The Further Education Maturity Model: Development and Implementation of a Maturity Model for the Selection of Further Education Offerings in the Field of IT Management and IT Consulting

Completed Research Paper

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ABSTRACT

The permanently changing information and communication technology (IT) makes it inevitable for IT professionals to keep up-to-date. However, the market for further education presents itself as being diversified and opaque at the same time. Especially for young professionals, the selection of the "right" training offering is difficult. This entails the necessity to develop methods and models to create the further education market in a more comprehensible and transparent way. This article describes the development of the Further Education Maturity Model (FEMM). It enables users to assign IT training offerings to certain maturity levels and consequently to make decisions about the quality of the further education offering. A proven procedure is used to develop the FEMM, implement it into an online tool, and evaluate it. Results show the appropriateness of the proposed model.

Keywords

Maturity Models, Continuing Education, Chief Information Officer, IT Consultant, Software Tool, Design Science

INTRODUCTION

The significance of information and communication technologies (IT) has continuously increased during the last decades. Parallel to the growing diversity and the accelerating development cycles of innovative technologies, the requirements and qualification demands on the employees in the companies grow (Luftman and Derksen, 2012). Hence, qualified employees working in the field of IT management and IT consulting (ITMC) are permanently looking for new opportunities for further education (Boehm, Stolze, Breitschwerdt, Zarvić and Thomas, 2011). This is not a trivial task since the type of skills required to move forward in the career depends on various career paths available in this field (Joseph, Boh, Ang and Slaughter, 2012). In literature, there is a comprehensive discussion on this issue by examination of existing and future skills of ITMC professionals, for example (Boehm, Stolze and Thomas, 2013).

Further education (continuing education) can be understood as the resumption of organized learning after completion of a first period of education and subsequent employment or family business activities. In addition to the first education of professionals and university graduates, the permanent training and further education is daily routine for qualified personnel in the ITMC field (Agarwal and Ferratt, 2002). The aim is to increase competences covering a wide range of fields. Competence describes a person's capacity which does not only consist of knowledge and abilities, but also of other skills, like, e.g., social or methodological competences (Wieringa, van Eck, Steghuis and Proper, 2009).

It is nothing more than waste of funds if the wrong sort of training is done poorly at the wrong time (Berge, 2008). Results are often the questioning of training's effectiveness and subsequently the reduction of financial resources for it. Problems also occur when selecting further educational offerings because the market is very diversified (Boehm et al., 2011). Nevertheless, attending useful training programs for safeguarding power and political situation within the company is especially required for ITMC professionals, like for example the Chief Information Officers (CIO) (Gerow, Grover and Thatcher, 2012).

An adequate means in order to avoid the problem of conducting wrong training is to categorize training offerings in advance in a more transparent manner by means of a maturity model. By doing so, the selection process becomes more transparent and better training results will be visible. A maturity model represents a sequence of maturity levels for a class of objects (Becker, Knackstedt and Pöppelbuß, 2009). It describes an anticipated, requested, or typical development process of formerly selected objects. These objects are pictured in consecutive levels. The smallest level represents an early stage whereas the highest constitutes complete maturity. Although we conducted an extensive literature research, no maturity model helping to find a suitable further education offering could be identified. The following sections therefore describe how the Further Education Maturity Model (FEMM) has been systematically developed, implemented, and evaluated.

