

A Method to Construct Dynamic, Adaptable Maturity Models for Digital Transformation

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Abstract: Maturity models are a well-established method to assess and improve Digital Transformation processes in organizations. However, many models lack theoretical foundations and specificity for a branch or sector. The Dynamic Adaptable Maturity Model development method (DA3M) provides the steps to develop scientifically sound, specific and relevant maturity models to be used to improve organizational performance. The method was successfully validated in different branches – in this paper, the method is used to develop a maturity model with a focus on human aspects and to create an adaptation for Higher Education Institutions.

1 INTRODUCTION

Digital Transformation (DT) is crucial in the age of digitalization with emerging trends like Artificial Intelligence (AI), as it enables organizations to leverage advanced technologies to enhance efficiency, innovation, and customer experience. However, organizations face several challenges in this process. One significant challenge is the integration of emerging technologies which can be complex and resource-intensive (Vial, 2019). Measuring the success of digital transformation efforts can be challenging, making it difficult to justify the expenditure (Kane et al., 2015). For this purpose, maturity models are an important and well-established method to assess the status of digital transformation in organizations by providing a structured framework to evaluate current capabilities and identify areas for growth (Thordsen & Bick, 2023). These models help organizations to measure their digital maturity, in some cases compared to industry standards (Proença & Borbinha, 2016). Some models also offer a roadmap for digital transformation, guiding organizations through various stages of development (Berghaus & Back, 2016). By identifying gaps in digital capabilities, maturity models enable organizations to prioritize investments and allocate resources effectively (Chanias & Hess, 2016). Furthermore, they assist in aligning digital transformation initiatives with strategic business goals, ensuring coherence and focus (Matt, Hess, & Benlian, 2015). Maturity models

also promote continuous improvement by providing metrics to measure progress and success (Westerman, Bonnet, & McAfee, 2014). Additionally, they help in managing change by fostering a culture of innovation and adaptability (Kane et al., 2017). Finally, maturity models support risk management by identifying potential challenges and mitigating risks associated with digital transformation (Vial, 2019). However, maturity models are often criticized – Thordsen & Bick (2023) identify main challenges and problems of maturity models, amongst them the lack of empirical validations, neglecting the dynamic nature of digital transformation maturity and the complexity of integration into organizations' operations.

Based on these challenges, it is the aim to develop a method to construct maturity models which are 1) theoretically sound, 2) based on empirical evidence, 3) adaptable to specific domains, and 4) dynamic to emerging trends. The starting point is an analysis of a variety of maturity models to identify their theoretical foundation and construction method. Based on this analysis, a new method for maturity model construction was developed and applied it in different scenarios.

2 BACKGROUND: DEVELOPING MATURITY MODELS

As a starting point, I have examined frameworks that enable organizations to assess their current status in the digital transformation process. The focus is the

use of maturity models (Wagner et al., 2023; Heinpensel et al., 2023) which aim to enhance organizational performance (Thordsen & Bick, 2023).

Numerous maturity models have been scientifically developed and evaluated (Aras & Büyükožkan, 2023; Ochoa-Urrego & Peña-Reyes, 2021, Proenca & Borbinha, 2016, Santos-Neto & Costa, 2023). These models vary in terms of abstraction level, methodology, and scope (Williams et al., 2019). The scope of models can be generic such as the capability maturity model for digital transformation (Gökalp & Martinez, 2022), other models focus on specific industries such as the IT industry (Gollhardt et al, 2020, Proenca & Borbinha, 2016). Further models focus just on specific aspects of DT such as strategy, value creation, structural changes, barriers (Vial, 2019) or focuses like participation and inclusion (Pawlowski et al, 2025). All these models vary in terms of abstraction level, methodology, and scope (Williams et al., 2019). Pöppelbuss et al (2011) have analyzed the theoretical foundation of maturity models in the Information Systems domain, finding that about half of the models have a focus on conceptual work, in contrast to empirical evidence. Also, there is not well-established method for constructing maturity models. Several review (Pereira & Serrano, 2020, Wendler, 2012) identified a broad variety of methods with a focus on (systematic) literature reviews but also constructive methods like Design Science Research including experts in the field. Very few methods are based on community recognition and empirical evidence (Pereira & Serrano, 2020). Finally, the evaluation methods of maturity models include a wide variety of methods (Helgesson et al, 2012) such as qualitative expert interviews (Salah et al, 2014), case studies and surveys (Wendler, 2012).

