

Assessing Healthcare Process Maturity: Challenges Of Using A Business Process Maturity Model

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Abstract—The quality of healthcare services is influenced by the maturity of healthcare processes used to develop it. A maturity model is an instrument to assess and continually improve organizational processes. In the last decade, a number of maturity models have been proposed with varied focus and depth for business processes. However, the number of studies that adapt these models to healthcare domain or propose healthcare-specific maturity models is very scarce. In this study, we share our experience and observations on assessing the healthcare processes of a hospital department in accordance to a well-known Business Process Maturity Model (BPMM) by Object Management Group (OMG). We also discuss challenges of assessing maturity of healthcare processes in accordance to a generic maturity model and outline opportunities for future work.

Keywords—healthcare, service quality, process maturity, maturity model, process assessment

I. INTRODUCTION

Hospitals offer high-risk services to a considerable number of patients every day. Being heavily human-oriented and knowledge-intensive, healthcare processes and their management have a direct impact on healthcare service quality and related costs, and the reputation of the hospital [1]. Establishing process thinking and effective process management in the healthcare ecosystem, however, is not straightforward. In a complex, dynamic, specialized, and multidisciplinary sector like healthcare, process management is achieved only with the right tools and supportive organizational culture [2]. As such, business process improvement and clinical guidelines together with people issues as significant ingredients are considered as key research topics in the healthcare domain [3].

Business Process Management (BPM) is a discipline that aims to oversee the work performed in an organization to ensure consistent outcomes in order to reveal and implement opportunities for improvement. Rather than concerning improvement of individual activities, it is about managing entire chains of events, activities, and decisions that ultimately add value to the organization and its customers [4]. It consolidates objectives and methodologies proposed in a number of approaches including business process reengineering, innovation, modeling, and automation management [5].

The implementation of BPM approaches in an organization is a challenging undertaking. A number of business process maturity models have been proposed in the last decade to guide organizations in improving their process capabilities. A maturity model is a conceptual model that consists of a sequence of

discrete maturity levels for a class of processes in one or more business domains, and represents an anticipated, desired, or typical evolutionary path for these processes [6]. The following studies provide a critical review of the key maturity models in the BPM field: [7], [8], [9]. Some disciplines (e.g. system/software engineering [10] and supply chain management [11]) have defined and used maturity models as a way to appraise and improve the competence of their organizations. However, the number of studies that adapt these maturity models to the healthcare domain or propose healthcare-specific maturity models is scarce [12].

The aim of this study is to investigate the challenges of assessing healthcare process maturity using a generic business process maturity model, and explore the opportunities for future work that would facilitate process maturity assessment and improvement in the healthcare domain. We base our discussions on a case where we performed a business process maturity assessment of the ophthalmology department of a hospital operating in the Netherlands, and share our experience in using OMG's BPMM [13] as the base for the assessment.

The remainder of this study is organized as follows. In Section 2, we provide a background on business process assessment and improvement, OMG's BPMM, and related work on healthcare process maturity. Section 3 introduces the assessment method that we propose and that we followed in the case organization. Section 4 summarizes the challenges of and opportunities for assessing healthcare process maturity. Finally, Section 5 presents our conclusions.

II. BACKGROUND

A. Business Process Assessment

Process assessment is the foundation activity for process improvement. It investigates strong, weak, or missing points in definition and enactment of a set of business processes [14]. Findings from an assessment are typically transformed into a roadmap for improvement. The roadmap is realized by actions which are expected to result in better performing business processes [10]. This chain of activities is performed continuously as an application of Deming's "Plan-Do-Check-Act" cycle [15] for excellence of organizational performance.

Process assessment is carried out in accordance to an assessment model that requires evaluation of business practices with respect to the requirements of a conformant maturity model [14], [16]. Among the maturity models that have been proposed in the last decade for assessing and improving business process

maturity, The Business Process Orientation (BPO) Maturity Model [17], the BPM Capability Framework [18], the Process and Enterprise Maturity Model [19], and the OMG standard Business Process Maturity Model [13] are commonly referred to in the literature [9]. Among these four models, the OMG's BPMM is considered to possess strong descriptive and prescriptive properties that bring it to the fore as a unique maturity model for systematic and detailed business process assessment and improvement.