METHOD

The methodological basis for the development of the maturity model is a design-oriented approach which encompasses the principles of artifact design and evaluation (Hevner, March, Park and Ram, 2004). In general, the development process of maturity models as artifacts follows the phases of problem definition, construction and evaluation (Marx, Wortmann and Mayer, 2012). On this basis, de Bruin et al. (2005) derived the main steps Scope, Design, Populate, Test, Deploy, and Maintain for the general maturity model development (MMD). This serves as a basis for quite a number of detailed procedure models concerning MMD that can be found in literature. Van Steenbergen et al. (2010) focus on maturity models for functional areas. Marx et al. (2012) use the Rasch algorithm for the development. Based on a comprehensive literature research and analysis of existing procedure models, Knackstedt, Pöppelbuß and Becker (Becker et al., 2009; Knackstedt, Pöppelbuß and Becker, 2009) have designed a universal but detailed procedure model which has already been successfully used for MMD several times (cf. for example Hain, 2010; Herz, Hamel, Uebernickel and Brenner, 2011; Stolze, Rah and Thomas, 2011). For this reason and in view of the fact that the procedure model of Knackstedt, Pöppelbuß and Becker (Becker et al., 2009; Knackstedt et al., 2009) gives detailed and practically feasible instructions – despite its universal validity – the model has been used for the development of FEMM.

According to Knackstedt, Pöppelbuß and Becker, the starting point for the MMD is the problem definition (cf. Figure 1). Here, the addressed area, its sub-discipline and the target group are determined. In the second phase, already existing models are compared to each other. Deficiencies or a lack of transferability are often considered to be the reason for a necessary further development. In the third phase, it is necessary to determine the development strategy. This can take different forms. It is possible to either initiate a completely new construction or to merge several already existing models to one new model. A further possibility is to adapt existing structures to the model that shall be developed.

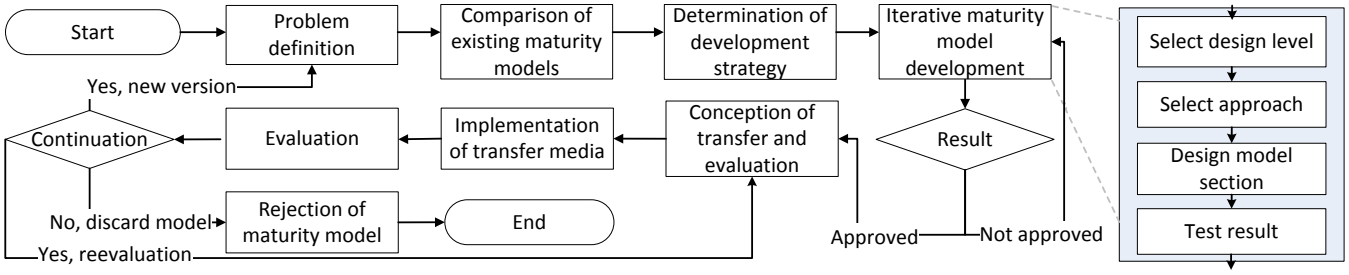

Figure 1. Procedure Model for the Development of Maturity Models (Becker et al., 2009)

The central phase in developing a maturity model is the iterative maturity model development (cf. Figure 1). Here, the following steps are repeatedly run through: selection of design level, selection of approach, design of model section, and test of results. The design level reflects the determination of the maturity model's architecture. Here, methods to be applied can be literature analyses, explorative research methods, or creativity techniques. The results that occurred in the course of construction need to be evaluated with regard to their consistency, their problem adequacy, and their completeness. These partial steps are run through repeatedly until the evaluation shows a positive result.

The central phase is followed by the phase of the conception of transfer and evaluation in which a decision is taken about how the results shall be made available to the target group. This can be realized by means of check lists, manuals, or a software tool. In the following step, the transfer media has to be implemented. This phase serves to place the maturity model at the stakeholders' disposal in the way it had been determined in the previous phase.

In the last phase, the model is evaluated with regard to the question whether it offers the intended benefit and whether it provides a solution of the deficit described in the first phase. This can, for example, be done by offering the model via the internet. This kind of evaluation provides the possibility to decline the model resulting either in a restart of the development phase or in a rejection of the maturity model.

DEVELOPMENT OF THE MATURITY MODEL

Problem definition

The market for further education in the field of ITMC is hardly transparent and there is a wide range of different offers (Boehm et al., 2011). Especially young professionals in the ITMC field are facing difficulties in orientating in view of the numerous offers (Fuschini, 2006). As a consequence, problems may occur in the selection of a suitable further education offering. This issue can be solved by means of a maturity model which gives IT managers, IT consultants, and companies the possibility to distinguish between the different further education offerings and to classify them. By enabling ITMC professionals to do so, the selection of more useful training programs can be ensured.