Based on the methodological weaknesses, several meta-methods for maturity model development have been developed (Lasrado et al, 2016) defining the generic steps of model development starting with scope/ problem definition to evaluation and improvement of the model.

As a summary, it can be stated that an enormous number of maturity models for digital transformation exist. However, the successful use of these model is not ensured due to a lack of theoretical foundation and methodological weaknesses. Therefore, it is necessary to develop a methodology for model development including adaptation and continuous improvement.

3 THE DYMANIC, ADAPTABLE MATURITY MODEL METHOD (DA3M)

In the following, I will describe the main steps of the method construction leading to the Dynamic Adaptable Maturity Model Method (DA3M). As a kernel theory, I use the (lifecycle) process theory (Hernes, 2014, van de Ven & Poole, 1995). In general, process theory is a framework that explains how entities change and develop over time. The theory explains that change follows a predetermined sequence of stages, in this case in a lifecycle. This corresponds to the main idea of maturity models, understanding and initiating change in organizations. A maturity model is used as part of this change process to assess the current situation and initiate change, in this case towards digital transformation.

The research methodology to construct the method used Action Design Research (Sein et al, 2011) as a research method. Action Design Research (ADR) is a methodology that it is used for creating artefacts to solve complex organizational problems in a scientific, rigorous way. Additionally, ADR is used as part of and as a guiding structure for the DA3M method, so that the model construction phases are also aligned to a well-established research method. The phases of ADR are as follows: 1) Problem Formulation: (Identifying and understanding the problem context), 2) Building, Intervention, and Evaluation (Developing, implementing and evaluating the design artefact), 3) Reflection and Learning (Analyzing the outcomes of the BIE phase), 4) Formalization of Learning (Documenting and disseminating the findings and contributions of the research).

ADR is in this case used to construct the maturity model development method as the main artefact. Secondly, it is used in the development process to assure that specific maturity models are developed in a rigorous way.

As a second step, principles were defined for the maturity model development method based on the weaknesses and challenges shown in the analysis above.

- **Principle 1 Theoretical Foundation:** A maturity model should have a theoretical foundation. Process theory can be used as a generic basis, however, in other context / focus area other theories might be more appropriate.
- **Principle 2 Evidence base:** A maturity model (and its contents) should be based on scientific, empirical evidence
- **Principle 3 Adaptability:** A model should take

Table 1: Main phases of DA3M.

ADR Phase	DA3M Phase	Explanation / Activities
Problem Formulation	P1.1 Problem and Scope Definition	Defining the research problem and scope Determining theoretical foundation Defining a model development project
	P1.2 Comparison of existing models	Defining comparison criteria Comparing relevant existing models Proposing classes and factors
Building Intervention, Evaluation	P2.1 Model development	Select initial factors Analyze trends Analyze domain Identify additional factors Provide evidence for factors Collect interventions
	P2.2 Model implementation	Use model
	P2.3 Model evaluation	Evaluate model / factors Suggest improvements
Reflection and Learning	P3.1 Model transfer	Adapt model Use model in different domains
	P3.2 Impact evaluation	Evaluate impact in different domains
Formalization of Learning	P4.1 Model dissemination	Communicate and disseminate model
	P4.2 Model evolution	Continuously improve model

the specific needs, requirements of a sector, branch or focus issue into account.

