. These artifacts were then extended and adjusted to fit the purpose of assessing the maturity of IG using the

guidance from these ISO standards. As outlined within our research methodology, we applied an iterative process for the development of this maturity model. In total, we needed three iterations, which are described in the following:

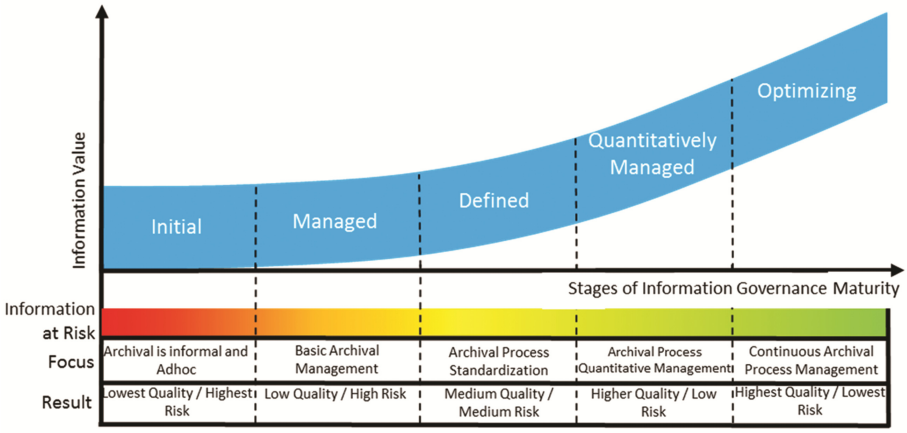

Fig. 2. Information Governance Maturity Model – Maturity Curve

First Iteration: As a first step, we identified the basic characteristics and structure of the model. As a starting point, we proposed five maturity levels – Initial, Managed, Defined, Quantitatively Managed, Optimizing – as this approach is evident in several reputable maturity models, such as, the CMMI [6]. In this initial iteration, we focused in just one dimension of the maturity model, the processes dimension. For each criterion of the maturity model we modeled what is the manifestation of that criterion at the different maturity levels. The first iteration was published through the E-ARK project in Deliverable 7.1 and was communicated to the scientific community through [29].

Second Iteration: The aim of the second iteration was to build on the success of the results of the first iteration. Thus, the maturity model was extended to contemplate all the dimensions of the maturity model. We continued with the approach of the first iteration and modeled each of the criteria at each maturity level. We then conducted a trial assessment using the maturity model, which revealed some issues that will be solved in the third iteration. This second iteration and the results of the trial assessment were published through the E-ARK project in Deliverable 7.2 and were communicated to the scientific community through [29–31].

Third Iteration: After the trial assessment using the maturity model one relevant issue was identified. The trial revealed that there was a difficulty in understanding the differences in each possible answer for the assessment questions. As an example, participants could understand what a "documented procedure" is but it was difficult for them to understand what is a "defined procedure" or even an "ad-hoc assessed procedure". This led to a revision of the assessment questionnaire and an overhaul of the maturity model to accommodate the changes to the assessment questionnaire. The maturity levels definition remained the same, however there are major changes in the overall structure of the criteria. Now instead of modelling each criterion at each maturity level we opted by

identifying capabilities for each maturity level and dimension, which resulted in an easily understandable maturity model that is presented in Figs. 3, 4 and 5. This third and final iteration was published through the E-ARK project in Deliverables 7.5 and 7.6.

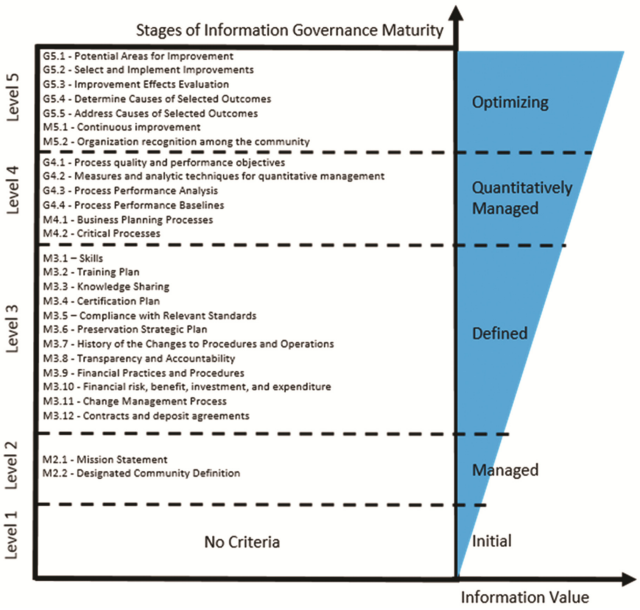

Fig. 3. Information Governance Maturity Model – Management Dimension Maturity Levels