As no model was found in a comprehensive literature search that shows the described features, the Further Education Maturity Model (FEMM) is developed. It enables ITMC professionals, like for example IT managers or IT consultants, to analyze further education offerings (cf. Figure 2). By means of a criteria catalogue, the content and basic conditions of an offering are collected and weighted. In doing so, the offering can be classified and the maturity level can be read. The achieved maturity level represents the offering's added value in competence that is reached in attending it.

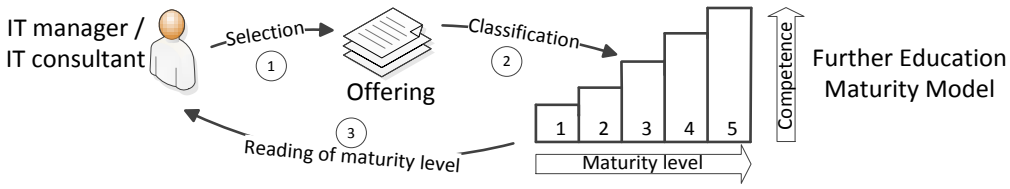

Figure 2. Procedure Model for the Usage of the FEMM

Systematical literature review and comparison of existing models

Before a completely new maturity model can be constructed, it has to be made sure that no similar model exists so far. Furthermore, it has to be checked whether elements of existing models can be taken over. For this purpose, a literature review following Webster and Watson (2002) has been executed. By means of the databases *JSTOR, EconBiz, EconLit EBSCO Host* and *Springer Link* journals and conference proceedings have been searched using combinations of the following keywords: *maturity model, education, further education,* and *continuing education.* In order to extend the search for suitable models, Google and Google Scholar also have been used applying the same keywords. After identifying relevant sources, the literature was scanned for further relevant sources by means of the so-called reverse search. The subsequent selection of sources has been viewed and independently examined by the authors in terms of their relevance.

In literature, many different maturity models can be found. Mettler and Rohner (2009) identified 138 models in 2008. However, there is none among these which categorizes further education offerings.

A well-known maturity model is the Capability Maturity Model (CMM). The American Department of Defense authorized the Software Engineering Institute (SEI) of the Carnegie Mellon University in Pittsburgh to develop a model which can assess software suppliers. After the development of the Software Process Maturity Framework, the CMM emerged in the following years as advancement (Kneuper, 2006). The CMM has had a significant influence on the software development (Herbsleb, Zubrow, Goldenson, Hayes and Paulk, 1997). It distinguishes the five consecutive levels Initial, Repeatable, Defined and Managed which serve to reflect the maturity level of the software development processes. Each level contains process objectives and guidelines through which the next higher level can be reached. However, this model is not suitable for the categorization of further education offerings because it concentrates on another field. Nevertheless, the design of the model – like in case of many other maturity models (such as Business Process Maturity Model, Knowledge Management Maturity Model or Information Technology Infrastructure Library) – can be taken over.

In literature, only two maturity models can be found which bear an even vague reference to the field of further education. The People Capability Maturity Model (P-CMM) (Curtis, Hefley and Miller, 2009) serves for the process improvement of the administration and further education of employees. Like the CMM, this model was developed by the SEI and aims at giving organizations clues about the in-house human resources in the software development process. The E-learning Maturity Model (eMM) (Marshall and Mitchell, 2002) was developed for measuring the development, the introduction, and the use of e-learning at universities. It is a maturity model based on the CMM and SPICE (Software Process Improvement and Capability Determination). Both models are not suitable for our research objective as both cover other areas.

Determination of development strategy

The maturity models known in the relevant literature cannot be used in the context of this research. For this reason, a new construction is required. Initially, it has to be determined which content and basic conditions of the further education offerings shall be applied for the calculation of the maturity levels. In doing so, different further education offerings have to be systematically analyzed, documented, and summarized.