- **Principle 4 Dynamic model evolution:** New trends and technologies emerge in shorter periods. A model should be updated and improved regularly.
- **Principle 5 Practical guidance:** A maturity model should not solely assess the current status but also provide guidance on potential interventions to initiate changes.

The method is based on the methods of Becker et al (2009) and Thordsen & Bick (2020). The following table summarizes the main steps.

The initial phase in developing a maturity model involves a comprehensive **problem and scope definition**. This phase begins with clearly defining the research problem and the scope of the study – this includes the description on strategic objectives (e.g. improving competitiveness, improving employee competences and motivation), the branch / sector (e.g. IT industry, building and construction industry) as well as potential focus topics (e.g. integration of AI techniques and tools). It is essential to establish a solid theoretical foundation (e.g. process theory) that will guide the development of the model. Additionally, this phase includes outlining a detailed project plan for the model's development, ensuring that all necessary steps and resources are identified and allocated. This also includes the involvement of stakeholders and experts for the model development. Following the problem and scope definition, the next phase involves a systematic comparison of existing

maturity models. This phase starts with defining the criteria for comparison, which may include factors such as the models' applicability for the above selected sector, comprehensiveness, and theoretical and methodological underpinnings. Relevant existing models are then compared based on these criteria. The outcome of this comparison is the proposal of classes (e.g. strategy, processes, competences (Pawlowski et al. 2025) and factors that will form the basis of the new maturity model. This structured approach ensures that the new model is built on a thorough understanding of existing frameworks.

The second phase in developing a maturity model focuses on **model development, implementation, and evaluation**: The Model Development phase begins with the selection of initial factors that will form the foundation of the maturity model. To incorporate current developments, it is necessary to analyze current trends for certain technology developments (e.g. use of AI data analysis tools) and for the specific domain (e.g. organizational and technological innovations). It is essential evidence is provided for each factor to be included in the model (e.g. the use of AI-based coding tools improves the productivity of a programmer). Only factors including this evidence should be incorporated in the model. It is also recommended to collect potential interventions ("how to improve the maturity level of a certain factor?"), as it helps in understanding the practical applications and impacts of the model. Last but not least, the different levels need to be described. Here it should be decided if maturity levels are

defined generically (e.g. using a Likert scale from 1 = no activities to 5 = continuously improved) or specifically (one statement per factor and maturity level). It also needs to be decided how to include weights for specific factors as well as rating mechanisms. These activities form the initial version of the maturity model.

Then the **Model Implementation** follows. The (adapted) model it is implemented within an organizational context. This involves using the model to assess the current maturity level and identify areas for improvement. The implementation phase is critical for testing the model's applicability and effectiveness in real-world scenarios. This phase is accompanied by the Model Evaluation. This phase involves the evaluation of the overall model and its factors (e.g. using expert interviews, or a Delphi study). This includes assessing the model's quality (e.g. understandability, comprehensiveness, applicability), identifying any shortcomings, and suggesting improvements. The evaluation phase ensures that the model is continuously refined and updated based on feedback and empirical evidence, enhancing its reliability and utility. The second phase can be repeated multiple times – the phases defined ensure a systematic approach to developing, implementing, evaluating and improving a maturity model.

The third phase in developing a maturity model involves **model transfer and impact evaluation**. The Model Transfer focuses on adapting the maturity model to different contexts and domains. It involves modifying the model to ensure its relevance and applicability across various organizational settings. The adapted model is then used in these different domains to assess their maturity levels and identify areas for improvement. This step is crucial for testing the model's versatility and ensuring it can be effectively applied in diverse environments. Following the transfer, the impact of the model is evaluated in the different domains where it has been implemented. This involves assessing the outcomes and benefits of using the model, such as improvements in organizational processes, performance, and overall maturity. The evaluation helps in understanding the model's effectiveness and provides insights into any further adaptations or refinements needed to enhance its impact. These phases ensure that the maturity model is not only versatile and adaptable but also effective in driving improvements across various organizational contexts.

