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Enterprise Agile Transformation

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ABSTRACT: Implementing agile methods is currently one of the central topics for many organizations and teams focused on developing technological products. Although the benefits of these methods are widely recognized by the product and project management community, their implementation in organizations means going through a complex transformation with several changes in the way of working. There are few scientific studies that explain how an organization can carry out this transformation, what are the barriers, the enablers and the recommendations that should be followed to increase agility level and drive an agile transformation successfully. Knowing that the adoption of agile methods generates several changes in roles, processes and organizational culture, this research aims to create the Enterprise Agile Transformation Model to serve as a guide for organizations to adopt and improve agile practices.

Keywords: Agile Transformations, Agile Maturity Models, Enterprise Agile Transformation Model

JEL Classification: M10, M15, O21

1. Introduction

Over the last few years organizations have questioned themselves why they should adopt agile methods (Highsmith, 2006). This new way of working, officially introduced through values and principles of Agile Manifesto in 2001 (Beck, Cockburn, Jeffries & Highsmith, 2001), has been showing many success cases, where the value added for teams and organizations are unquestionable (Korhonen, 2013). Scrum, Extreme Programming (XP), Crystal and Dynamic Systems Development Method (DSDM) were the main agile methods included in this new way of working mindset (Hamed & Abushama, 2013; Anand & Dinakaran, 2016). These success cases had encouraged the adoption of these methods across all sectors, particularly in the Information Technology (IT) sector (Dybå & Dingsøyr, 2008), where more than half of projects fail to deliver functional software and the main obstacles are related to communication problems with stakeholders, who play critical roles in the execution and development phases of IT products (The Standish Group, 2015). Digital and mobile platforms are having a key role in transforming the way organizations run their businesses (Bondar, Hsu, Pfouga & Stjepandić, 2017) although product-oriented struggle to introduce the correct product components and modules to quickly respond to customer needs and the introduction of new technologies (Raudberget, Elgh, Stolt, Johansson & Lennartsson, 2019). Challenges such as the pressure to reduce the time to market, the need to improve product quality and increase the ability to adapt to customer needs changes, contributed to the decision to adopt agile methods (VersionOne, 2016) to deliver products quickly and adapted to the customer needs (Korhonen, 2013; Petersen & Wohlin, 2010). Many authors in the IT scientific literature designate this process of adopting agile methods as an agile transformation (Dikert et al, 2016). As a result of the growing success and popularity of adopting agile methods, many organizations are now seeking to understand how they can holistically implement these practices in their teams (Highsmith, 2006). However, scientific literature on these transformations is still scarce (Dikert et al, 2016) and is difficult to find a clear direction to follow (Sillitti, Ceschi, Russo & Succi, 2005; Schwaber, Laganza & D'Silva, 2007).

Through this research, it is intended to define a theoretical model that guides organizations in adopting agile methods, highlighting the most important agile practices and adding an improvement plan in order to drive the organizations to achieve the maximum agility potential they can reach. Thus, this research had as starting point the barriers and enablers of agile transformations studied by Batista et al (in press)^b and the theoretical model Agile Adoption Framework (AAF) developed by Sidky, Arthur & Bohner (2007), which was used as a structural piece in Enterprise Agile Transformation Model (EATM) created through this research. The EATM has the mission to guide organizations in adopting agile methods, highlighting the most important agile practices and adding an improvement plan to increase the agility that is intended to be achieved. Section 2 of this research

consists of a literature review of the main concepts. Section 3 contains the methodology used to identify the research problem as well as carry out data collection and data analysis. Section 4 presents the results collected via interviews and surveys from project management and agile methods experts, to evaluate the EAT. Chapter 5 contains the discussion and answers to the research questions. Chapter 6 brings together the conclusions, limitations of the research as well as the recommendations for future lines of research.

2. Theoretical background

2.1. Agile Transformations

An agile transformation goes far beyond the simple adoption of agile practices (Paasivaara, Behm, Lassenius & Hallikainen, 2018). In fact, this transformation promotes the change of several traditional management practices (Dosquet, Conticello, Dosquet, Dour & Van Bennekum, 2017) and requires fundamental changes at the individual and organizational level (Laloux, 2014). Agile transformation as a process of transition from traditional project management methods to agile methods is a complex and evolutionary process and requires a high level of coordination between the organization and its projects (Dikert et al, 2016) and it has several obstacles that should be considered (Gandomani, Zulzalil, Ghani, Sultan, & Nafchi, 2013).

Agile methods are often criticized for being applicable primarily to small teams and small organizations rather than large organizations with several development teams (Reifer, 2003). There are a limited number of comprehensive scientific studies dedicated to agile transformations at the organizational level in IT sector (Petersen & Wohlin, 2010). These processes are impacted by a large number of issues, barriers and enablers (Dikert et al, 2016) requiring a lot of long-term investment and collaboration across all the organization levels (Dikert et al, 2016; Gandomani & Nafchi, 2015). There are studies that explain the most important issues that organizations are facing during an agile transformation. People-related issues represent the majority of the problems associated with this type of transformation (Nerur, Mahapatra & Mangalaraj, 2005). Other study has addressed several success factors that can facilitate the adoption of agile practices, most of which are also related to people (Misra, Kumar & Kumar, 2009; Vijayasarathy & Turk, 2012). Moe & Dingsoyr (2009), report that the main issues to be addressed in an agile transformation are: 1) coordination between teams, 2) business agility, 3) knowledge sharing and 4) knowledge networks. Paasivara et al (2018), analyzed an agile transformation in an organization oriented to product development and presented four lessons learned: 1) use experimental transformation approach, 2) gradual and phased transformation, 3) common agile method and 4) team skills development. These characteristics, barriers and enablers should be considered for all organizations that intend to implement agile methods.

2.2. Models to measure agile maturity

An agile maturity model could be defined by a group of agile best practices that have the purpose to help organizations improve their processes (SEI, 2010) through a step by step and iterative approach (Yin, Figueiredo & Mira da Silva, 2011). The shift from traditional project management methods to agile methods represents the main goal of every agile transformation (Dikert et al, 2016) and should consider the agility potential of the organization, to choose the right agile practices and to get a competitive advantage as a result (Gandomani & Ziaei, 2016). Organizations have many difficulties in implementing this type of transformations in short term (Qumer & Henderson-Sellers, 2008) and the maturity models should work as an action plan that organizations

can implement with a step-by-step approach (Norton, 2008). Typically, these models have different maturity levels with several agile practices that should be achieved to reach each level (Becker, Knackstedt, & Pöppelbuß, 2009). In a recent literature review carried out by Schweigert, Vohwinkel, Korsaa, Nevalainen & Biro (2013), it was possible to identify about 40 agile maturity models. Nevertheless, none of these models are consensual either by professionals or academics (Schweigert et al, 2013). On the other hand, the systematic literature review conducted by Ozcan (2013) assessed the strengths and weaknesses of five agile maturity models where AAF obtained the best result. The other four agile maturity models considered in this literature review were Agile Maturity Model, Scrum Maturity Model, Benfields' Model and Agile Scaling Model (Ozcan, 2013).