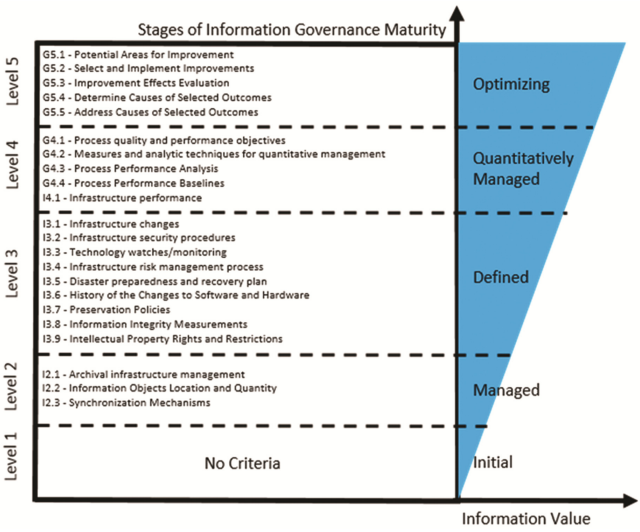

Fig. 4. Information Governance Maturity Model – Infrastructure Dimension Maturity Levels

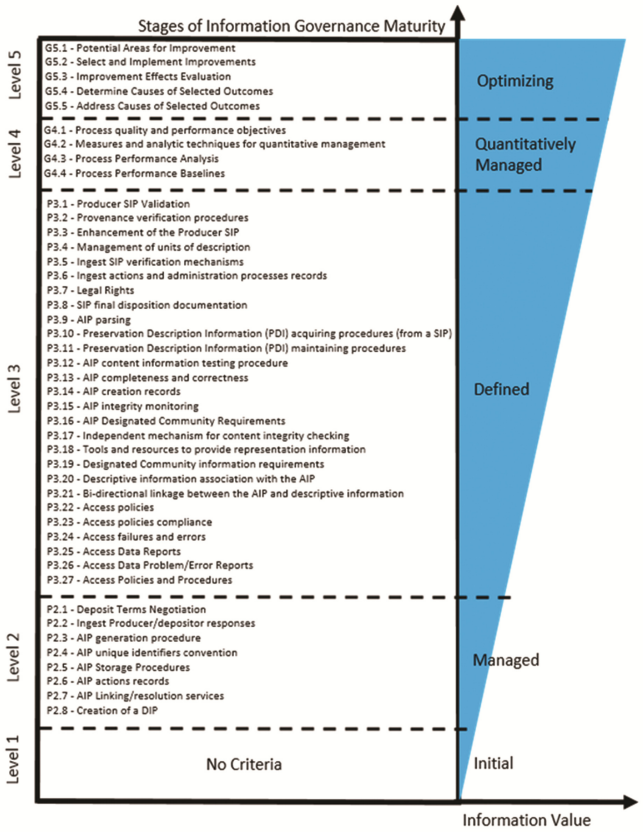

Fig. 5. Information Governance Maturity Model – Processes Dimension Maturity Levels

At maturity level 1, the organization needs to be aware that IG is needed as a relevant function of the organization.

At maturity level 2 IG meets its goals. However, there is no standardization of procedures, which can lead to two people doing different tasks to achieve the same goal and in turn can result in the inability to repeat tasks that were previously performed. Moreover, at this maturity level there is no assignment of responsibilities.

Then at maturity level 3, the organization has a standardized list of procedures with responsibilities assigned. There are also tools and methods that support IG, which are agreed upon and become a standard across the organization. Procedures at this maturity level are well defined and include its purpose, inputs, entry criteria, activities, roles, verification steps, outputs and exit criteria.

At maturity level 4 the organization establishes quantitative objectives for quality and performance of all functions related with IG. Specific measures of performance are collected and are analyzed using statistical and other quantitative techniques. There are also performance baselines and models that help in setting quality objectives. A key

difference between maturity levels 3 and 4 is the predictability of performance as predictions are based on the statistical analysis of fine-grain information.

Finally, at Maturity Level 5 the organization continually improves its IG functions based on quantitative analysis of the business objectives and performance baselines. It uses quantitative techniques to understand variations in procedures and the causes of outcomes. It also focuses on continually improving performance using incremental and innovative procedures. Additionally, the quality and performance objectives are established and continuously revised to reflect changing business objective and the organization's performance. A key difference between maturity level 4 and 5 is the focus on improving and managing the organization performance, which at this level is concerned in analyzing performance using data collected from multiple sources. This data helps identify gaps and weak points in performance that are then used to generate a measurable improvement.

To improve from level X to level X + 1, the organization must comply with all the criteria from level X, which makes this maturity model follow a "stages" approach. What an organization can expect from progressing through the maturity levels is that their IG practice will become increasingly managed, defined and optimized.