Next, the respective weights for content and basic conditions need to be calculated. In our case, we decided to derive these weights quantitatively using a questionnaire. This method offers the possibility to reach a broad range of persons who can answer the questions independently (Bryman and Bell, 2007). This way of data collection is relatively cost-effective and practicable. The most important aspect in the construction is an exact formulation of questions. Before dispatch of the questionnaire, therefore a pre-test has to be run through in order to eliminate weaknesses or uncertainties. At the end of the survey, a rating scheme based on the results is developed.

Iterative maturity model development

So far, two iterations of FEMM development have been gone through (cf. Figure 1). In its initial version, the model consisted of three maturity levels which had been derived from the literature. After evaluation we recognized that following the five-level-structure from models like CMM would be more advantageous also for FEMM. Although the range of ITMC training offerings is much diversified, these five levels are still usable. The maturity levels determined in the second iteration are: Basic course (Amateur), constitutive course (Constitutive), advanced course (Advanced), professional course (Professional) and expert course (Expert). A more detailed description of each maturity level is effected in the next section. However, it cannot be executed without an analysis of the questionnaire.

In order to set up the questionnaire, it is necessary to get an overview about the topics that are taught in the further education offerings. For this purpose, a structured literature research following Webster and Watson (2002) has been conducted again. In doing so, the search in the above-mentioned databases comprised combinations of the following terms: *IT, further education, continuing education,* and *training*.

The literature search identified four core content blocks for further education offerings in the field of ITMC. These blocks are hardware (e.g. telecommunication, computer environment, or IT security), software (e.g. business application systems, programming, graphics, or construction and visualization programs), soft skills (e.g. management techniques, legal aspects, or rhetoric) and business skills (e.g. project management, process management, or IT basic knowledge). Another (content) block comprises the basic conditions of a further education offering (e.g. provider, duration, type of degree, or type of examination). Each of these blocks represents a summary of various main topics. The basic conditions do not directly refer to the taught issues. They can rather be considered as secondary features of a further education offering.

The questionnaire embraces 18 questions, which refer to the five blocks, and was pre-tested with a group of persons consisting of both scientists and practitioners. From 2012-01-27 until 2012-04-14 the questionnaire was presented to a selected circle of IT managers, CIOs, IT consultants, and scientists. All participants are proven experts in their respective fields. After this period, the questionnaire came back having been completely answered by 34 persons; this corresponds to a response rate of 15.7 %. Among the respondents were 30 male (88.2 %) and 4 female persons (11.8 %). The average age was 36.2 years. With respect to their actual jobs, it turned out that most participants of the interview were professional IT consultants (35.3 %).

The questionnaire has been analyzed using statistical tools of arithmetical mean, mode, median, and standard deviation. The derived values have been used to set the scoring values of the FEMM.

THE FURTHER EDUCATION MATURITY MODEL (FEMM)

Description of the model

The FEMM consists of five maturity levels. These are described in Figure 3.

Maturity level	Description
Basic course (Amateur)	The basic course is characterized by a rather narrow content framework. Only few hardware and software topics are worked on. In addition, the offering hardly furnishes soft skills or business skills. The content of the IT further education offerings only have little reference to the educational area of IT managers or consultants. The basic conditions do not have a high quality standard.
Constitutive course (Constitutive)	The maturity level 2 - constitutive course (Constitutive) - is characterized by a higher extent of taught content. Soft skills and business skills are conveyed only to a certain extent. A relation to the profession of the IT manager or IT consultant is recognizable. However, the quality of the basic conditions is small.
Advanced course (Advanced)	The maturity level 3 - advanced course (Advanced) - is characterized by a higher extent of taught topics. Both soft skills and business skills are part of the course. A relation to the profession of the IT manager or IT consultant is recognizable. The quality of the basic conditions is high.
Professional course (Professional)	The maturity level 4 - professional course (Professional) - is characterized by a high extent of professionally relevant topics. Both soft skills and business skills are part of the course. The basic conditions of the further education offering are of high quality.
Expert course (Expert)	The maturity level 5 - expert course (Expert) - is the highest level in this model. Its basic characteristic features are numerous professionally relevant issues. Furthermore, it furnishes not only hardware and software topics, but also soft skills and business skills. The quality of the basic conditions is superior which results in a high-quality teaching.