3. Methodology

3.1. Research approach

To conduct this research was used a qualitative approach with secondary data to expand a theoretical model identified through the scientific literature. To validate the model was used a focus group with a sample of 10 experts using a defined and clear topic to be discussed where the main purpose was to promote an interactive discussion with all the participants (Saunders, 2009).

3.2. Research questions

This research intends to expand a theoretical model that allows the assessment of the barriers and enablers of agile transformations and provide a plan to improve the weaknesses identified through the assessment. The relationship between the problem, the questions, the research objectives and the discussion of results with authors in the literature is shown in table 1. The following are the questions of research:

- *Question of research 1:* How to assess agile practices associated with barriers and enablers of an agile transformation?
- *Question of research 2:* What is the action plan that has the goal to improve the maturity level of agile practices associated with barriers and enablers of an agile transformation?

Table 1
Identification of the research problem, general and specific research questions, research objectives and discussion of the results
Source: Elaboration of the author

Research problem	General question	Specific questions of research	Research objectives	Discussion of results with authors of literature
Lack of theories to identify and mitigate barriers and identify and accelerate enablers of agile transformations	What should the theory consider to mitigate the barriers and accelerate the enablers of an agile transformation?	<p><i>Question of research 1:</i> How to assess agile practices associated with barriers and enablers of an agile transformation?</p> <p><i>Question of research 2:</i> What is the action plan that has the goal to improve the maturity level of agile practices associated with barriers and enablers of an agile transformation?</p>	<p><i>Research objective 1:</i> Evolution of a theoretical model that allows assessing the maturity level of agile practices associated with barriers and enablers of an agile transformation</p> <p><i>Research objective 2:</i> Definition of a plan to help organizations to improve the maturity level of agile practices associated with barriers and enablers of an agile transformation</p>	It is intended to expand the theoretical model Agile Adoption Framework, developed by Sidky et al (2007)

3.3. Data collection

3.3.1. Selecting the theoretical model to expand

The data collection was based on secondary data, largely collected from the studies of Ozcan (2013), Sidky et al (2007), Batista et al (in press)a and Batista et al (in press)b. The validation of this data was obtained through a focus group with 10 experts from agile methods and project management community. To get different point of views during the focus group session, were selected academics, project and program managers, product owners, scrum masters and agile consultants, where 75% have more than 10 years of professional experience. The first step consisted in identifying the most appropriate agile transformation theoretical model expand with the agile practices associated with barriers and enablers. Through the systematic literature review and multiple case study analysis carried out by Ozcan (2013), it was possible to verify that the AAF obtained the best result, considering the criteria *Fitness for Purpose, Completeness, Definition of Agile Levels, Objectivity, Correctness, Consistency*. The inclusion criteria of theoretical models in this systematic literature review considered i) a detailed process for each model that could be analyzed and ii) a publication in a conference or academic journal. After an exhaustive literature review of agile theoretical and maturity models, the AAF model was selected as the starting point of this research, mainly due to its comprehensive structure, which is also confirmed by the scientific literature.

3.3.2. Analysis of AAF model

According to Sidky et al (2007), AAF has an agile measurement index and a 4-step process that act together to assess and guide agile practices adoption. While the agile measurement index has the mission to assess the agile potential of projects and organizations, the 4-step process has the goal to determine the organization readiness and which agile practices could be applied. Despite being a robust and complete model, AAF authors indicated that the model also has some limitations, namely, it does not present recommendations neither a plan on how to overcome the identified weaknesses in the assessment, which is an essential piece to organizations improve their processes and agile maturity (Sidky et al, 2007). Additionally, the authors also mentioned that, according to the feedback collected in agile community, exist some discussion around the right agile level for each agile practice presented in the model (Sidky et al, 2007).

3.4. The barriers and enablers of agile transformations

Considering the limitations identified in the AAF model, the next step of this research was to improve it through the results obtained by Batista et al (in press)b, where was identified the barriers and enablers that best explain the success of an agile transformation. The enablers had the designation of success factors in Batista et al (in press)b research but the name was change to harmonize the nomenclatures. Barriers of agile transformations are considered factors that have a negative impact, block and delay the successful implementation of agile methods and practices. On the opposite side, enablers are considered factors that have positive impact and accelerate the successful implementation of agile methods and practices. To reach these results, the authors conducted a multiple linear regression analysis to analyze the relation between the independent variables - barriers and enablers - and the dependent variable - agile transformation success - where the relative predictive importance of the independent variables was defined (Williams & Monge, 2001). Through this analysis two models were established. The barriers and enablers models indicate which factors best explain the success and failure of an agile transformation (table 2). The results of Batista et al (in press)b showed that the barriers *Using traditional methods and agile*

methods in parallel, Lack of coaching for teams, Gap between short and long term planning and Revert to the old way of working are the factors that best explain the failure of an agile transformation. The enablers *Concentrate on Agile values, Allow teams to self-organize, Recognize the importance of the Product Owner role, Communicate the change intensively* and *Educate Management on Agile* represent the enablers that best explain the success of an agile transformation. Considering the importance of these factors, the agile practices associated to each were highlighted in the theoretical model developed.

Table 2
Barriers and enablers that better explain agile transformations success and failure
Source: Batista et al (in press)b

	b	SE b	β
Model 1 - Barriers			
(Constant)	11,003	0,441	
Using old and new approaches side by side	-0,485	0,093	-0,306***
Agile Coaching is insufficient	-0,284	0,100	-0,158**
Gap between short and long term planning	-0,249	0,105	-0,126*
Reverting to the old way of working	-0,239	0,101	-0,148*
Model 2 - Enablers			
(Constant)	1,905	0,349	
Concentrate on Agile values	0,421	0,102	0,249***
Allow teams to self-organize	0,280	0,091	0,179**
Recognize the importance of the Product Owner role	0,280	0,091	0,173**
Communicate the change intensively	0,244	0,102	0,140*
Educate management on Agile	0,216	0,092	0,125*

