

Towards a Double-Edged Sword: Modelling the Impact in Agile Software Development

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Abstract

Agile methods are state of the art in software development. Companies worldwide apply agile to counter the dynamics of the markets. We know, that various factors like culture influence the successful application of agile methods in practice and that success varies from company to company. To counter these problems, we combine two causal models presented in literature: The Agile Practices Impact Model and the Model of Cultural Impact. In this paper, we want to better understand the two facets of factors in agile: Those influencing their application and those impacting the results when applying them. This paper's core contribution is the Agile Influence and Impact Model, describing the factors influencing agile elements and the impact on specific characteristics in a systematic manner.

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Towards a Double-Edged Sword: Modelling the Impact in Agile Software Development

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Abstract. Agile methods are state of the art in software development. Companies worldwide apply agile to counter the dynamics of the markets. We know, that various factors like culture influence the successful application of agile methods in practice and that success varies from company to company. To counter these problems, we combine two causal models presented in literature: The Agile Practices Impact Model and the Model of Cultural Impact. In this paper, we want to better understand the two facets of factors in agile: Those influencing their application and those impacting the results when applying them. This papers core contribution is the Agile Influence and Impact Model, describing the factors influencing agile elements and the impact on specific characteristics in a systematic manner.

Keywords: Agile Methods · agile practice · impact · influence · causal model

1 Introduction

In the last decades, agile software development has gained a lot of research interest (e.g., [2, 10, 11]). Today, agile methods are used in a wide variety of contexts (organization, industry, region, ...) with different motivations [14]. Organizations want to improve product quality, increase the speed of delivery of product increments, or optimize predictability. It is therefore not surprising that the question of how to successfully apply agile methods has been investigated [1], which led to an understanding of success factors. On this basis, (causal) models have been defined to systematically describe the influences in the planned or existing application of agile methods (e.g., [3, 8]). Two perspectives may be distinguished here: a) The influence on agile practices in relation to their successful application. b) The effects of the application of agile practices on product or

project characteristics. Below, we will focus on two specific models considering these two perspectives. We are aware, that further causal models exist in the SE field (e.g., [5]). However, in this paper we are focusing on agile methods and the possibility to define influences on or by agile methods.

Today, we know that social facets are important for the success when using agile methods as these facets guide the behaviour of people, e.g., how they communicate and act [12, 13, 15]. Also, aspects with regard to an agile culture are relevant for the successful use of agile methods [4, 7].

To be more precise, specific models were presented explaining the influences of social facets like cultural characteristics on agile methods in a systematic manner in the past. One is the Model of Cultural Impact on Agile Methods (MoCA) [8]. It describes cultural influences on the use of agile methods on a systematic basis. Another model, considering primarily the second perspective is the Agile Practices Impact Model [3] (APIM) aiming to provide a systematic description of the impact of agile practices on specific process improvement goals like e.g. (product) quality, development costs, or time.

However, for the current understanding of the influences and impacts on agile methods the available models, underlying theories and empirical findings do not cover or combine both perspectives. Nevertheless, this knowledge is of high importance as we see the need for a bigger picture supporting researchers and practitioners to find well-suited agile practices for their context considering their specific needs.

This motivated us in a first step to combine our models in order to cover the both mentioned perspectives. Thus, this paper presents the Agile Influence and Impact Model (AIIM) aiming to provide a solution for the explained challenges.

This paper is structured as follows: In Sect. 2, we give a brief introduction of the background, in particular the models we used as a basis for our paper: the APIM, followed by a description of MoCA. The core contribution of this paper is the Agile Influence and Impact Model, which we introduce including a practical example in Sect. 3. Finally, the paper closes with a conclusion in Sect. 4.

2 Background

2.1 Agile Practices Impact Model

The APIM model was created as a basis for an agile capability analysis. The model described the impact of agile practices on the specific impact characteristics, which are detailed as process improvement goals. Even if the model considers the impact on agile practices, it focuses more on the outcome perspective. Thus, the scientific ground for the APIM are agile practices, the impact characteristics and the impact association between them, which is more specified using Influence Factors. The impact between both aspects is defined as binary in terms of a positive or negative impact.