B. OMG's Business Process Maturity Model (BPMM)

As shown in Table I, OMG's BPMM consists of a group of process areas under each process area thread (in columns) and at each maturity level (in rows) [13].

The BPMM is structured by *maturity levels (MLs)* that represent different states through which an organization is transformed as its processes and capability are improved. A *process area (PA)* contains a cluster of related practices in an area, that when implemented collectively, provides a process capability that is an important component of the ML at which it resides. A *process area thread* depicts how the practices at one ML are transformed into one or more process areas at higher MLs. The BPMM has 5 maturity levels, 5 process area threads (e.g. Organizational Process Management) and 30 process areas (e.g. Organizational Process Leadership). Each process area has a number of *specific goals and practices* defined in its own knowledge area. The model also has *institutionalization goals and related practices* that apply to all process areas.

TABLE I. PROCESS THREADS AND PROCESS AREAS IN OMG'S BPMM

Maturity Level	Process Area Threads				
	Organizational Process Management	Organizational Business Management	Domain Work Management	Domain Work Performance	Organizational Support
Level 5 Innovating	Organizational Improvement Planning, Organizational Innovative Improvement, Organizational Improvement Deployment	Organizational Performance Alignment		Defect and Problem Prevention, Continuous Capability Improvement	
Level 4 Predictable		Organizational Capability and Performance Management	Quantitative Product and Service Management	Product and Service Process Integration, Quantitative Process Management	Organizational Common Asset Management
Level 3 Standardized	Organizational Process Management	Organizational Resource Management	Product and Service Business Management, Product and Service Work Management	Product and Service Preparation, Product and Service Deployment, Product and Service Operations, Product and Service Support	Organizational Competency Development, Organizational Configuration Management
Level 2 Managed	Organizational Process Leadership	Organizational Business Governance	Work Unit Requirements Management, Work Unit Planning and Commitment, Work Unit Monitoring and Control	Work Unit Performance, Work Unit Configuration Management	Process and Product Assurance, Sourcing Management

C. Related Work on the use of Maturity Models in Healthcare

Gillies and Howard [20] combine a process improvement approach derived from the Capability Maturity Model [10] with a model of competency derived from a previous work for becoming a skilled professional in healthcare, and provided a case study application on managing change from paper-based to electronic health records in primary care. Gemmel et al. [21] adapted an existing tool of BPO [17] to the specific context of healthcare. Mettler and Blondiau [22] propose a maturity model that is aimed to assist hospitals in evolving the required strategic, organizational, and technical capabilities in a systematic way so that the formation of collaborative structures and processes is efficient and effective. Cleven et al. [23] declare an empirically grounded conceptualization of process management capabilities and presented a staged capability maturity model algorithmically derived on the basis of empirical data from 129 acute somatic hospitals in Switzerland. However, none of these studies emphasizes the assessment perspective including the challenges and opportunities of adopting a generic BPMM, which is addressed by this study.

III. PROCESS MATURITY ASSESSMENT IN HEALTHCARE

Based on our knowledge from scientific literature review, there is no guidance reported for the maturity assessment of healthcare processes. With the aim to develop a systematic but also a pragmatic approach to the process maturity assessment, we reviewed the steps of SCAMPI [15] and ISO 15504 [16] methods and defined the assessment process as given in Fig. 1.

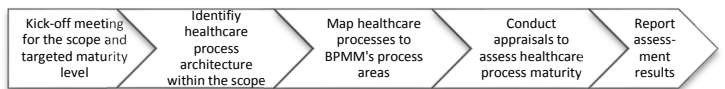


Fig. 1. Steps to assess maturity of healthcare processes

To assess the maturity of healthcare processes, we developed an assessment questionnaire based on the goals and practices of each process area shown in Table I. An example part of the questionnaire for 'Organizational Business Governance (OBG)' process area is given in Table II.