3.5. Data analysis

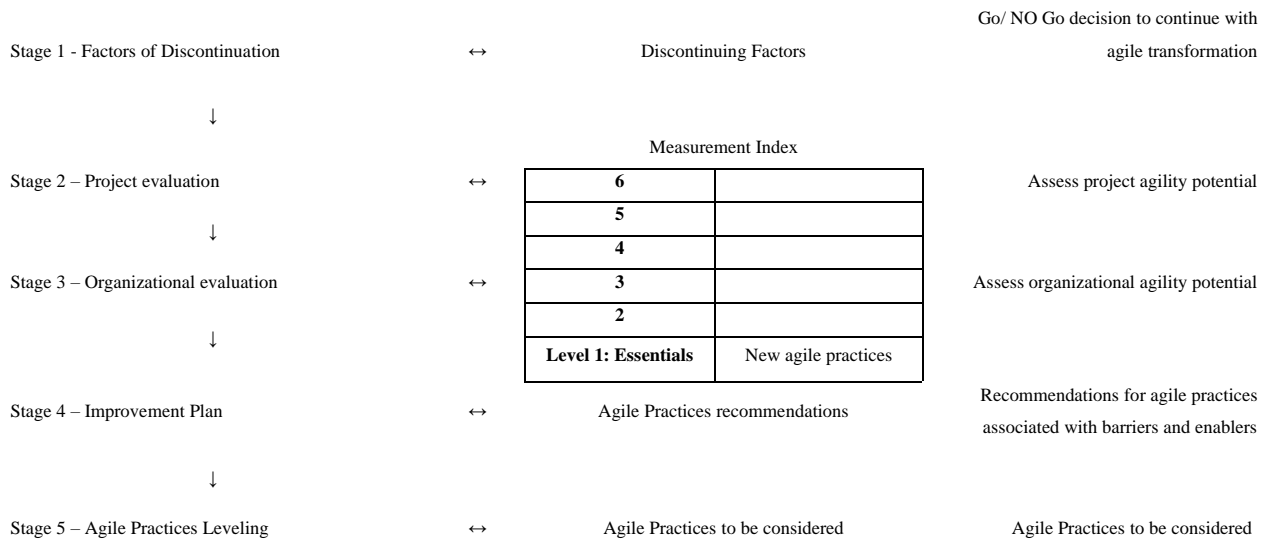
As the objective of this research is to expand a theoretical model that allows to assess and improve the maturity level of agile practices associated with barriers and enablers of an agile transformation, the following sub sections focus on suggested evolutions for the AAF model through the data collected. These evolutions resulted in the creation of the EAT model (table 3).

3.5.1. A new Agile Level 1 - Essentials

The agile measurement index of AAF consists of 5 agile levels where each one represent an agile maturity level of a given project or organization. Level 1 represents the first level of agility and level 5 represents the maximum level of agility that can be achieved. There are agile practices from the AAF model that represent barriers or enablers identified in this research but there are new agile practices associated with barriers and enablers that have been added to the EAT model. A new Agile Level 1 – Essentials was developed (table 3), where the new agile practices associated with barriers and enablers identified by Batista et al (in press)b were considered. The agile practices associated to this new Agile Level 1 have a critical role since has the purpose to create a solid ground for successful agile adoption. The Level 1 only contemplates the new agile practices not considered yet in AAF and works as a pre-agility level to guarantee a successful adoption of the practices of next levels. All the practices associated with agile levels already identified in AAF kept the same level.

Table 3
Enterprise Agile Transformation (EAT)
Source: Elaboration of the author and AAF adaptation

Measurement Index	Artifacts	Objective
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3.5.2. New indicators to assess Agile Level 1 practices

To assess the maturity level of each new agile practice, the assessment method developed by Sidky et al (2007) was considered (table 4), where was used the same categories, areas and characteristics to be assessed. Using this method, were developed new indicators to assess Agile Level 1 practices (table 5). These indicators allow the assessment of several organizational characteristics through questions made to managers, developers and through the evaluator’s observation, where was used a five-level likert scale: *strongly disagree, tend to disagree, neither agree nor disagree, tend to agree, strongly agree*. After the data collection, the maturity of each agile practice was assessed using a four-level scale: *not achieved, partially achieved, largely achieved and fully achieved*. If any organizational characteristic evaluated in an agile practice was considered “*not achieved*” or only “*partially achieved*”, that means that the organization needed to improve that characteristic to adopt that agile practice (Sidky et al, 2007). If the organizational characteristics obtained the classification of “*largely achieved*” or “*fully achieved*” it means that had the required maturity level to move forward to the next level (Sidky et al, 2007). The OE1_M1, OE1_M2, ..., acronyms used in table 4 and table 5 stand for: OE - Organizational Evaluation, 1 - Agility Level, (M)anager / (D)eveloper / (O)bservation by the Assessor, 1 - Question number. This classification was selected to assess each agile practice of Level 1.

Table 4
Assessment tables for Level 1 agile practices
Source: Elaboration of the author and AAF adaptation

Level 1 Agile practice	Category of Assessment	Area to be assessed	Characteristics to be assessed	To determine	Assessment method	Sample indicators
Agile Training for Leaders	People	Management	Learning	Whether or not managers are willing to learn agile principles	Interviewing	OE1_M1, OE1_M2
			Buy-in	Whether or not managers are committed to apply agile principles	Interviewing	OE1_M3, OE1_M4
	Experience		Whether or not the managers have experience in work with agile methods	Interviewing	OE1_M5	
	Process		Learning	Whether or not the managers have already attended agile training	Interviewing	OE1_M6
			Existence	Whether or not the organization can provide agile training	Interviewing	OE1_M7
Active Change Management Communication	People	Management	Buy-in	Whether or not the managers are aware of the importance of constantly inform the stakeholders involved about the goals and outcomes of the agile transformation	Interviewing	OE1_M8, OE1_M10

				Whether or not the managers are committed to constantly share the goals and outcomes of agile transformation with all the stakeholders	Interviewing	OE1_M9
			Competence	Whether or not organization has a culture of communicate the goals and outcomes of the projects in a regular and transparent way	Observation	OE1_A1
		Developers	Existence	Whether or not organization has a culture of communicate the goals and outcomes of the projects in a regular and transparent way	Interviewing	OE1_D1
Teams Coaching for Agile Users	People	Coaching	Competence	Whether or not the organization has competences to coach all the team involved in agile transformation	Interviewing	OE1_M11, OE1_M12
			Experience	Whether or not the organization has people with experience in agile transformations	Interviewing	OE1_M13, OE1_M14
	Project	Resources	Existence	Whether or not the project has an allocated resource, responsible to coach all the people involved in agile transformation	Interviewing	OE1_M15

Table 5
Indicators for Level 1 agile practices
Source: Elaboration of the author

Agile Practice	ID	Statement
Agile Training for Leaders	OE1_M1	You are willing to dedicate time to agile training to learn agile values
	OE1_M2	You are interested in learning agile values and principles
	OE1_M3	You recognize that learning agile values and principles before the adoption of agile practices is critical
	OE1_M4	You are willing to apply agile principles and values in agile transformation
	OE1_M5	You already applied agile methods in previous projects and organizations
	OE1_M6	You already attended agile training sessions
	OE1_M7	Organization has the necessary resources to provide agile training for leaders
Active Change Management	OE1_M8	You believe that it is important to create a change management plan to communicate the new way of working effectively to the stakeholders involved
	OE1_M9	You are willing to dedicate time in communicate the vision, objectives and accomplishments of the transition to agile methods to the team
	OE1_M10	You believe that including others in the planning of a project is critical.
Communication	OE1_A1	After looking to previous project's change management or communication plans, you know that the organization is prepared to communicate the transition to agile methods properly
	OE1_D1	You recognize that the organization use to share the vision, objectives and accomplishments of every organizational initiative and changes in the way of working
Teams Coaching for Agile Users	OE1_M11	The organization already identified the resources responsible to lead agile coaching
	OE1_M12	The Agile Coach holds agile certifications
	OE1_M13	The Agile Coach has a proven record of leading agile transformations
	OE1_M14	The Agile Coach has a proven record of leading agile teams
	OE1_M15	The Agile Coach has an allocation of 100% on the agile transformation