A maturity table consists of a table that crosses maturity levels with the maturity dimensions and characterizes each dimension in each level. Figure 2 presents the maturity table. The mapping to the assessment criteria for each dimension and maturity level is later detailed in Figs. 3, 4 and 5. The main goal of the IG Maturity Model is to improve the value of information in an organization. Information value will increase when going from a lower to a higher maturity level, as depicted in Fig. 2. Moreover, the lack of procedures and policies in lower levels results in the organization's information being at risk and this risk reduces as policies and procedures become implemented, defined, documented and assessed.

The IG maturity model, consists of three dimensions, Management, Process and Infrastructure. These dimensions provide different viewpoints of IG which help to decompose the maturity model and enable easy understanding. For each dimension we have a set of levels, from one to five, where one show the initial phase of maturity of a dimension and level five shows that the dimension is fully mature, self-aware and optimizing. These levels and their meaning were adapted from the levels defined for CMMI. [6] The management dimension "refers to all the activities that are used to coordinate, direct, and control an organization." [5] The criteria for assessing the maturity of this dimension is depicted in Fig. 3.

The infrastructure dimension "refers to the entire system of facilities, equipment, and services that an organization needs in order to function." [5] The criteria for assessing the maturity of this dimension is depicted in Fig. 4.

Finally, the processes dimension contains the "set of activities that are interrelated or that interact with one another. Processes use resources to transform inputs into outputs." [5] The criteria for assessing the maturity of this dimension is depicted in Fig. 5.

6 Maturity Model Evaluation

This section details the assessment strategy used in the development of the maturity model proposed in this paper. For the purpose of this maturity model we opted for the self-assessment method as it provides a way for organizations to assess their IG practice while maintaining a low cost to the organizations.

Table 2 depicts a comparison between the E-ARK pilots for the initial assessment and final assessment. Pilot 1 is the one which achieved the best overall results, especially the infrastructure dimension achieved the best results. Pilot 3 achieved the second-best results. Pilot 5 also shows a high-level maturity across the dimensions measured in the assessment. However, as in pilot 2, there are still some important enhancements to perform to the infrastructure capability. The other four pilots showed similar results among the dimensions. With some exceptions for pilot 4, where it shows higher maturity levels for the infra-structure dimension. Another exception are pilots 6 and 7 which show higher maturity levels for the processes dimension in the final assessment results.

Table 2. Initial and Final Self-assessment Results of the E-ARK Pilots

Dimension	Initial Assessment								Final Assessment							
	P1	P2	P3	P4	P5	P6	P7	∅	P1	P2	P3	P4	P5	P6	P7	∅
Management	4	2	4	2	4	1	1	**2.6**	4	2	4	2	4	1	1	**2.6**
Processes	4	1	3	1	3	2	2	**2.3**	4	2	4	1	3	3	4	**3**
Infrastructure	5	2	3	4	2	1	2	**2.7**	5	2	4	4	2	2	3	**3.1**
∅ (Average)	**4.3**	**1.7**	**3.3**	**2.3**	**3**	**1.3**	**1.7**	**2.5**	**4.3**	**2**	**4**	**2.3**	**3**	**2**	**2.7**	**2.9**

The results of the E-ARK project helped the pilots improve their maturity level and as result improved archival practice as can be seen by analyzing the results of the final assessment depicted in Table 2. The final results show several improvements in the overall maturity levels for all pilots. One aspect to take into consideration is that E-ARK outputs focus on the processes dimension as such this is the dimension where the most improvements are as illustrated in Table 2.

7 Conclusion

This paper presented the third and last iteration of a maturity model for IG, as well as, a state of the art on maturity models surrounding IG found in literature. Based on that state of the art and other references from the archival domain, namely the ISO16363, ISO14721 and ISO 20652 we developed a maturity model consisting of three dimensions and five levels.

This paper also presents how the assessment of the E-ARK pilots was performed, as well as, the analysis of the results for the pilots. As can be seen, the self-assessment questionnaire enabled a detailed analysis and comparison of the pilots and proved useful in identifying weak points and strengths of the pilots. Using the results it is then possible for pilots to identify points of improvement which can then lead to the creation of an improvement path for the pilots. Additionally, the self-assessment questionnaire is now

available online at http://earkmaturitysurvey.dlmforum.eu. Organizations can use it to assess their current IG Maturity and based on the results plan for improvement.

Despite this there is still room for improvement of the questionnaire, we are now finishing a detailed guide on how to fill the questionnaire and analyze the results which will be available online as a companion to the self-assessment questionnaire.

To extend the research component, we suggest evaluating (and refining) the maturity model within different industry sectors to gather an insight of what IG methods and procedures different industries are using and how far in the maturity scale they are.

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