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A disciplined approach to adopting agile practices: the agile adoption framework

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Abstract Many organizations aspire to adopt agile processes to take advantage of the numerous benefits that they offer to an organization. Those benefits include, but are not limited to, quicker return on investment, better software quality, and higher customer satisfaction. To date, however, there is no structured process (at least that is published in the public domain) that guides organizations in adopting agile practices. To address this situation, we present the agile adoption framework and the innovative approach we have used to implement it. The framework consists of two components: an agile measurement index, and a four-stage process, that together guide and assist the agile adoption efforts of organizations. More specifically, the Sidky Agile Measurement Index (SAMI) encompasses five agile levels that are used to identify the agile potential of projects and organizations. The four-stage process, on the other hand, helps determine (a) whether or not organizations are ready for agile adoption, and (b) guided by their potential, what set of agile practices can and should be introduced. To help substantiate the "goodness" of the Agile Adoption Framework, we presented it to various members of the agile community, and elicited responses through questionnaires. The results of that substantiation effort are encouraging, and are also presented in this paper.

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1 Introduction and motivation

Over the past few years organizations have asked the agile community: "Why should we adopt agile practices?" [24]. Numerous success stories highlighting the benefits reaped by organizations successfully adopting agile practices provide relevant answers to this question [8,9,29,31,38,45]. As a result, many organizations are now aspiring to adopt agile practices. Once again, however, they are turning to the agile community, but with a different question: "How do we proceed with adopting agile practices? " [24]. Unfortunately, there exists no structured approach (at least published in the public domain) for agile adoption. The absence of guidance and assistance to organizations pursuing agility is the main problem addressed by this paper.

A major factor contributing to this absence is the number of issues a structured approach must address when providing organizations with guidance for the successful adoption of agile practices. These include, among other issues, determining: (1) the organization's readiness for agility, (2) the practices it should adopt, (3) the potential difficulties in adopting them, (4) and finally, the necessary organizational preparations for the adoption of agile practices.

The agile adoption framework, introduced in this paper, is an attempt to address the issues mentioned above by providing a structured and repeatable approach designed to guide and assist agile adoption efforts. It is designed to assist the agile community in supporting the growing demand from organizations that want to adopt agile practices.
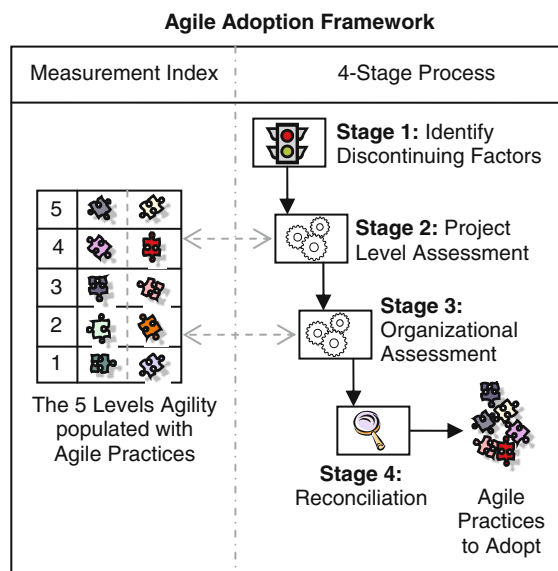
The agile adoption framework has two main components: (1) a measurement index for estimating agile potential, and (2) a four-stage process that employs the measurement index in determining which, and to what extent, agile practices can be introduced into the organization. Figure 1 illustrates the

Agile Adoption Framework

Fig. 1 Overview of the agile adoption framework

different components of the framework and the relationships among them.

The first component, the Sidky agile measurement index (SAMI), is a scale the coach uses to identify the agile potential of a project or organization. The agile measurement index is used in the process component of the framework, which consists of four stages working together to guide organizations in identifying agile practices that best fit into their environment. The four stages are:

- *Stage 1: Identification of discontinuing factors*. Discovers the presence of any "show stoppers" that can prevent the adoption process from succeeding.
- *Stage 2: Project level assessment*. Utilizes the SAMI to determine the target level of agility for a particular project.
- *Stage 3: Organizational readiness assessment*. Uses the SAMI to assess the extent to which the organization can achieve the target agility level identified for a project.
- *Stage 4: Reconciliation*. Determines the final set of agile practices to be adopted by reconciling the target agile level for a project (from stage 2) and the readiness of the embodying organization (from stage 3).