3.5.3. AAF Agile practices associated with barriers and enablers and new agile practices

All the practices associated with barriers and enablers that were identified in EAT are described in table 6 and below. *Teams that self-organize* is a practice that was used to assess the enabler with the same name. *Concentrate on Agile values* is an enabler that aggregates four AAF agile practices embedded in Agile Manifesto values (Beck et al, 2001): *Customer dedication to collaborate with a team*, *Cooperative Teams*, *Frequent Delivery* and

Changing Requirements. Was created the practice *Agile Training for Leaders* to respond to the enabler *Educate Management on Agile*. The practice *Teams Coaching for Agile Users* was created to respond to the barrier *Agile Coaching is insufficient* and the practice *Active change management communication* was created to respond to the enabler *Communicate the change intensively*. The *Customer availability* practice is associated with the *Recognize the importance of Product Owner role* enabler. *Different layers of planning* is associated with the *Gap between short and long term planning* barrier. The *Teams with a sense of purpose* practice is associated with the *Reverting to the old way of working* barrier. Finally, the *Continuous improvement process* practice is associated with the *Using old and new approaches side by side* barrier. The new agile practices that were created for EAT model are all in Level 1 – *Essentials* (table 7). Since the AAF agile practices already have indicators suggested to measure the maturity level of each practice, were not defined new indicators for these practices. Level 6 has no barriers or enablers associated and was left without any agile practice in table 6. Nonetheless this level has 7 agile practices identified in AAF not mentioned in this research since it is not the focus of this work.

Table 6
New Agile Practices in EAT and AAF Agile Practices associated to barriers and enablers
Source: Elaboration of the author and AAF adaptation

	Adapted AAF Agile Practices	New Agile Practices
Barriers		
Using old and new approaches side by side	Continuous improvement process	-
Gap between short and long term planning	Different layers of planning	-
Reverting to the old way of working	Teams with a sense of purpose	
Agile coaching is insufficient	-	Teams coaching for agile users
Enablers		
Concentrate on agile values	Customer dedication to collaborate with a team, Cooperative teams, Frequent delivery, Changing requirements	-
Allow teams to self-organize	Teams that self-organize	-
Recognize the importance of product owner	Customer availability	-
Communicate the change intensively	-	Active change management communication
Educate management on agile	-	Agile training for leaders

Table 7
The 6 Levels of Agility of EAT populated with Agile Practices and Concepts associated to barriers and enablers
Source: Elaboration of the author and AAF adaptation

	Agile Principles				
	<i>Accept Change in Order to Provide Customer Value</i>	<i>Frequently plan and deliver software</i>	<i>Human-centered design</i>	<i>Technical quality</i>	<i>Collaboration with Customers</i>
Level 6					
Level 5					Customer availability
Level 4			Teams that self-organize		
Level 3	Changing Requirements	Frequent Delivery			
		Different layers of planning			
Level 2	Continuous improvement process		Cooperative Teams		Customer dedication to collaborate with a team
			Teams with a sense of purpose		
Level 1			Agile training for leaders		
			Active change management communication		
			Teams coaching for agile users		

Bold: Agile practices associated with barriers and enablers

3.5.4. New stage with improvement plan for agile practices associated with blockers and enablers

To respond to the lack of an action plan of AAF to overcome the weaknesses identified, a literature review was also carried out to find the best practices and recommendations that aims to improve the maturity level of agile practices assessed with a low maturity level in EAT. Considering the importance of the barriers and enablers in agile transformation, it is crucial not only to identify their maturity but also what are the best practices that allow overcoming the weaknesses of each factor. A new stage in the EAT process was developed – Stage 4: Improvement Plan – which contain a set of actions, best practices and tools found in the scientific literature that aim to improve the degree of maturity of each barrier and enabler. Thus, organizations that are involved in a transformation of this scale have a direction they can take to successfully move to the next agile level (table 8).

Table 8
Improvement plan for each agile practice associated with blockers and enablers
Source: Elaboration of the author

Barriers	EAT Agile Practice	Best practices and tools	Actions description
Agile Coaching is insufficient	<i>Teams coaching for agile users</i>	Agile Coordination Office (Batista et al, in press) ^a Agile Coach (Batista et al, in press) ^a	Honest, objective feedback from an outside source (Schatz & Abdelshafi, 2005) Frequent retrospective moments where the group share their experiences (Martin et al, 2005) Define individuals and groups within the organization with a positive attitude toward agile methods and previous experience with agile (Dikert et al, 2016) Identify who can provide coaching for less experienced employees (Paasivaara, 2018) Agile networks for Scrum masters and product owners, called guilds; and biweekly Agile meetings with specific topics or guest speakers (Sommer, 2019) A group of Agile advocates and coaches responsible to persuade other staff to adopt the same elements of interpretation and practice to frame agile adoption as their own (Abdelnour-Nocera et al, 2007)
Using old and new approaches side by side	<i>Continuous improvement process</i>	Customized Agile framework (Batista et al, in press) ^a Assessment of Organizational Needs (Batista et al, in press) ^a Sprint Retrospective (Henriksen & Pedersen, 2017).	Develop an agile software development process model building on feedback continuously gained from iterative improvement workshops at the project level (Pikkarainen et al, 2012). Define the use of agile development methods in specific situations (Pikkarainen et al, 2012). Continuously adapt the agile-based process model at the organizational level (Pikkarainen et al, 2012).
Gap between short and long term planning	<i>Different layers of planning</i>	Business Unit Roadmap (Batista et al, in press) ^a Epic Planning (Batista et al, in press) ^a Scrum of Scrums (Vallon et al, 2017) Sprint Planning (Vallon et al, 2017) Estimation Meeting (Vallon et al, 2017) Requirements workshop (Vallon et al, 2017) Sprint Backlog (Henriksen & Pedersen, 2017)	Co-operation between customer and team for initial and flexible requirements and team-level goals, (Lappi et al, 2018). Product backlog and vision guide prioritization and iteration process (Lappi et al, 2018) Flexible budgeting (short-term) and contracting (time & material) support agile projects (Lappi et al, 2018) Iterative project planning using product vision and backlogs (Lappi et al, 2018) Backlogs and priorities analyzed in each sprint in order to assess possible changes resulted from deliverables tests or product vision update (Bjarnason et al, 2016)
Reverting to the old way of working	<i>Teams with a sense of purpose</i>	Agile Pilots (Batista et al, in press) ^a Incremental Agile Adoption (Batista et al, in press) ^a Improve collaboratively (Henriksen & Pedersen, 2017) Team based estimation (Henriksen & Pedersen, 2017)	Include motivated developers on each team (Conboy et al, 2011). Gather and share success tales and good experiences about adoption. (Conboy et al, 2011). Provide psychological motivators since they play a significant role, together with abilities to cope with and manage change, in adopting new technologies and methods (Murphy & Cormican, 2015) Locally experiment, test, learn and protect before repeating and adapting at the scale (Calnan & Rozen, 2019). Let the experiment guide your learning, not the expected (desired) result (Calnan & Rozen, 2019).
Enablers			
Concentrate on agile values	<i>Customer dedication to collaborate</i>	Agile Mindset & Autonomy (Batista et al, in press) ^a Incremental design (Henriksen & Pedersen, 2017) Iterative development (Henriksen & Pedersen, 2017)	Make sure the team, management and all stakeholders have a clear vision, understanding and awareness of agile methods (Pikkarainen et al, 2012).