The fourth phase in developing a maturity model involves **model dissemination and continuous improvement**. The Model Dissemination focuses on

communicating and disseminating the maturity model to the target audience such as academic experts and professionals. It involves publishing the model in academic journals or at conferences, and sharing it through various professional networks. The goal is to ensure that the model reaches a wide audience, including researchers, practitioners, and organizations as well as receiving further feedback and stimulating the academic discourse.

As organizational and technological advancements occur in shorter and shorter cycles, it is necessary to update the model regularly to assure a Model Evolution: This involves regularly updating and refining the model based on feedback from its users and new developments in the field. Continuous improvement ensures that the model remains relevant and up to in addressing the evolving needs of organizations. It also involves monitoring the model's performance and making necessary adjustments.

As a summary, DA3M defines the main phases of maturity model development, leading to theoretically sound, evidence-based, adapted models as a basis for assessing and improving digital transformation in organizations.

4 CASE STUDY: USING DA3M

In this section, the use of the DA3M for the development of the Co-Digitalization Maturity Model (Pawlowski et al, 2025) and the first adaptation which was done for the Higher Education context is outlined. The method was used to design 1) a participatory maturity model which focuses on human aspects (such as motivation, competencies, participation) in digital transformation processes and 2) adaptations for different branches including the specific needs and characteristics of a branch (here: Higher Education Institutions).

In a first step (P1.1), the focus of the initial model is set. Based on the initial analysis, it was clear that most maturity models in Digital Transformation focus on technological and neglect human aspects. Therefore, the research scope was defined to incorporate and focus on human aspects into maturity models. As the theoretical foundation, three theories are used for guidance: for the change aspect, the model is based on Process Theory (Hernes, 2014), for the human aspects, Self Determination Theory (Deci et al, 2017) and the Competence-Based View of the Firm (Freiling, 2004) is used to explain the role of employees in organizations. Finally, an iterative approach according to Action Design Research (Sein et al, 2011) is applied to build, use and improve the

model. To validate the model, multiple case studies (Yin, 2017) were run in different sectors and domains. In this paper, one case is used to show the applicability and usage of the model.

The second step (P1.2) started with an initial comparison of existing models to identify potential factors. These included general factors for DT but a focus was put on identification of human factors (e.g. how are employees trained for new DT competencies). By this, a first classification and initial set of factors was determined.

The following table summarizes the main steps and outcomes of the first phase. It also became clear that most models do not include the focus of the maturity model, the human aspects.

The second phase started with the extension of the initial model with a focus on 1) human aspects and 2) technological trends which are not included in current maturity models. Sample human aspects identified and included were openness, participation, and digital competencies. Additionally, technological trends were identified and included such as autonomous

processes, data-based decision making, and artificial Intelligence.

As a third step, specific aspects for the first adaptation of the model (Higher Education) were identified. Three types of adaptation were made:

- Additional factors: Factors which are not part of the generic model as they are only relevant for a specific branch / sector. Examples for Higher Education are specific capabilities such as pedagogical capabilities or student services.
- Modified / more specific factors: Some generic factors need to be described in a more specific way. As an example, the generic model includes a factor on how processes are automated. In the Higher Education context, it should be distinguished how learning/research and administrative processes are technology-supported.
- Irrelevant factors: In the adaptation, some factors might not be relevant. As an example, the factor of “use of robotics for automation” is not relevant for HEIs.

Table 2: Applying DA3M to develop a human-oriented maturity model: Phase 1.