TABLE II. QUESTIONNAIRE FOR ASSESSING MATURITY OF OBG PA

Process Area				
SGx - Specific Goal				
	Spy - Specific Practice	Question	Answer [N,P,L,F]	Explanation
Organizational Business Governance				
SG1 - Business Workflows Are Aligned		Does executive management align the business activities involved in the organization's product and service work with the organization's business goals?		
	SP1 - Establish Business Objectives	Are the organization's business goals established and maintained?		
	SP2 - Define Business Measures	Are definitions of the business outcome measures related to the organization's near-term and long-term business goals established and maintained?		
	SP3 - Maintain Descriptions of Business Workflows	Are descriptions of the business activities and workflows required to prepare, deploy, operate, and support the organization's products and services established and maintained?		
	SP4 - Define Work Performance Objectives	Does executive management establish and maintain performance goals for business workflows that are drawn from the organization's business strategy and goals?		
	SP5 - Maintain Organizational Policies	Does executive management establish and maintain the organizational policies that govern the performance of the business activities?		

The answer to each question is given in four values in ordinal scale, which is derived from the rating scheme of ISO/IEC 15504 [16]: Not achieved (N: 0 to 15 % achievement), partially achieved (P: 16 to 50 % achievement), largely achieved (L: 51 to 85 % achievement), and fully achieved (F: 86 to 100 % achievement).

By following the steps of the assessment process shown in Fig.1 and using the assessment material shown partially in Table II, we have carried out a maturity assessment of the ophthalmology department of a hospital operating in the Netherlands. The details of the steps are summarized below:

- *Kick-off meeting* aims to determine the scope of the assessment in terms of the organizational units and their services to be assessed, and the targeted maturity level against which the existing status will be assessed. In the case organization, we conducted an opening meeting of an hour with the managerial staff of the ophthalmology department. We made a presentation that explains the structure and process areas of OMG’s BPMM as well as aim of and expectations (e.g. people to be involved and effort to be required) for the assessment. The output of this initial meeting was the scope of the assessment, the targeted maturity level, and the schedule for the next meeting. The unit to assess was the ophthalmology department, and the targeted ML was set by the department as 4. We also asked to receive the department structure, roles and services provided, to acquire further knowledge about the way the department operates before the next meeting.
- *Identify healthcare process architecture within the scope:* During a series of meetings (of two hours each) with mid-managers, we elicited process knowledge in the ophthalmology department including the regulations and standards that the department has to comply with. We identified the process architecture depicting the processes and their relations within the department (and also with other departmental units) at the highest level of granularity. We validated this architecture with the department, received their feedback, and finalized it.
- *Map healthcare processes to the BPMM’s PAs:* At this step, we mapped the list of ophthalmology processes to the *Domain Work Performance* process areas at ML3 of OMG’s BPMM (shaded cell in Table I). These include Product and Service Preparation, Deployment, Operations, and Support¹. These process areas are considered as the key areas that have to be adapted to the domain specific processes for healthcare service development and delivery. The services of the department included, for instance, the core service of patient handling of different diseases, and clinical training services (to bachelor and master students, and ophthalmology residents). Since the OMG’s BPMM is a generic model and originated from engineering domains, mapping these process areas was a critical and challenging step of the assessment. The mapping of healthcare processes to the BPMM’s PAs was carried out in interaction with the next step and in

several iterations. Hence, it was not until we assessed the maturity of the ophthalmology services with respect to the requirements of these process areas that we could finalize the mapping. For demonstration purposes, we present in Fig. 2 the mapping of the activities in ‘clinical training’ service of the ophthalmology department to the process areas of domain work performance at ML3.

- *Conduct appraisals to assess healthcare process maturity:* We assessed the maturity of ophthalmology processes by using the assessment questionnaire exemplified in Table II. We went over process areas one by one with the quality manager of the department, who also masters the ophthalmology domain. He acted as the intermediate for other mid-managers and staff in the department. We went over the goals and practices in each process area, and provided explanations and examples from other domains where necessary. For each practice, we elicited the details regarding task executions, and also referred to related documents as additional sources of evidence. We rated the achievement of a practice in four values (N, P, L, F; as mentioned previously) together with the rationale for the rating. We also rated the achievement of each goal considering the degrees of achievement of its practices. As a consequence, this required more effort than we initially planned for. It took from 1 to 1.5 hour(s) to go over a single process area. After assessing the achievement of the goals of process areas, we declared our ratings and underlying rationale to the quality manager for validation purposes.
- *Report assessment results:* The results of the assessment are reported at different abstraction levels for different stakeholders. In the case organization, we are currently in the process of reporting the results of the assessment. The report will summarize the status of each process area elaborating the strengths and weaknesses that were observed with respect to the requirements of the ML4 (which also cover the requirements of ML3 and ML2) of the BPMM. This presentation can be considered as a gap analysis, where the results are transformed into process improvement plans that will serve as a roadmap to move from the existing state to the targeted maturity level. Before finalizing the assessment report, it will be shared with the case organization for validation.