	<i>with a team, Cooperative teams, Frequent delivery, Changing requirements</i>	Continuous integration (Vallon et al, 2017)	<p>Ensure multiple members get agile training or attend agile conferences (Conboy et al, 2011)</p> <p>Encourage agile coaching and championing (Conboy et al, 2011)</p> <p>Ensure cross-team observation and validation of agile practices (Conboy et al, 2011)</p> <p>Assess agility in terms of agile values not practice adherence (Conboy et al, 2011)</p> <p>Focus on behaviour and mindsets to foster culture (Calnan & Rozen, 2019)</p> <p>Agile principles can work as a shared compass to align the efforts of all actors (Calnan & Rozen, 2019).</p>
Allow teams to self-organize	<i>Teams that self-organize</i>	<p>Cross Functional Teams (Batista et al, in press)^a</p> <p>Dedicated Teams (Batista et al, in press)^a</p> <p>Whole Team (Henriksen & Pedersen, 2017)</p> <p>Daily Stand-up (Henriksen & Pedersen, 2017)</p> <p>Task Board (Henriksen & Pedersen, 2017)</p> <p>Visualize workflow (Henriksen & Pedersen, 2017)</p>	<p>People should be eager to share information with one other, continuously learn (Misra et al, 2009)</p> <p>Teamwork and team building are critical to establishing self-managing teams. (Schatz & Abdelshafi, 2005)</p> <p>Team colocation is a real boost to productivity (Schatz & Abdelshafi, 2005)</p> <p>Managers learn to properly delegate to teams, they should shift their focus from tasks and assignments to team dynamics (Schatz & Abdelshafi, 2005)</p> <p>Small teams are better suited for implementing Agile methods (Boehm, 2002)</p> <p>The number of 10 elements of the development team is the ideal number, although it is not mandatory (Rising & Janoff, 2000)</p> <p>A successful implementation requires a certain level of freedom among the development team to decide which agile practices they intend to adopt once they have received training in Agile methods (Pikkarainen et al, 2012)</p> <p>Encourage self-assignment task to let developers work in different areas and learn new skills (Morgan, 1986)</p> <p>Senior management defining only the critical factors that are needed to direct the team and placing a few restrictions on the team as possible (Morgan, 1986)</p> <p>Promote an environment of “bounded” or “responsible autonomy” (Morgan, 1986)</p> <p>Introduction of more decentralized decision-making processes (Paasivaara et al, 2018)</p>
Recognize the importance of the product owner role	<i>Customer availability</i>	<p>Product Owner Group (Batista et al, in press)^a</p> <p>Feature Product Owner (Batista et al, in press)^a</p> <p>Onsite/proxy customer (Vallon et al, 2017)</p> <p>Sprint review/demo (Vallon et al, 2017)</p>	<p>Ensure that they are responsive, collaborative, authorized, committed and knowledgeable (Conboy et al, 2011)</p> <p>Clear roles are identified to be essential for successful agile implementation (Boehm & Turner, 2005)</p> <p>Ensure the Product Owner is dedicated to this role and/or if there is only one (single) PO in the team (Alliance, 2015)</p>
Communicate the change intensively	<i>Communicate the change intensively</i>	<p>Management Support (Batista et al, in press)^a</p> <p>Stakeholders Engagement (Batista et al, in press)^a</p> <p>Evaluate Stakeholders Satisfaction (Batista et al, in press)^a</p> <p>Engage Change Leaders (Batista et al, in press)^a</p> <p>Change Driver Team (Batista et al, in press)^a</p> <p>Promote Communication & Transparency (Batista et al, in press)^a</p>	<p>Identify a Sponsor who’s willing to put everything on the line and is committed to moving to agile (Schatz & Abdelshafi, 2005)</p> <p>Sponsor should be able to stand up to the critics, encourage the leaders and communicate the team’s vision (Schatz & Abdelshafi, 2005)</p> <p>Pick good people and reward the results of pilot projects (Boehm & Turner, 2005)</p> <p>Show your appreciation for the team’s work, regardless of the outcome (Boehm & Turner, 2005)</p> <p>The team members put their reputations on the line for the organization, leaving themselves vulnerable to the organizational antibodies. Don’t minimize that effort (Boehm & Turner, 2005)</p> <p>Small local and personal initiatives can have a big impact (Calnan & Rozen, 2019)</p> <p>Small successes are contagious and help foster emulation (Calnan & Rozen, 2019)</p>
Educate management on agile	<i>Agile training for leaders</i>	<p>Agile Concepts Alignment (Batista et al, in press)^a</p> <p>Scaled Agile Training (Batista et al, in press)^a</p>	<p>Make sure the team, management and all stakeholders have a clear vision, understanding and awareness of agile methods (Pikkarainen et al, 2012)</p> <p>People should understand and learn agile values and principles in addition to practices to be motivated and committed. (Conboy et al, 2011)</p> <p>To transforming from traditional to agile methods, management style should be changed from “command and control” to “leadership and collaboration” (Yang et al, 2009)</p> <p>The role of project manager should be altered from planner and controller to director and coordinator (Moe et al, 2009; Monteiro et al, 2011)</p> <p>Project manager should have an adaptive leadership style (Lappi et al, 2018)</p>

4. Results

The next step consisted of the presentation and validation of the EAT with a focus groups of 10 experts from agile methods and project management community, during August 2021. To get different point of views, the experts had a heterogeneous background as academics, project and program managers, product owners, scrum masters and agile consultants. The presentation was carried out in one-hour session, where at the second part of the session there was a moment of discussion to collect qualitative feedback about the importance, clarity, completeness, practicality, necessity, and effectiveness of EAT. It was also possible to collect data from experts about their professional experience and role. The following section presents the analysis of the data obtained related with the 6 levels of agility and the 5-stage process.

4.1. Feedback on the 6 levels of agility

The questions discussed during the focus group related with the 6 agility levels aimed to collect feedback on its completeness, practicality, necessity, as well as whether the practices represent the correct agility levels. The majority of the experts agreed that the EAT has a high level of completeness and partially agreed that the 6 levels are defined in a valid and logical order. As for the practicality of the EAT, all participants fully agreed the 6 Agile levels can be used to rate and support an agile transformation and could be beneficial to the software development industry. About agile practices at the respective levels, the majority agreed that they are correctly assigned and a small group disagree with the attribution of practices by level. This disagreement may be associated with the different experiences and previous projects of each participant, which influences the way in which they attribute the degree of agility to each technique.