DA3M Phase	Explanation / Activities	Outcomes
P1.1 Problem and Scope Definition	Defining the research problem and scope	Development of a comprehensive DT maturity model Focus on human aspects Adaptation for Higher Education Institutions
	Determining theoretical foundation	Process theory (Hernes, 2014) Self determination theory (Deci et al, 2017) Competence-Based View of the Firm (Freiling, 2004)
	Defining a model development project	Defining multiple case studies in different branches (e.g. Higher Education, social welfare, IT, craft sector, construction) Defining stakeholders and roles for model usage and evaluation
P1.2 Comparison of existing models	Defining comparison criteria	Focus on theoretical foundation and methodology Practical relevance
	Comparing relevant existing models	Selection of eight scientific and four practice models
	Proposing classes and factors	Initial classification Selection of most common factors
	Suggest improvements	Inclusion of more specific human factors

Table 3: Applying DA3M to develop a human-oriented maturity model: Phase 2.

P2.1 Model development	Select initial factors	Selection of most common factors
	Analyze trends	Analysis of human aspects of DT Analysis of emerging technologies
	Analyze domain	Analysis of trends in Higher Education (first case study)
	Identify additional factors	Deriving potential factors for inclusion
	Provide evidence for factors	Analysis of evidence for each factor
	Collect interventions	Proposing interventions for each factor
P2.2 Model implementation	Use model	Model usage in different sectors
P2.3 Model evaluation	Evaluate model/ factors	Expert interviews with 5-10 experts (academics and company representatives) per case study Model improvement (refinement of descriptions, exclusion of redundant and unnecessary factors)

Each factor was also validated analytically – so for each factor, it was checked whether there is empirical evidence that the factor has a positive influence on organizations' performance.

The model created was then used, evaluated in three cycles (Pawlowski et al, 2025) The following table shows the steps and outcomes of the second phase.

The third phase contains the usage of the (finalized) model. Here, the (long-term) impact should also be analyzed. Last but not least, the models need to be updated regularly to include emerging trends and technologies.

5 EVALUATION RESULTS

After the model development and adaptation for Higher Education, the model was applied in Higher Education institutions. 41 respondents replied when applying and validating the model (23 female, 18 male). Of the participant, 68% came from a university, 32% of universities of applied sciences. 76% were professors or lecturers, 24% administrative staff. By this participation, a very comprehensive view of perspectives was ensured. The evaluation focused on three key criteria based on the evaluation method by Salah et al (2014):

- **Factor Importance:** Feedback on how important a factor is for the university.

Importance (Organization)
Number of respondents: 41

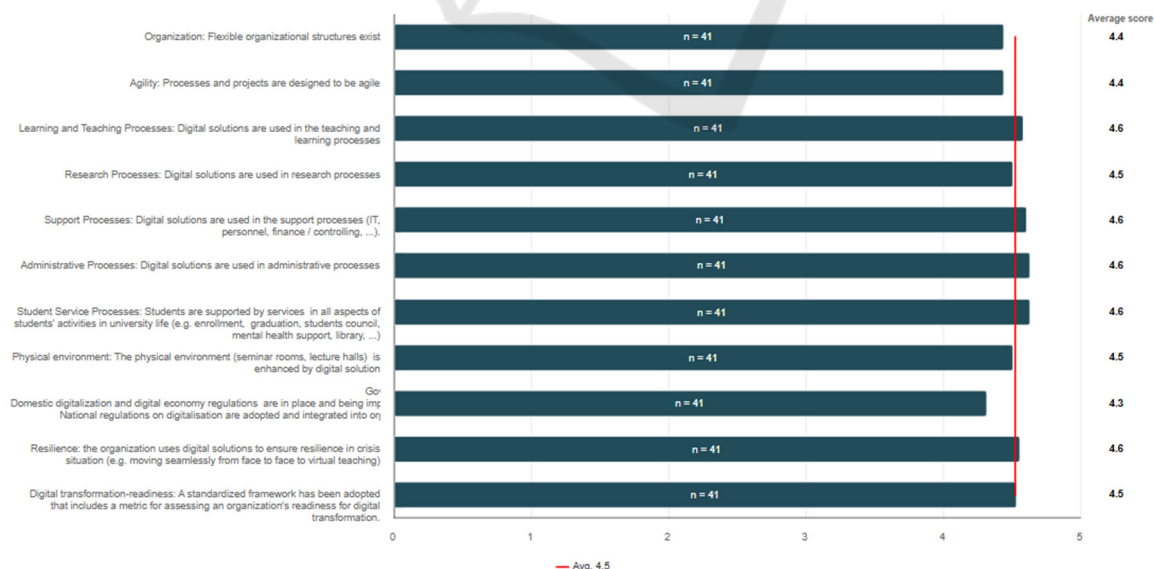


Figure 1: Sample results (factor importance) on the category “Processes”.