As outlined above, the agile adoption framework provides an essential ingredient for successfully adopting agile practices, but this alone is not enough. Some element of interpreting the measures and guidance throughout the four stages of the framework is also important—perhaps via an experienced agile coach or an in-house employee with sufficient training on agile methods and the use of the framework.

The remainder of this paper presents the agile adoption framework and provides insights gained through industry interactions to substantiate our work. Section 2 presents the structure and details of the Sidky agile measurement index (SAMI). Each of the four stages in the process is then presented in detail in Sect. 3. Section 4 presents industry feedback regarding the framework. Section 5 provides concluding remarks about the agile adoption framework.

2 Agile measurement index

One of the concerns organizations have when seeking to adopt agile practices is determining how agile they can become [20]. The agile potential (i.e., the degree to which that entity can adopt agile practices) of projects and organizations is influenced by the circumstances surrounding them. To determine the agile potential, the coach (or the one conducting the assessment) needs some measurement index or scale to enable an assessment of the agility of an entity. The agile adoption framework refers to this scale as the SAMI.

The agile adoption framework uses the SAMI to determine the agile potential of projects and organizations. The SAMI is an agile measurement index that is composed of four components:
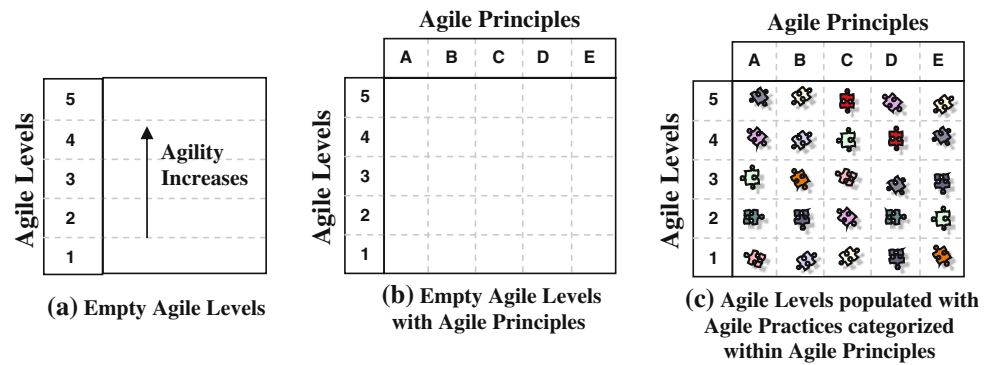
1. Agile levels: a set of agile practices that are related and, when adopted, make significant improvements in the software development process, thereby leading to the realization of a core value of agility
2. Agile principles: guidelines that need to be employed to ensure that the development process is agile
3. Agile practices and concepts: concrete activities and practical techniques used to develop and manage software projects in a manner consistent with the agile principles
4. Indicators: questions the assessor uses to assess certain characteristics of an organization or project, such as its people, culture and environment, in order to assess the readiness of the organization or project to adopt an agile practice.

Sections 2.1–2.4 introduce each of components of the SAMI. Section 2.5 focuses on issues related to the tailorability of the measurement index.

2.1 Agile levels

Agile levels, as depicted in Fig. 2a, are considered the units of the measurement scale as they enumerate the different possible degrees of agility for a project or organization. The agile potential of a project or organization is expressed in terms the highest agile level it can achieve. The attainment

Fig. 2 Components of the SAMI (indicators are not shown)

(a) Empty Agile Levels

(b) Empty Agile Levels with Agile Principles

(c) Agile Levels populated with Agile Practices categorized within Agile Principles

of a particular level symbolizes that the project or organization has realized and embraced the essential element needed to establish an agile development process. For example, when the elements inherent to *enhancing communication and collaboration* are embodied within the development process, then Agile level 1 (*collaborative*) is attainted. However, before one can expect to move to level 2 status, all practices associated with agile level 1 must be achieved (or achievable).