Figure 3. Maturity Levels of the FEMM

A further education offering has to achieve a predefined number of scores in order to reach a certain level. The possible scores range from 0-20 points for maturity level 1 (Amateur), 21-40 points for level 2 (Constitutive), 41-60 points for level 3 (Advanced), 61-80 points for level 4 (Professional) up to more than 80 points for level 5 (Expert). For example, a further education course which reaches a total score of 27 points after addition of all points is assigned to maturity level 2 (Constitutive).

The foundation for this scoring scheme is the statistical analysis of the questionnaire. In each block, respective ratios have been calculated for each topic. The final rule for the calculation of points was developed by repeated iterations:

$$\mathrm{ATS} = \left(\left(\sum_{i=1}^{n} \mathrm{GP_{HS}} + \sum_{i=1}^{n} \mathrm{BP_{HS}}\right)\mathrm{GF_{HS}}\right)\mathrm{Q}) + \left(\frac{\sum_{i=1}^{n} \mathrm{BP_{SK}} \cdot \mathrm{GF_{SK}} + \sum_{i=1}^{n} \mathrm{BP_{BK}} \cdot \mathrm{GF_{BK}}}{2}\right) + \sum_{i=1}^{n} BC$$

whereas:

ATS = Achieved total score serving to classify the offering into the maturity model
HS = Hardware or software issues
SK = Soft skills
BK = Business skills
BC = Basic conditions
GP = Basic points
n = Selected topics in total
BP = Bonus points
GF = General factor
Q = Factor for the number of taught hardware and software topics

$$\mathrm{Q} = \begin{cases} 0.75 \text{ for number of selected } |\mathrm{HS}| > 5 \\ 1 \text{ for number of selected } |\mathrm{HS}| \leq 5 \end{cases}$$

When weighting the scores, the blocks hardware and software are assigned to a basic score (GP) of 3 for each selected topic/subject. This value is taken as a basis as hardware and software are core topics of a further education offering in the field of ITMC. In addition to the basic points, a certain number of bonus points can be achieved. These bonus points result from the fact that a participant who already has comprehensive knowledge of certain hardware or software topics would choose an offering which suits his personal knowledge level. In addition to the already reached score, each subject gets further enhancement which depends on the professional interest gathered from the questionnaire. This revaluation is carried out as these are focal points which reflect a present or future relevance – due to their actual profession – for the target group of the IT manager or IT consultant. For the calculation, the sum of basic and bonus points is multiplied by a factor which – based on the relative response frequency – results from the questionnaire. As an example, a topic is multiplied by the factor 1.2 in case the relative importance is between 0 % and 20 %. If the relative value is between 80 % and 100 %, the factor is 2.

Every participant of the survey agreed that practical contents support the quality of the further education offering which proves the significance of these contents. Thus, each offering that evidences such contents obtains 10 bonus points. Furthermore, the interviewees agreed to the view that the quality of an offering decreases in the way the number of taught content increases. Therefore, starting with a number of topics higher than 5, the total score achieved with the blocks hardware and software is multiplied by the factor Q = 0.75.

The award of points within the soft skill block follows the ranking which refers to the relative importance resulting from the survey. Thus, management techniques, for example, obtain the highest score (5 bonus points) and IT ethics 2 bonus points. As most of the interviewed persons (67.5 %) think that soft skill contents are important, each soft skill matter is multiplied by the factor 2.4. The respondents consider soft skill contents to be important, however, they would prefer if they were part of a separate offering. Based on this response, the product of soft skill contents is divided by 2.