- **Adaptability:** Were the adapted factors (from the generic towards the Higher Education model) seen as important?
- **Understandability:** Are the model descriptions understandable?
- **Usefulness:** Are the results of the assessment useful to improve the digital transformation of a university.

The main focus of the evaluation was on the factor importance as this is the crucial aspect for maturity models: to identify key aspects of Digital Transformation. Each factor in the maturity model was used to assess the status of an institution in terms of maturity and importance (on a Likert scale between “1 not important at all” and “5 very important”). By this ranking, we can determine whether factors identified using the DA3M method were relevant to the participants. We combined this quantitative assessment with open questions regarding understandability and usefulness of the model.

Overall, the constructed maturity model consisted of 77 factors in nine categories. In comparison to the base maturity model (Pawlowski et al, 2025), 18 factors were modified and adapted (e.g. specific processes for Higher Education), 6 factors were dropped (e.g. robotics). No factor received a lower average importance than 3. More than 50% of the factors had an average greater than 4. This means that the factors have generally a strong relevance in the opinion of the participants.

As a second step, the results of the modified factors were analysed as this adaptation is one of the main feature of DA3M. All 18 factors which were modified and specifically adapted for the Higher Education context received an average importance greater than 4. This means that the method has clearly identified factors with a very high relevance for the context of Higher Education.

One example of factors importance is shown in the following figure. In the category “Processes” most of the factors were adapted for the Higher Education context (e.g. specific processes for research or student service).

Regarding understandability, most users found the statements of the model were very clear. Regarding usefulness, we received only positive comments although just half of the respondents replied to this question. However, one user stated “the survey is excellent elaborated, it will be very helpful for organizations to drafting the digitalisation strategy and implementation”. As a negative aspect, it was mentioned that – even though the status assessment was accurate – there were no recommendations how to improve certain factors. This can be seen as the next research step, not solely focusing on status assessment but focusing on improvements.

Overall, the validated aspects of DA3M lead to the conclusion that especially the adaption of maturity models is clearly successful.

6 DISCUSSION

I have described a methodology for developing and adapting maturity models for digital transformation. The model is based on the methods of Becker et al (2009) and Thordsen & Bick (2020) and addresses weaknesses of many maturity models. Many maturity models are based on the synthesis of existing models. This weakness is addressed by clearly defined principles and model phases. It is important to clearly define the model scope including its theoretical foundation. Here, process theory for generic models seems appropriate but also other theories can be used for specific focuses (e.g. Self Determination Theory). Secondly, many maturity models are prescriptive without evidence. Therefore, evidence should be collected for each factor included in a maturity model. Finally, generic models cannot fully support the DT process in specific branches. Therefore, it is necessary to include the adaptation in the model, refining a generic model including branch-specific characteristics and trends. It is also necessary to

continuously update models regularly to keep up with current trends such as generative AI.

As a limitation, it is necessary to state that the method has not been validated in the long term, i.e., how frequent does the model change due to new trends and societal and market developments. The next steps will include both long-term studies on how maturity models evolve but also how organizations change when using maturity models.

7 CONCLUSIONS

In this paper, a new methodology for the development and adaptation of maturity models for digital transformation was constructed. The approach consists of four main phases starting with scoping to a long-term model evolution. The method is based on clear principles such as providing a theoretical foundation, evidence-base and guidance. The DA3M method has been successfully applied for constructing both, generic as well as branch-specific maturity models.

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