2.2 Model of Cultural Impact on Agile Methods

The MoCA model was defined to provide a systematic description of cultural influences on agile practices. The scientific ground for MoCA are the Cultural and Agile Elements dimensions and the specified impact between them. The cultural dimension consists of specific characteristics based on often used cultural models in Software Engineering. The agile elements dimension was created using the results from a tertiary study aiming to provide an up-to-date list of agile practices [6]. The influence between both dimensions is described as positive or negative, in terms of the application of the agile element with regard to the guideline in which it is defined.

3 The Agile Influence And Impact Model

In this Section, we provide an explanation of the formal structure on a presented meta-model in Fig. 1.

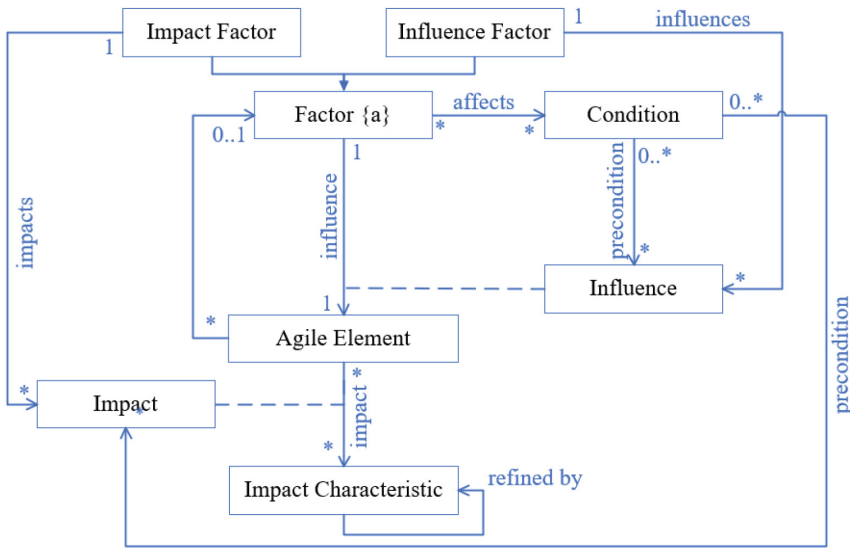


Fig. 1. Agile Influence and Impact meta-model

Similar to the two underlying models, we decide to use Unified Modeling Language (UML) as it fits to the needs explaining the formal structure of the AIIM. Below, we explain the classes and the relationships between them.

An *Agile Element* (using the MoCA wider definition of the elements of agile methods proposed in [9]) is an abstract description of agile activities, roles, and artifacts regardless of their relationship to the different agile methods guidelines.

Also, Agile Activities are abstract agile practices as defined in the paper by Diebold and Zehler [3]. Thus, we consider for the AIIM all the elements of agile elements including specific roles (like Scrum Master or Product Owner), artifacts (such as a Product Backlog), or even agile practices (e.g., Daily Meetings or Retrospectives).

Factor: A Factor can be a specific *Influence Factor* or *Impact Factor*. We decided to use a generalized structure as we wanted clearly differ between Impact Factors and Influence Factors to be able to consider both perspectives of influences on agile practices and impacts of agile practices. A *Condition* may applies as a precondition for a specific *influence* from a *Factor* on one *Agile Element*. This influence is not binary in terms of positive or negative (similar to the impact, which we understand as not binary). We assume that an influence of one Influence Factor (e.g., a cultural value) on an *Agile Element* is defined based on the expected application of the *Agile Element* with respective to the guideline in which this practice is defined. An *Impact* is represented by an Impact Factor on an Impact Characteristic, which are often related to process improvement goals, like Development cost or time [3].

To provide a more practical perspective of the AIIM, we introduce a hypothetical example. A visual representation of this example is shown in Fig. 2. The example covers three cultural characteristics (as influence factors), three Agile Elements, three Impact Characteristics and the relationship between them. Furthermore, the model covers both two organizational constraints and organizational goals.