The calculation scheme for the business skills is similar to the soft skills. The bonus points for each content block are determined via ranking. This ranking results from the relative frequency of answers in the questionnaire. Thus, the topic project management is, for example, credited with 6 bonus points. Since the interviewees – like in case of the soft skills – again preferred the business skills to be part of a separate offering, the product of basic points and the factor is divided by 2.

The basic conditions also have influence on the calculation. Based on the results of the questionnaire, a ranking showing the quality of executing organizations had been generated. If the training is, for example, organized by a private provider of further education, the training obtains 5 bonus points. In case of an e-learning provider, one bonus point is assigned. Factors like the duration of the further education offering, the kind of degree, structure, organization as well as lecturer also have influence on the calculation of points for the basic conditions.

Conception of transfer and evaluation

The conception of transfer and evaluation is realized by this article and an online tool which make the FEMM available to the general public. A concept for this tool has been developed and realized.

Implementation of transfer media

The online tool has been developed on the basis of the script language PHP. It is freely accessible for any user via the URL http://www.imwi.uos.de/femm/. The home page starts with an explanation of the tool for the user (cf. Figure 2). Moreover, the user gets the chance to get into contact with the authors in case there are questions. Upon starting the tool, the user first has to answer a number of questions concerning the respective further education offering which needs to be classified. After the user has filled in all fields and clicked the analyze button, the values are delivered via the `POST`-method. Subsequently, the values are reviewed by means of several `for`-loops (cf. Figure 4). In doing so, an initial point value of zero is increased by the respective point value of the variable `$question`. Finally, the user receives the result with a detailed explanation.

```
$points=0;
$mistake_z=0;
$mistake_radio=array();
$answers_check=0;
$answers_factor=0.75;

if(isset($_POST["check"])){

for($t=1;$t<=$t_z;$t++){
$ti_z=count($topic_t[$t]);
if($ti_z>0){
for($ti=1;$ti<=$ti_z;$ti++){
if(isset($_POST["q".$t."-".$ti])){

if(is_array($_POST["q".$t."-".$ti])){

foreach($_POST["q".$t."-".$ti] AS $qp){
  $qp--;

$points+=$question[$t][$ti][$qp]["p"];

if($ti==1 AND $t==1){
  $answers_check++;
}}

if($ti==1 AND $t==1 AND $answers_check>5){
  //If greater than 5, then reduce
  $points*=$answers_factor;
}}
else{
  $points+=$question[$t][$ti][($_POST[
  "q".$t."-".$ti]-1)]["p"];
}

}
elseif($t==2 AND (!isset($_POST["q".$t."-
".$ti]) OR $_POST["q".$t."-".$ti]==0)){
  $mistake_radio[$ti]=1;
}}}}
```

Figure 4. Evaluation of the selected content

EVALUATION

Two ITMC offerings are categorized by means of the tool. Afterwards, the offerings were analyzed by the authors and compared to the results from the online tool.

The first offering is a further education training which is offered by a major university. Among others, topics like cloud computing, business application systems (hardware and software block), management techniques (soft skills) as well as process management (business skills) are taught. It is a weekly offering running over a total time period of 2 months. The lecturers are solely experts with practical experience. The attended offerings are supported by means of an online platform. A final examination is not offered. Only a certificate of attendance is issued. Figure 5 shows the input of parameters for the content key topics.