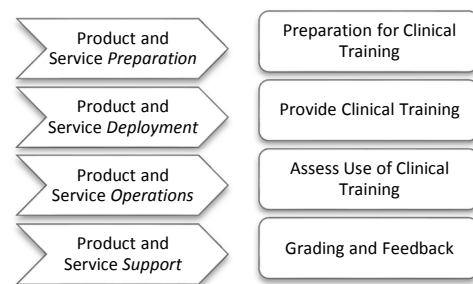


Fig. 2. Generic mapping of the ‘clinical training’ service of the ophthalmology department, to the process areas of domain work performance at ML3.

¹ The mapping was performed in line with the approach proposed in the BPMM guide (Annex-C), with the exception of ‘Product and Service Business Management’ and ‘Product and Service Work Management’

process areas, where the practices of these two process areas were deemed applicable as-is for the case.

IV. CHALLENGES AND OPPORTUNITIES

We faced a number of *challenges* in assessing the maturity of the case organization based on the generic model of OMG's BPMM. These challenges are mainly related to domain-specificity and to the skills and resources required. There was a difference in process areas and related terminology between the healthcare domain and the OMG's BPMM, which required more effort for orientation between the ophthalmology department and the assessors. Healthcare-specific knowledge on the side of the assessor(s) and management-related knowledge on the side of the department would be an advantage. Alternatively, a preliminary phase on mapping of healthcare-specific processes to the BPMM's process areas would be helpful to reduce the orientation effort on both sides.

Mapping of the healthcare-specific processes to the BPMM's process areas was the most challenging yet critical step of the assessment. The OMG's BPMM is originated from engineering domains and is a generic model that provides process areas for product/service development and delivery, and their management. The use of OMG's BPMM in combination with a compatible, domain-specific maturity model is suggested by the BPMM itself [13]. However, since there is no such model in the healthcare domain yet, we tried to map ophthalmology-specific processes to the process areas in the 'Domain Work Performance' thread at ML3.

Due to the challenges stated and to the strong prescriptive properties of the BPMM, the detailed appraisals of the processes with respect to the requirements of the ML4 took more effort than we initially planned for. We spent about 40 hours for detailed appraisal. Although this did not constitute a serious problem in our case, it might be a hindering issue on the side of the staff of the ophthalmology department due to their busy schedule. Moreover, knowledge and expertise on the theory and practice of using the BPMM are demanded on the assessors' side.

Based on and in addition to the challenges discussed above, we see a number of *opportunities* for research and practice on maturity assessment and improvement in the healthcare. First, holding the assessment in accordance to a generic BPMM brought a total quality perspective to the healthcare processes, and created awareness to improve goal-setting practices and feedback loops. Second, it enabled a detailed look into the domain-specific processes in terms of business, process, and people management. Third, the challenges faced during the assessment highlighted the need for a domain-specific maturity model per specialty-basis. We believe that the development of such models, either stand-alone or as an extension to the BPMM, would be beneficial to widen the practice of process assessment and improvement in the healthcare domain.

V. CONCLUSION

The first step to improve the effectiveness and efficiency of business processes is to understand the current state of practices by conducting process assessments. Maturity models have been successfully used in several domains. However, there is a lack of such a model in the healthcare domain. In this study, therefore, we shared our experience in using a generic business process maturity model proposed to assess the maturity of a healthcare institution. Although adapting a generic BPMM had some challenges, it was beneficial in identifying weaknesses and

creating awareness to recognize the weaknesses and improve the current practice. Developing and using a healthcare-specific maturity model might resolve the challenges faced and decrease the effort required for orientation and detailed appraisal.

ACKNOWLEDGMENT

This work was supported by the Scientific Research Council of Turkey (TUBITAK) under 2219 program. The authors acknowledge this support as well as the support of Hacettepe University, Eindhoven University of Technology, and Maastricht University Medical Center as other enabling bodies of the joint research.

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