The IT-CMF: A Practical Application of Design Science

Brian Donnellan[1] and Markus Helfert[2]

[1] National University of Ireland,
MaynoothCounty Kildare, Ireland
brian.donnellan@nuim.ie
[2] Dublin City University,
Dublin, Ireland
markus.helfert@computing.dcu.ie

Abstract. The IT-Capability Maturity Model [IT-CMF] is a high-level process capability maturity framework for managing the IT function within an organization. The purpose of this paper is to explore and explain the IT-CMF as a " method meta-model" for IT management, emphasizing the novel approach to addressing the application of design processes and design artifacts by means of a very structured use of engaged scholarship and open innovation techniques to the ongoing challenge of managing organization's IT capability.

1 Introduction

The research reported in this paper has been developed in the context of the IT-CMF, which presents a high-level process capability maturity framework for managing the IT function within an organization [1], [2], and [3]. The framework identifies a number of critical IT processes, and describes an approach to designing maturity frameworks for each process. The IT-CMF addresses a continuing structural problem in the IT profession and IT industry around managing the returns from IT investments.

Both "method engineering" and "method construction" can be seen as elements of Design Science-oriented information systems research [12]. The purpose of this paper is to explore and explain the IT-CMF as a "method meta-model" for IT management. There has been relatively little published research addressing the *practical* application of design processes and design artifacts in Information Systems Management. This paper addresses this paucity of published research and introduces an innovative solution to the ongoing challenge of managing the returns from IT investments.

2 The Application of DSR Principles in the IT-CMF

Design Science creates and evaluates IT artifacts intended to solve identified organizational problems. Such artifacts are represented in a structured form that may vary from software, formal logic, and rigorous mathematics to informal natural language descriptions. The rich phenomena that emerge from the interaction of people, organizations, and technology may need to be qualitatively assessed to yield an understanding of the phenomena adequate for theory development or problem solving [5].

R. Winter, J.L. Zhao, and S. Aier (Eds.): DESRIST 2010, LNCS 6105, pp. 550–553, 2010.

As field studies enable behavioral-science researchers to understand organizational phenomena in context, the process of constructing and exercising innovative IT artifacts enable design-science researchers to understand the problem addressed by the artifact and the feasibility of their approach to its solution [8].

Developing innovative artifacts is a central activity in DSR [4]. Such artifacts can be in the form of constructs, models, methods or instantiations [5]. For the construction of such artifacts two basic activities can be differentiated: build and evaluate where building "is the process of constructing an artifact for a specific purpose" and evaluation "is the process of determining how well the artifact performs" [5, p. 254]. The construction of an artifact is a heuristic search process [5]. Within this process an extensive use of theoretical contributions and research methodologies stored in the knowledge base should be made [5]. On the one hand theoretical contributions can come from governance, value based management, risk management, compliance management, etc. to build an artifact, i.e. the situational method. The IT-CMF uses the following DSR patterns proposed in [6]:

- *Different Perspectives:* The research problem is examined from different perspectives, e.g. conceptual, strategic, organizational, technical and cultural.
- *Interdisciplinary Solution Extrapolation:* A solution or solution approach (i.e. methods, instructions, guidelines, etc.) to a problem in one discipline can be applied in or adapted to the integrated IT CMF.
- *Building Blocks:* The complex research problem of IT Management is broken into thirty six critical processes that are examined in turn.
- *Combining Partial Solutions:* The partial solutions from the building blocks are integrated into the overall IT CMF and the inter-dependencies between the building blocks are identified and high-lighted. In order to rigorously demonstrate the utility of the developed artifact, different evaluation methods can be used. Amongst others, the "informed argument" is suggested as an appropriate evaluation method [5].

Maturity models in design oriented research are regarded as being located between models and methods in the form of state descriptions (e.g. the maturity levels) and guidelines [12]. In this sense, maturity models contain two aspects, one capturing the assessment of the current status and another one guiding organizations towards higher maturity levels. In the context of Design Science the first aspect can be described as a model perspective describing various maturity levels (states) of organizations whereas the second aspect describes guidelines to improve the current situation of organizations in form of method components [12]. In order to transform organizations from one maturity level to another, usually the method component is described by "maturity curves" or "maturity profiles".

In our work, we recognize this dual perspective on maturity models and aim to represent both perspectives in the meta-model of the IT-CMF. We also extend the traditional perspective of generic maturity models, in the form of providing guidelines to contextualize maturity models. As such, we combine the recent work on model and method contextualization with our work on maturity models. In order to develop an approach to contextualize the IT-CMF, we follow DSR and apply a method engineering (ME) approach. Recognizing the two perspectives of maturity models - model and methods - we developed a meta-model for the IT-CMF.