After collecting feedback from the experts, the existent AAF agile practices associated with barriers and enablers were not moved to the new Level 1 and remained at the levels initially assigned in the model. According to the feedback collected, these practices require some level of agility to be implemented and should stay in their original level. Additionally, their shift to Level 1 could represent a roadblock to the change as it may be too disruptive to require this practice as a Level 1 practice, which can lead to team frustration and abandonment of agile adoption. Some of the statements of participants were:

- **E2:** *“The basic practices must exist”;*
- **E3:** *“If there is no context, it's harder to be faithful to Agile”;*
- **E5:** *“It has to be simple and easy to understand.”;*
- **E8:** *“If level 1 included all barriers and enablers it could represent a big barrier to agile transformation”.*

4.2. Feedback on the 5-Stage process

Regarding the 5-step process, the discussion was designed to assess the criteria of understanding, need, completeness and clarity. All participants understood the objective of the model and the majority indicated that they agree that the process is appropriate to be used by the IT organizations. In terms of clarity, most of the experts mentioned that all activities are organized in a logical sequence. Regarding completeness, a small number of experts indicated that they partially disagree that the model contains all the necessary elements.

Some of the statements of participants were:

- **E3:** *“The improvement plan could have some suggestions for possible paths of implementation”;*

- **E4:** *“Agile training should not only focus on top management but also on middle management as these positions are often the ones leading the real change”;*
- **E7:** *“Active communication is a necessary and fundamental skill for change and must be implemented from day 1”;*
- **E8:** *“The creation of organizational awareness is essential, so the practice related to active communication makes perfect sense”;*
- **E10:** *“The process is clear and simple to follow”.*

5. Discussion

5.1. General comments

The evolution of AAF to the EAT model allows organizations to initiate agile transformation with the practices that ensure the success of the transition and adoption. Level 1 – Essentials contains the practices associated with mitigating the barriers and accelerate the enablers of an agile transformation, which means that the successful adoption of practices at this level allows organizations to look to the future with confidence that they are building solid foundations. Level 1 ensures that there is an alignment of the agile principles with the organization needs while implementing agile methods in an organization (Kalenda, Hyna & Rossi, 2018) through the application of agile essentials concepts that allows flexibility to accommodate expected or unexpected changes rapidly (Qumer & Henderson-Sellers, 2006). This flexibility could be gained by applying knowledge management techniques to overcome ambiguity (Tooranloo & Saghafi, 2018) which can be complemented with training and coaching practices. Additionally, all these Level 1 agile practices are related with people, culture and communications which are factors that influence agile transformations success (Lindvall et al, 2004). On the other hand, the new Level 4 - Improvement Plan, aims to respond to one of the weaknesses pointed out to the AAF and suggested a set of actions, best practices and tools that organizations could try if they intend or need to increase the maturity level of a specific Level 1 agile practice. EAT also allows to understand the causes of failure and success of an agile transformation before applying a specific tool or technique which represents a clear benefit according to Pereira & Santos (2020). On the other hand, the improvement plan for agile practices aims to mitigate the limitation identified in the AAF model of Sidky et al (2007) related with the lack of guidance about how organizations can overcome their weaknesses and improve agile maturity.

5.2. Findings

Considering the development of the EAT theoretical model developed during data analysis and based on the results collected through a focus group of experts, it was possible to answer the research questions, identified in the following sub-sections.

5.2.1. Findings of question of research 1

Research question 1 was *“How to assess agile practices associated with barriers and enablers of an agile transformation?”*. Agile practices of the AAF and new practices associated with barriers and enablers were identified in EAT. The agile practices already identified in AAF should use the indicators already suggested in

AAF to measure the maturity level of each practice. For the new practices identified in Level 1 - Essentials, they should be assessed through the assessment table and indicators suggested in table 4 and table 5, respectively.

5.2.2. Findings of question of research 2

Research question 2 was “*What is the action plan that has the goal to improve the maturity level of agile practices associated with barriers and enablers of an agile transformation?*”. Through the creation of step 4 – Improvement Plan, it was possible to create a plan that mitigates barriers and accelerate the enablers. The plan consists of a set of actions, best practices and tools that can be tried out by the teams to understand which are the most efficient (table 8).

6. Conclusions

EAT aims to define a theoretical model that guides organizations in adopting agile methods, highlighting the most important agile practices and adding an improvement plan to help increase the maturity of the agility level that is intended to be achieved in each organization. The structure was based on the AAF theoretical model that evolved in this research through the creation of a new Agile Level 1– Essentials, where new agile practices associated with barriers and enablers of an agile transformation were added. Was also considered a new stage in the process – Stage 4: Improvement Plan – where was defined a set of recommendations, actions and tools found in the scientific literature that aimed to improve the degree of maturity of each barrier and enabler. With EAT theoretical model, organizations involved in an agile transformation have a better direction they can take to successfully move to the next agile level, with clear instructions about how they can holistically implement these practices in their teams (Highsmith, 2006). This research represents a considerable contribution to the theory and literature review due to the clear direction that provide to the organizations and which is currently missing (Sillitti, Ceschi, Russo & Succi, 2005; Schwaber, Laganza & D'Silva, 2007). In conclusion, EAT represents a theoretical model that serves as a guide for organizations that intend to start adopting agile practices in their projects and teams.

6.1. Limitations

It is important to recognize that this research has some limitations. In first place, the data of this study was collected via secondary data. In second place, the data validation was obtained through a focus group of 10 experts which could represent a small sample. In third place, Step 4 – Improvement Plan only suggests recommendations and actions for agile practices of Level 1 – Essentials. In fourth place, the assessment indicators of the new practices of Level 1 – Essentials are already defined but need to be validated and will be tested in further research.

6.2. Future lines of research

It is recommended the development of an improvement plan for all levels and agile practices contained in EAT. It is also recommended that the EAT be tested and validated through qualitative studies, namely through case studies carried out in organizations from several sectors. Other approaches are also recommended that allow the validation and consolidation of agile practices at each level.

References

Abdelnour-Nocera J., Sharp H. (2008). Adopting Agile in a Large Organisation. In: Abrahamsson P., Baskerville R., Conboy K., Fitzgerald B., Morgan L., Wang X. (eds) *Agile Processes in Software Engineering and Extreme Programming*. XP 2008. Lecture Notes in Business Information Processing, vol 9. Springer, Berlin, Heidelberg. DOI: http://dx.doi.org/10.1007/978-3-540-68255-4_5

Anand, R.V. & Dinakaran, M. (2016). Popular Agile Methods in Software Development: Review and Analysis. *International Journal of Applied Engineering Research*, 11(1), 3433-3437.

Alliance, S. (2015). Scrum Guide. Retrieved from <https://www.scrumalliance.org/why-scrum/scrum-guide>

Batista, F. Pereira, L. & da Costa, R.L. (in press)a. Agile project and portfolio management: a systematic literature review. *International Journal of Process Management and Benchmarking*.

Batista, F.B., Pereira, L.F. & da Costa, R.L. (in press)b. Success and Barrier Factors in Agile Transformations. *International Journal of Agile Systems and Management*.