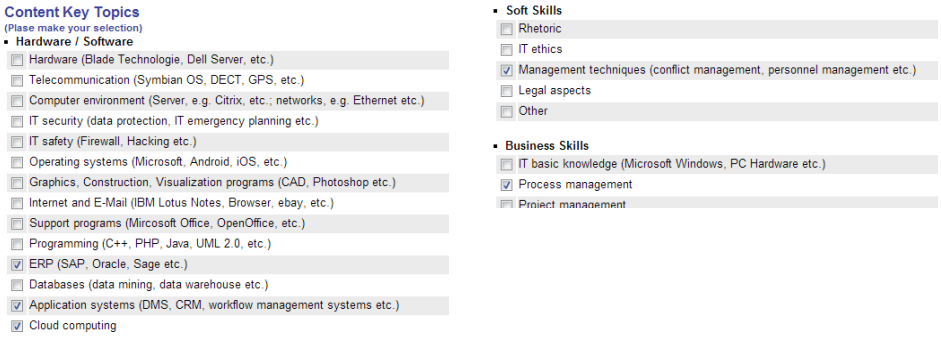

Figure 5. Input of parameters for the content key topics

By entering the parameters and the resulting calculation of the maturity level, the maturity level of 4 (Professional) is the result. This level is characterized by a wide range of professionally relevant topics. In addition, soft skills and business skills are taught. The basic conditions of the offering also show high quality (cf. Figure 6).

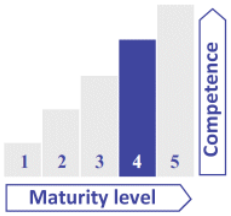

Figure 6. Maturity level of the first further education offering

In the second example, a course offered by a private further education provider was subject of the investigation. Here, the content key topic is IT security. Soft skills and business skills are not part of the course. The course takes 1-3 days; it is a pure presence offering. Contrary to the first further education offering, no practical subjects are taught. However, the course ends with a certificate. Like in case of the first examined offering, parameters are entered into the online tool as well. The evaluation shows that this offering reaches the maturity level 2 (Constitutive). This level is characterized by a higher extent of taught contents. In particular cases, soft and business skills are also part of the course. A relation to the job description of IT managers or IT consultants is recognizable. Nevertheless, the quality of the basic conditions is low.

In the manual analysis, all information has to be summarized to one maturity level by hand. However, this is hardly possible without the support of a tool. This is precisely where the online tool developed in this paper comes into play; it supports the user by assigning a certain offer (or course) to the above-mentioned scale of maturity levels. This enables the user in a simple way to evaluate the offer and to compare it with others. Thus, the evaluation shows that the maturity model and the resulting online tool solve the problem of comparing different offers for further education.

CONCLUSION, LIMITATIONS, AND OUTLOOK

In this paper, a maturity model for further education offerings in the field of ITMC has been developed and implemented. The viability of maturity models and their development has been explained. The procedure model of Knackstedt, Pöppelbuß und Becker (Becker et al., 2009; Knackstedt et al., 2009) was used for constructing it. The FEMM had been implemented in an online tool which all users can access at any time and free of charge. By means of this maturity model, people now can select specific further education offerings which offer them a real added value in term of their profession.

The FEMM represents an added value for every IT manager and IT consultant and makes the saving potentials visible for companies. The target group is given a certain transparency which does not exist on the opaque market of ITMC offerings. They get the opportunity to compare these offerings and thus to differentiate them from each other. Manually, this would hardly be possible. A further advantage is that the categorization of the target group also entails a more simple selection of the further education offering. By simplifying the selection, false investments and costs that may occur when choosing the wrong further education offering can be avoided. The most important advantage of the FEMM is that interested persons can undergo trainings in a more specific way. This means a higher gain in competence than without the model.

The benefit for the theory is also clearly visible. The process model has been validated and applied by the MMD. In addition, a new artifact is made available to the science community. The development of the model has been scientifically derived and documented in the context of this paper. Based on this article, further models can be developed which, for example, concentrate on other target groups. A rigorousness concerning the scientific and practical relevance is provable.

The development of the FEMM also has limitations. Individual value judgments of the persons filling in the questionnaires have influence on the design process. Furthermore, it is necessary to evaluate the model again within a determined time period. Since the IT sector is very fast moving, the requirements of the participants change.

In future, a permanent further development of the FEMM is necessary. Above all, process aims and operating instructions shall be defined by means of which the next higher level can be reached. The possibility to depose personal preferences when calculating the maturity levels is intended as well. Nevertheless, the maturity model today already provides a feasible support in selecting further education offerings.

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