Based on the influence, we defined the relationships H1..H3. *H1 (in-depth discussions of questions)* defines a positive influence of a High Uncertainty Avoidance on a Planning Meeting, as we assume in-depth discussions for open aspects (e.g., for requirements) by the team. This would lead to a higher quality of the Planning Meetings outcome, which furthermore should lead to an increased predictability of the teams performance (and plans) and transparency (e.g., of the process). Considering *H2 (open communication (of problems))*, a decreased open communication of problems triggered by a high power distance would affect a Daily Meeting in a negative way, if a manager attends the meetings. This attendance further lead to a decreased transparency, even if the Daily Meeting itself should increase the progress transparency of the team. Both Impact Characteristics Predictability and Transparency would provide a trade off for specific organizational goals. In our example, the Predictability would affect the organizational goal of reducing time to market. Finally, the cultural characteristic of a High Masculinity lead to a decrease of communication of code related problems (*H3: communication of code related problems*), which manifests a negative impact on the Test-Driven Development practice, if a manager attends (or even observe) this activity. The attendance of a manager of Agile Elements could be triggered by the influence of interfaces, e.g., stakeholder which want more in-depth informations. Also, it could be a management decision from a command and control strategy perspective to act in such kind of ways. These organizational constraints are of high importance, as they implicitly trigger such Impact

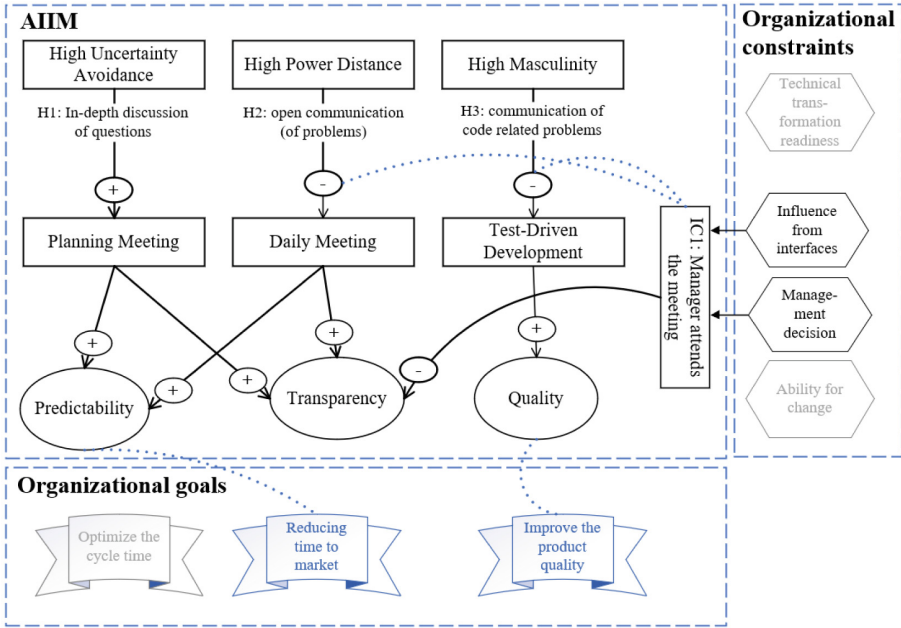


Fig. 2. Example of the AIIM model

Conditions in our model. However, the Test-Driven Development practice lead to a better process and product quality and thus, provide the opportunity to improve the product quality.

The example presented above provide a practical perspective based on three specific influence and impact relationships considering organizational constraints and goals.

4 Conclusion and Future Work

In this paper, we present the Agile Influence and Impact Model (AIIM) aiming to cover both perspectives: The influence on the elements of agile methods and the impact by agile elements on the outcome or output while applying such approaches.

In its current state, the AAIM is a meta-model describing both perspectives of influences and impacts with regard to agile methods. The model was created based on the combination of two existing models: The Agile Practices Impact Model and the Model of Cultural Impact on Agile Methods. To be more precise, we present furthermore a practice-oriented example of the AIIM considering in total three influences on agile elements and three impacts on specific impact characteristics.

We are aware, that the model is in an initial state and we are further planning future work activities. In the next step, we want to define how the model can be

applied using examples from our previous models. The vision of the AIIM is to provide a theory which can be applied in real-world settings. Thus, we aim in further step to define an application process for the AIIM to be able to evaluate the new model in practice using empirical data.

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