Beck, K., Cockburn, A., Jeffries, R. & Highsmith, J. (2001). Agile manifesto. Available: <http://www.agilemanifesto.org>

Becker, J., Knackstedt, R. & Pöppelbuß, J. (2009). Developing maturity models for IT management. *Business & Information Systems Engineering*, 1(3), 213–222. DOI: <https://doi.org/10.1007/s12599-009-0044-5>

Boehm, B. & Turner, R. (2005), Management challenges to implementing agile processes in traditional development organizations. *IEEE Software*, 22(5). DOI: [10.1109/MS.2005.129](https://doi.org/10.1109/MS.2005.129).

Boehm B. (2002). Get ready for Agile methods, with care. *IEEE Computer*, 35(1), 64-69. DOI: [10.1109/2.976920](https://doi.org/10.1109/2.976920)

Bondar, S., Hsu, J.C., Pfouga & A., Stjepandić, J. (2017). Agile digital transformation of System-of-Systems architecture models using Zachman framework. *Journal of Industrial Information Integration*. 7, 33-43. DOI: <https://doi.org/10.1016/j.jii.2017.03.001>

Calnan, M., & Rozen, A. (2019). ING's Agile Transformation—Teaching an Elephant to Race. *Journal of Creating Value*, 5(2), 190 - 209. DOI: <https://doi.org/10.1177%2F2394964319875601>

Conboy, K., Coyle, S., Wang, X. & Pikkariainen, M. (2011). People over Process: Key Challenges in Agile Development. *IEEE Software*, 28(4), 48-57. DOI: [10.1109/MS.2010.132](https://doi.org/10.1109/MS.2010.132).

Dybå, T. & Dingsøyr, T. (2008). Empirical studies of Agile software development: a systematic review. *Information Software Technology*. 50 (9-10), 833–859. DOI: <https://doi.org/10.1016/j.infsof.2008.01.006>

Dosquet, E., Conticello, J.-C., Dosquet, F., Dour, B. & Van Bennekum, A. (2017). L'innovation agile: Guide de survie dans un monde en disruption (Collection). *Herblain, France: Éditions ENI*.

Gandomani, T.J., Zulzalil, H., Ghani, A., Sultan, A.M. & Nafchi, M.Z. (2013). Obstacles to moving to agile software development; At a Glance. *Journal of Computer Science*, 9(5), 620-625. DOI: [10.3844/jcssp](https://doi.org/10.3844/jcssp)

Gandomani, T.J. & Nafchi, M.Z. (2015). An empirically developed framework for Agile transition and adoption: A Grounded Theory approach. *Journal of Systems and Software*. 107(1), 204-219. DOI: <https://doi.org/10.1016/j.jss.2015.06.006>.

Gandomani, T.J. & Ziaei, M. (2016). The Essential Prerequisites of Agile Transition and Adoption: a Grounded Theory Approach. *Journal of Internet Computing and Services*, 17(5), 173-183. DOI: [10.7472/jksii.2016.17.5.173](https://doi.org/10.7472/jksii.2016.17.5.173)

Goulding, C. (2002). *Grounded Theory: A Practical Guide for Management. Business and Market Researchers*. London: Sage.

Kalenda, M., Hyna, P. & Rossi, B. (2018). Scaling agile in large organizations: Practices, challenges, and success factors. *Journal of Software: Evolution and Process*, 30. DOI: <https://doi.org/10.1002/smr.1954>

Korhonen, K. (2013). Evaluating the impact of an Agile transformation: a longitudinal case study in a distributed context. *Software Quality Journal*, 21, 99–624. DOI: <https://doi.org/10.1007/s11219-012-9189-4>

Hamed, A.M.M. & Abushama, H. (2013). Popular agile approaches in software development: Review and analysis. *Computing, Electrical and Electronics Engineering (ICCEEE), International Conference*, 160-166. DOI: [10.1109/ICCEEE.2013.6633925](https://doi.org/10.1109/ICCEEE.2013.6633925)

Henriksen, A. & Pedersen, S. (2017). A qualitative case study on agile practices and project success in agile software projects. *The Journal of Modern Project Management*, 5, 62-73. DOI: [10.19255/JMPM01306](https://doi.org/10.19255/JMPM01306).

Highsmith, J. (2006). Agile: From Rogue Teams to Enterprise Acceptance. *Cutter Consortium: Business Technology Trends and Impacts*.

Laloux, F. (2014). *Reinventing organizations: A guide to creating organizations inspired by the next stage of human consciousness*. Brussels, Belgium: Nelson Parker.

Lappi, T., Karvonen, T., Lwakatare, L.E., Aaltonen, K. & Kuvaja, P. (2018). Toward an Improved Understanding of Agile Project Governance: A Systematic Literature Review. *Project Management Journal*, 49(6), 39-63. DOI:[10.1177/8756972818803482](https://doi.org/10.1177/8756972818803482)

Lindvall, M., Muthig, D., Dagnino, A., Wallin, C., Stupperich, M., Kiefer, D., May, J. & Kähkönen, T. (2004). Agile software development in large organizations. *Computer*, 37(12), 26-34. DOI: [10.1109/MC.2004.231](https://doi.org/10.1109/MC.2004.231).

Misra, S. C., Kumar, V. & Kumar, U. (2009). Identifying some important success factors in adopting agile software development practices. *Journal of Systems and Software*, 82(11), 1869-1890. DOI: <http://www.dx.doi.org/10.1016/j.jss.2009.05.052>

Moore, D.M., Crowe, P. & Cloutier, R. (2011). The balance between methods and people. *CrossTalk*, (24), 11-14

Misra, S.C., Kumar, V. & Kumar, U. (2009). Identifying some important success factors in adopting agile software development practices. *The Journal of Systems and Software*, 82(11), 1869-1890. DOI: <https://doi.org/10.1016/j.jss.2009.05.052>.

Moe, N.B., Dingsoyr, T. & Oyvind, K. (2009). Understanding shared leadership in agile development: A case study. *Proceedings of the 42nd Hawaii International Conference on System Sciences*, Jan. 5-8, IEEE Xplore Press, Waikoloa, HI, 1-10. DOI: [10.1109/HICSS.2009.480](https://doi.org/10.1109/HICSS.2009.480)

Monteiro, C.V.F., Silva, F.Q.B.D., Santos, I.R.M.D., Farias F. & Cardozo, E.S.F. (2011). A qualitative study of the determinants of self-managing team effectiveness in a scrum team. *Proceedings of the 4th International Workshop on Cooperative and Human Aspects of Software Engineering*, (SE' 11), ACM Press, New York, USA., pp: 16-23. DOI: [10.1145/1984642.1984646](https://doi.org/10.1145/1984642.1984646)

Morgan, G. (1986). *Images of organization*. Sage Publications, Beverly Hills

Nerur, S., Mahapatra, R. & Mangalaraj, G. (2005). Challenges of migrating to agile methodologies. *Communications of the ACM*, 48(5), 72-78. DOI: <http://www.dx.doi.org/10.1145/1060710.1060712>