The five levels of agility are designed to represent the core qualities of the agile manifesto [2], rather than the qualities related to any particular agile method. After careful analysis of the manifesto, five essential agile qualities have been identified. Those qualities constitute the five levels of agility that are used by the SAMI:

- *Level 1: Collaborative*. This level denotes the fostering of *communication and collaboration between all stakeholders*. The dimension of collaboration is the foundation of agile software development [16,17,42].
- *Level 2: Evolutionary*. Evolutionary development is the *early and continuous delivery of software*. It, too, is fundamental because every agile method assumes its presence [30].
- *Level 3: Effective*. The focus of this level is to increase efficiency of the development process by adopting *engineering practices* that will lead to the *development of high quality working software*. This is needed to prepare the development process for the next level where it can respond to constant change without jeopardizing the software system being developed [17,26].
- *Level 4: Adaptive*. This level constitutes establishing the agile quality of *responding to change in the process*. Defining and responding to multiple levels of feedback is essential to this level [23].
- *Level 5: Encompassing*. Agility is essentially a culture, and it is important to have an environment that is reflective and supportive of the agile nature of the software development process. This level concentrates on estab-

lishing an *all-encompassing environment* to sustain and foster agility throughout an organization.

Each of the agile levels is composed of a set of agile practices that introduce and sustain the agile quality pertinent to that level. The selection of agile practices and concepts assigned to each agile level is guided by the second component of the measurement index, *agile principles*.

2.2 Agile principles

Agile principles are the essential characteristics that must be reflected in a process before it is considered *agile*. For example, two key agile principles are *human centric*, which refers to the reliance on people and the interaction between them, and *technical excellence*, which implies the use of procedures that produce and maintain the highest quality of code possible. The agile manifesto outlines 12 principles that characterize agile development processes [13]. After careful grouping and summarization, five agile principles emerged that capture the essence of the 12. These five principles guide the refinement or tailoring of the five levels of agility:

- *Embrace change to deliver customer value* [12]. The success of a software development effort is based on the extent to which it helps deliver customer value. In many cases the development team, as well as the customer, are in a continuous learning process as to the requirements necessary to realize additional customer value. Hence, an attitude of welcoming and embracing change should be maintained throughout the software development effort.
- *Plan and deliver software frequently* [13,18,36]. Early and frequent delivery of working software is crucial, because it provides the customer with a functional piece of the product to review and provide feedback on. This feedback is essential for the process of planning for upcoming iterations as it shapes the scope and direction of the software development effort.

- *Human centric* [16]. The reliance on people and the interactions among them is a cornerstone in the definition of agile software processes.
- *Technical excellence* [23,28]. Agile developers are committed to producing only the highest quality code possible, because high quality code is essential in high-speed development environments, such as the ones characterized as agile.
- *Customer collaboration* [13]. Inspired from the original statement of the agile manifesto, there must be significant and frequent interaction between the customers, developers, and all the stakeholders of the project to ensure that the product being developed satisfies the business needs of the customer.

In effect, agile principles are used to ensure that the agile levels embody the essential characteristics of agility. Figure 2b illustrates the relationship between agile levels and agile principles. Each agile level should contain agile practices associated with most, if not all, of the agile principles. The principle reflects the approach that the agile practice uses to promote the agile quality pertinent to a level. For example, all of the practices in level 3 (Effective) promote the agile objective of *developing high quality, working software in an efficient an effective manner*. *How* that objective is achieved though, is determined by the practices associated with agile principles spanning each level. Along the same lines, practices associated with the *technical excellence* principle will promote its agile objective by focusing on enhancing the technical aspect of the process, while practices associated with the *human centric* principle promote enhancing the human aspect of the process.

The real essence of the SAMI, however, is in the agile practices it enunciates. The next section presents the third component of the five levels of agility—the *agile practices*.

2.3 Agile practices

Agile practices are concrete activities and practical techniques that are used to develop and manage software projects in a manner consistent with the agile principles. For example, *paired programming*, *user stories*, and *collaborative planning* are all agile practices. Since the agile levels are composed of agile practices (organized along the line of agile principles— see Fig. 2c), they are considered the basic building block of the agile measurement index. The attainment of an agile level is achieved only when the agile practices associated with it are adopted.

After surveying the agile methods currently used in industry [3,26,28], 40 distinct agile practices were selected to populate the SAMI. These practices, arranged along the lines of the agile levels and principles are illustrated in Table 1. (Underlined practices should be ignored at this point, but are

discussed later in the paper.) Although a detailed discussion about each of the agile practices and concepts is outside the scope of this paper, the references associated with each are good starting points to learn more about them.