Essential to IT-CMF are Critical Processes (CPs) that represent an IT management process. CPs are central to the IT organization and are defined for a particular domain within it. The IT-CMF contains 36 CPs, which are categorized in four macro processes within a high-level overarching process. A CP takes inputs from and provides output to other CPs. Specific characteristics of a CP are further described by Capability Building Blocks (CBB) that are self-contained and completely exhaustive aspects describing the management aspects of a CP.

The IT-CMF Content Development and Review Process is implemented by the IT-CMF development community in the Innovation Value Institute (www.ivi.ie). This community is comprised of university-based academic researchers and industry-based practitioner-researchers drawn from over 40 companies located throughout the world. The IT-CMF development and review processes are based on "engaged scholarship" [13] and "open innovation" principles [14].

Associated with each CP in the IT-CMF is a maturity profile referring to the level of value and assessment elements describing maturity indicators, assessment approaches and metrics. The set of maturity profiles assigned to a CP details the transformation from one maturity level to another. The IT-CMF also contains a defined set of templates describing critical process.

The IT-CMF maturity model (an instance of the IT-CMF meta-model) is then applied to various organizations presenting several distinguished organizational contexts. The organizational context can be differentiated by various factors, for instance; organizational size, sector, coordination form within the organization, decision making structures, organizational structure, communication structure, type of information systems used, task structure, automation level and many more. Generally most maturity models do not explicitly cater for this context adoption, and usually only provide some form of guidelines or best practice. During the application, researchers or consultants adapt the maturity model and select or parameterize certain aspects of the model.

Within the IT-CMF we recognize this contextualization challenge and aim to provide specific guidelines for adapting or configuring the maturity model to a specific problem. In the context of method engineering, several approaches have been suggested to consider situational and contextual factors [9], [10]; [11]. Furthermore Recker et al. [15] suggested an approach contextualizing models in order to facilitate the adaption to specific application contexts. The aim is to produce valuable organizational designs (in form of methods or models) for a set of situations by considering situations in form of contextual influencing factors of the firm. In this sense, we complement the IT-CMF maturity model by providing a process for contextualizing the maturity models. The process configures some element of the IT-CMF meta-model. Thus, the IT-CMF research is a timely response to the malaise in the IS discipline i.e. the tension between rigour and relevance in IS research.

3 Conclusions

In contrast to many other maturity models, the IT-CMF maturity model is based on DSR principles. Following a method engineering approach we have presented a development and review process. We have reviewed principles of Design Science and

Method Engineering and applied these principles to the development of an IT-Capability Maturity Framework. Following a rigorous Design Science-based development process we presented a meta-model for describing the IT-CMF maturity model together with a supportive contextualization process. Our work demonstrates the benefits of applying design science principles in a practical setting. By applying a rigorous development process together with a consistent meta-model it can help to improve model and methods as results of design science research.

References

1. Curley, M.: Managing Information Technology for Business Value. Intel Press (January 2004)
2. Curley, M.: A Value Based IT Capability Maturity Framework. Intel EMEA Academic Forum, Ireland (2006)
3. Curley, M.: IT Innovation, a new Era. In: Proceedings of the International Conference of Computational Science, Reading, UK (2006)
4. Hevner, A.R., March, S.T., Park, J., Ram, S.: Design Science in Information Systems Research. MIS Quarterly 28(1), 75–105 (2004)
5. Schön, D.A.: The Reflective Practitioner: How Professionals Think in Action. Basic Books, New York (1983)
6. Vaishnavi, V., Kuechler, W.: Design Research in Information Systems (January 20, 2004)
7. Klein, H.K., Myers, M.: Evaluating Interpretive Field Studies. MIS Quarterly 23(1) (March 1999)
8. Nunamaker, J., et al.: Electronic Meeting Systems to Support Group Work. Communications of the ACM 34(7), 40–61 (1991)
9. Brinkkemper, S.: Method engineering: engineering of information systems development methods and tools. Information and Software Technology 38(4), 275–280 (1996)
10. Gericke, et al.: Situational Method Engineering for Governance, Risk and Compliance Information Systems. In: DESRIST 2009, Malvern, PA, May 7–8 (2009)
11. Bucher, T., et al.: Situational Method Engineering – On the Differentiation of "Context" and "Project Type". In: Ralyté, J., Brinkkemper, S., Henderson-Sellers, B. (eds.) IFIP WG8.1 Working Conference on Situational Method Engineering (ME 2007), Geneva, pp. 33–48 (2007)
12. Mettler, T., Rohner, P.: Situational Maturity Models as Instrumental Artifacts for Organizational Design. In: DESRIST 2009, Malvern, PA, May 7–8 (2009)
13. Van de Ven, A.H.: Engaged Scholarship: A Guide for Organizational and Social Research. Oxford University Press, Oxford (2007)
14. Chesbrough, H.: Open Business Models: How to Thrive in the New Innovation Landscape. Harvard Business School Press, Boston (2006)
15. Recker, J., et al.: Model-Driven Enterprise Systems Configuration. In: 18th Conference on Advanced Information Systems Engineering. Springer, Luxembourg (2006)