Norton, D. (2008). The Current State of Agile Method Adoption. Gartner. Retrieved from: <http://audacium.com/wp-content/uploads/2012/05/Mode%23U0300le-de-maturite%23U0301-Agile-Gartner-version-anglaise1.pdf>

Ozcan Top, Demirors. (2013). Assessment of agile maturity models: a multiple case study. *SPICE 2013, CCIS 349*, vol. 349. Springer: Berlin Heidelberg, 130–141. DOI: http://dx.doi.org/10.1007/978-3-642-38833-0_12

Paasivaara, M., Behm, B., Lassenius C. & Hallikainen, M. (2018). Large-scale agile transformation at Ericksson: a case study. *Empirical Software Engineering*, 23(3), 2550–2596. DOI: <https://doi.org/10.1007/s10664-017-9555-8>

Pereira, L.F. & Santos, J.S. (2020). Pereira Problem Solving. *International Journal of Learning and Change*. 12(3), 274 – 283. DOI: <https://doi.org/10.1504/IJLC.2020.108348>

Petersen, K. & Wohlin, C. (2010). The Effect of Moving from a Plan-Driven to an Incremental Software Development Approach with Agile Practices. *Empirical Software Engineering*, 15(6), 654–693. DOI: <https://doi.org/10.1007/s10664-010-9136-6>

Pikkarainen, M., Salo, O., Kuusela, R. et al. (2012). Strengths and barriers behind the successful agile deployment—insights from the three software intensive companies in Finland. *Empir Software Eng*, 17, 675–702. DOI: <https://doi.org/10.1007/s10664-011-9185-5>

Qumer, A. & Henderson-Sellers, B. (2006). Crystalization of Agility: Back to Basics. *Icsoft 2006 - International Conference on Software And Data Technologies*.

Qumer, A. & Henderson-Sellers, B. (2008). A framework to support the evaluation, adoption and improvement of agile methods in practice. *Journal of Systems and Software*, 81(11), 1899–1919. DOI: <https://doi.org/10.1016/j.jss.2007.12.806>

Martin A. et al. (2005). XP/Agile Education and Training. In: *Baumeister H., Marchesi M., Holcombe M. (eds) Extreme Programming and Agile Processes in Software Engineering. XP 2005*. Lecture Notes in Computer Science, vol 3556. Springer, Berlin, Heidelberg. DOI: https://doi.org/10.1007/11499053_42

Murphy, T. & Cormican, K. (2015). Towards holistic goal centered performance management in software development: lessons from a best practice analysis. *International Journal of Information Systems and Project Management*, 3(4), 23–36. DOI: [10.12821/ijispm030402](https://doi.org/10.12821/ijispm030402)

Raudberget, D., Elgh, F., Stolt, R., Johansson, J. and Lennartsson, M. (2019). Developing agile platform assets – exploring ways to reach beyond modularisation at five product development companies. *Int. J. Agile Systems and Management*. 12(4),311–331. DOI: <https://dx.doi.org/10.1504/IJASM.2019.104588>

Reifer, D.J., Maurer, F. & Erdogmus, H. (2003). Scaling agile methods. *IEEE Software*, 20(4), 12–14. DOI: [10.1109/MS.2003.1207448](https://doi.org/10.1109/MS.2003.1207448).

- Rising L. & Janoff S. (2000). The scrum software development process for small teams. *IEEE Software*, 17(4), 26-32. DOI: <http://dx.doi.org/10.1109/52.854065>
- Röglinger, M., Pöppelbuss, J. & Becker, J. (2012). Maturity models in business process management. *Business Process Management Journal*. 18(2), 328–346. DOI: <http://dx.doi.org/10.1108/14637151211225225>
- Saunders, M., Lewis, P. & Thornhill, A. (2009). *Research Methods for Business Students* (5th ed.). London: Pearson Education.
- Schatz, B. & Abdelshafi, I. (2005). Primavera gets agile: a successful transition to agile development. *IEEE Software*, 22(3), 36-42. DOI: [10.1109/MS.2005.74](http://dx.doi.org/10.1109/MS.2005.74).
- Schweigert, T., Vohwinkel, D., Korsaa, M., Nevalainen, R. & Biro, M. (2013) Agile Maturity Model: A Synopsis as a First Step to Synthesis. *McCaffery F., O'Connor R.V., Messnarz R. (eds) Systems, Software and Services Process Improvement. EuroSPI 2013. Communications in Computer and Information Science*, vol 364. Springer, Berlin, Heidelberg. DOI: https://doi.org/10.1007/978-3-642-39179-8_19
- SEI. (2010). CMMI for Development (CMMI-DEV), Version 1.3
- Sidky, A., Arthur, J. & Bohner, S.A. (2007). A disciplined approach to adopting agile practices: the agile adoption framework. *Innovations in Systems and Software Engineering*, 3(1), 203-216. DOI: <https://doi.org/10.1007/s11334-007-0026-z>
- Sillitti, A., Ceschi, M., Russo, M. & Succi, G. (2005). Managing uncertainty in requirements: a survey in documentation-driven and Agile companies. *Proceedings of 11th IEEE International Symposium on Software Metrics*. 10-17. DOI: [10.1109/METRICS.2005.29](http://dx.doi.org/10.1109/METRICS.2005.29).
- Schwaber, K., Laganza, G. & D'Silva, D. (2007). The Truth about Agile Processes: Frank Answers to Frequently Asked Questions, *Forrester Report*.
- Schatz, B. & Abdelshafi, I. (2005). Primavera gets agile: a successful transition to agile development in IEEE Software, 22 (3), 36-42. DOI: [10.1109/MS.2005.74](http://dx.doi.org/10.1109/MS.2005.74).
- Sommer, A. (2019). Agile Transformation at LEGO Group, *Research-Technology Management*, 62(5), 20-29, DOI: [10.1080/08956308.2019.1638486](https://doi.org/10.1080/08956308.2019.1638486)
- The Standish Group. (2015). The Chaos Report 2015. Retrieved from https://www.standishgroup.com/sample_research_files/CHAOSReport2015-Final.pdf last accessed 08 May 2021

Tooranloo, H.S. & Saghafi, S. (2018). The relationship between organisational agility and applying knowledge management, *International Journal of Agile Systems and Management*, 11(1), 41-66. DOI: [10.1504/IJASM.2018.091360](https://doi.org/10.1504/IJASM.2018.091360)

Vallon, R., Estácio, B., Prikladnicki, R. & Grechenig, T. (2017). Systematic literature review on agile practices in global software development. *Information and Software Technology*. 96, 161-180

Vijayasathy, L. & Turk, D. (2012). Drivers of agile software development use: Dialectic interplay between benefits and hindrances. *Information and Software Technology*, 54(2), 137-148. DOI: <http://www.dx.doi.org/10.1016/j.infsof.2011.08.003>

VersionOne Inc. (2016). 10th annual “state of Agile development” survey. *Version Inc.*

Yang, H., Huff, S. & Strode, D. (2009). Leadership in software development: Comparing perceptions of agile and traditional project managers. *Proceedings of the 15th Americas Conference on Information Systems*, Aug. 6-9, San Francisco, California, USA. 184-184.