2.4 Indicators

Agile practices serve to support the production of software according to the agile principles. These principles act as goals. The goal-question-indicator-metric (GQIM) paradigm introduced by Basili and Rombach [10] and evolved by Park et al. at the Software Engineering Institute [34], provides a relevant approach for moving from goals to the measures used to make decisions about agility issues. From the agility goals, a set of questions is derived that if answered would determine the degree to which the goal has been met. From these questions, a set of indicators mapped to relevant metrics, accompany each agile practice or concept in the measurement index. Each indicator is designed to measure a particular organizational characteristic necessary for the successful adoption of the agile practice to which the indicator is related. The agile coach uses these indicators/metrics to determine the extent to which the organization is ready to adopt an agile practice or concept.

For example, assume the coach wants to determine the extent to which the organization is ready to adopt *coding standards* (level 1, technical excellence). In this respect, two organizational characteristics that need to be assessed are: (1) to what extent do the developers understand the benefits behind coding standards?, and (2) how willing are they to conform to coding standards? Several indicators (or questions) are used to assess each of these characteristics. For example, to assess the second (willingness), the assessor might ask the developers to what extent would they abide by coding standards even when under a time constraint.

The SAMI contains approximately 300 different indicators for the 40 agile practices. A detailed listing of all the indicators associated with each agile level is found in the framework's technical documentation [40].

The SAMI shown in Table 1 is one instance of the agile measurement index. Can there, however, be alternate instances? We address that issue in the next section.

2.5 Tailorability of the SAMI

The SAMI, along with its levels, practices and indicators, was presented to members of the agile community. Several of its leaders encouraged us to consider factors that might lead to alternate instances of the measurement index. These factors are *incorporating business values* and *reorganizing the practices based on experiential success*. The two following subsections elaborate on these factors.

Table 1 The five levels of agility populated with agile practices and concepts

	Agile Principles				
	Embrace Change to Deliver Customer Value	*Plan and Deliver Software Frequently*	*Human Centric*	*Technical Excellence*	*Customer Collaboration*
Level 5 Encompassing *Establishing a vibrant environment to sustain agility*	Low process ceremony [33, 39]	Agile project estimation [20]	Ideal agile physical setup [33]	Test driven development [11] Paired programming [49] No/minimal number of level -1 or 1b people on team [17, 15]	Frequent face-to-face interaction between developers & users (collocated) [12]
Level 4 Adaptive *Responding to change through multiple levels of feedback*	Client driven iterations [33] Continuous customer satisfaction feedback [35, 43]	Smaller and more frequent releases (*4-8 weeks*) [35] Adaptive planning [33] [20]		Daily progress tracking meetings [6] Agile documentation [40, 31] User stories [21]	Customer immediately accessible [15] Customer contract revolves around commitment of collaboration [26, 35]
Level 3: Effective *Developing high quality, working software in an efficient an effective manner*		Risk driven iterations [33] Plan features not tasks. [20] Maintain a list of all features and their status (backlog) [31]	Self organizing teams [33, 39, 31, 18] Frequent face-to-face communication [39, 18, 13]	Continuous integration [33] Continuous improvement (refactoring) [31, 12, 24, 5]. Unit tests [28] 30% of level 2 and level 3 people [17, 15]	
Level 2: Evolutionary *Delivering software early and continuously*	Evolutionary requirements [33]	Continuous delivery [33, 31, 26, 12] Planning at different levels [20]		Software configuration management [31] Tracking iteration progress [33] No big design up front (BDUF) [4, 12]	Customer contract reflective of evolutionary development [26, 35]
Level 1: Collaborative *Enhancing communication and collaboration*	Reflect and tune process [35, 43]	Collaborative planning [39, 18, 33]	Collaborative teams [46] Empowered and motivated teams [13]	Coding standards [29, 48, 36] Knowledge sharing tools [33] Task volunteering [33]	Customer commitment to work with developing team [13]

2.5.1 Incorporating business values

Business values refer to the added benefit realized by an organization after adopting agile practices. For most organizations, the achievement of these business values is the real incentive behind adopting agility. For example, *decreasing time to market* or *increasing product quality* are common business values that organizations hope to realize from adopting agile practices. Augustine (A. Sanjiv, personal communication, 2006) and A. Elssamadisy (personal communication, 2006) have suggested that the levels of agility might be prioritized according to the business values an organization hopes to realize. This suggestion is both valuable and beneficial to the growth the framework, because currently, the five levels of agility are not associated with any business values; instead they are based on the qualities and values of agility. This relation between agile and business values is parallel to that between the agile manifesto (focusing on agile values) and the declaration of interdependence (capturing the business values) [1,2].

2.5.2 Reorganizing the practices based on experiential success

The agile coaches and consultants A. Cockburn (personal communication, 2006), M. Cohn (personal communication, 2006), and W. Wake (personal communication, 2006), in addition to others, suggest a reorganization of the agile practices based on experiential successes. That is, they advocate that the kind of projects and the experiences gained from previous adoption efforts can, and should, serve as a basis for formulating a better arrangement of the practices within the agile levels. For example, Cohn has suggested that *user stories* be introduced in the first level of agility, because, from his experience, they enhance collaboration and communication between the stakeholders with regard to requirements. Others suggest that *pair programming* be in the first level because it helps to establish collaboration within teams. This inability to reach a consensus on the position of agile practice emphasizes an important factor in providing guidance in an agile adoption effort: the *adherence* to agile principles when establishing the levels is paramount, not the *positions* of the actual practices. The intention behind the levels of agility is to provide a framework to guide the adoption process, not to dictate it

Based on the above rationalizations, we conclude that a tailorable measurement index is both desirable and beneficial. However, when tailoring or creating another instance of the SAMI, it is important to observe the following guidelines to ensure that the new measurement index has all the necessary components and a valid structure:

- *Ensure that multiple levels exist*. Levels are needed to enumerate the degrees of agility. Without levels, the power of the measurement index, when used in conducting comparative measurements of the agility, is diminished.
- *The measurement index is based on practices and concepts*. Foundational to the agile measurement index are agile practices and concepts. The extent to which agile practices and concepts can be adopted determines the agility of a process.
- *Each practice or concept has indicators*. When introducing a new agile practice (other than the 40 identified) to the measurement index, it is important that the practice has an associated set of valid and sufficient indicators. Without indicators, there are no means by which this assessment can be conducted.

The next section presents the second component of the agile adoption framework—the four-stage process. This component utilizes the SAMI to provide structured guidance and assistance to organizations seeking to adopt agile practices.

3 The four-stage process for agile adoption

The four-stage assessment process is the "backbone" of the agile adoption framework. As depicted in Fig. 3, it first provides an assessment component that helps determine if (or when) an organization is ready to move toward agility, i.e., make the go/no-go decision. Secondly, the process guides and assists the agile coach in the process of identifying which agile practices the organization should adopt. The four stages are grouped according to the objective they help to achieve:
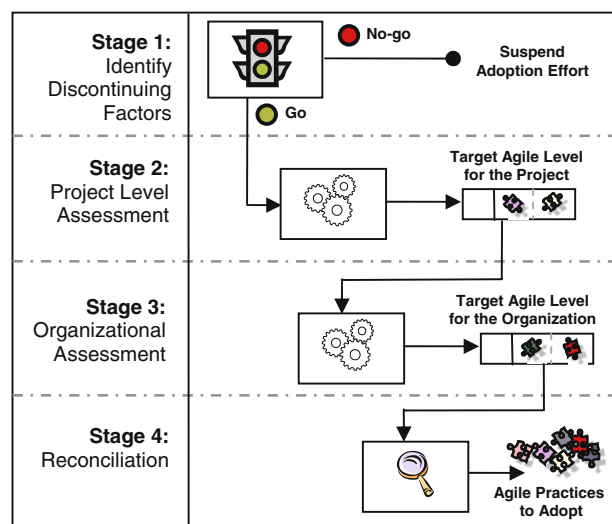
Fig. 3 The four-stage process for agile adoption

- Objective 1: Make go/no-go decision
  - *Stage 1*: Discontinuing factors
- Objective 2: Identify agile practices to adopt
  - *Stage 2*: Project level assessment
  - *Stage 3*: Organizational readiness assessment
  - *Stage 4*: Reconciliation

The next sections explain in detail how each stage of the four-stage process contributes to achieving its enunciated objectives.

3.1 Making the go/no-go decision

The first objective of the process is to provide organizations with a method for deciding whether or not to proceed with agile adoption initiatives. Since adopting agile practices is essentially a type of software process improvement (SPI), a pre-assessment phase is needed before the decision to start the initiative is made. Traditionally, pre-assessments determine the ability of the organization to undertake an SPI initiative [22]. Organizations lacking the factors necessary for a successful SPI effort are considered "not ready." In that situation the SPI effort is suspended until the missing factors can be mitigated.

Similarly, with respect to agile adoption, pre-assessment helps identify factors in an organization that can prevent the successful adoption of agile practices. If such factors exist, the organization must eliminate them before continuing with the adoption effort. Pre-assessment processes like these are important because they save the organization time, money and effort by identifying upfront missing or existing factors that can cause an SPI initiative to fail [27].

The next section describes how stage 1 of the process guides and assists organizations in making go/no-go decisions concerning the adoption of agile practices. This decision is determined by a pre-assessment activity that identifies any discontinuing factors.

3.1.1 Stage 1: Identifying discontinuing factors

The intent of stage 1 is to provide an assessment process that identifies key factors which could prevent the successful adoption of agile practices. These are called *discontinuing factors*, and can vary from one organization to another. Typically, they pertain to an organization's resources including money, time and effort, as well as the support of its leadership. The following are the three discontinuing factors identified by the agile adoption framework:

- *Inappropriate need for agility*: This refers to situations where, from a business or software development perspective, adopting agility does not add any value [41].

- *Lack of sufficient funds:* When funds are unavailable or insufficient to support the agile adoption effort, then an adoption process is not feasible.
- *Absence of executive support:* If committed support from executive sponsors is absent, then effective and substantial change in the organization is unlikely to occur [35,41].

When an organization demonstrates *any* of these discontinuing factors, it is unprepared to move towards agility and should suspend the adoption process until the environment is more supportive.

Indicators focusing on organizational characteristics are used to assess the degree to which a discontinuing factor is present in the organization. The assessor uses one or more indicators to evaluate each organizational characteristic. For example, two organizational characteristics that can be measured to determine whether there is a *lack of sufficient funds* are (1) the dollar amount allocated to the process improvement effort and (2) the ability to actually spend the funds for agile adoption. An example of a question (indicator) used to assess the ability to spend funds on agile adoption is *Can the funds be spent towards any process improvement activity?* Another assessment question is *Are there any restrictions on the type of activities for which these funds can be used?* Over 20 indicators are included in the agile adoption framework to assess the presence of discontinuing factors in organizations [40].

3.2 Identify agile practices to adopt

If stage 1 indicates that the organization is ready to move towards agility, the journey of introducing agile practices into the development process begins. This involves determining which agile practices and concepts are most suitable for the organization to adopt. Actually, to be more precise, the agile adoption framework first determines the agile practices that a *particular project* can adopt, not the whole organization. The framework is based on the fundamental belief that each project in an organization can adopt a different degree of agility based on its context. Therefore, the last three stages provide guidelines for identifying the agile practices suitable for a single project:

- *Stage 2: Project level assessment*: identifies the maximum level of agility the project can reach. This is also known as the target agile level.
- *Stage 3: Organizational readiness assessment*: determines the extent to which the organization is ready to accommodate the project's target agile level.
- *Stage 4: Reconciliation*: settles the differences, if any, between the highest level of agility the project can adopt

and the level of agility the organization is ready to embrace, and determines the agile practices that are to be adopted.

Sections 3.2.1–3.2.3 describe each of these stages, respectively.

3.2.1 Stage 2: Project level assessment

Stage 2 is the first stage of the adoption process that utilizes the SAMI presented earlier. The objective of this stage is to identify the highest level of agility a project can achieve. This is called the target level and is one of the five agile levels.

In theory, all projects should aspire to reach the highest level of agility possible. However, the reality is that circumstances, often outside of the organization's control, surround each project. These circumstances become constraining factors if they adversely affect the organizations' ability to adopt an agile practice. Thus, constraining factors limit the level of agility to which a project aspires.

For example, *frequent face-to-face communication* is a desirable agile practice at level 3. A factor that is needed to successfully adopt this practice is *near team proximity*. Assume that the project and organization have no say in changing this project characteristic (i.e., factor), because it is outside of their control. If the project level assessment determines that the factor (near team proximity) is missing for this project, then the highest level of agility for this project will be the same level of agility in which this agile practice is found (which is level 3 in this case).

Because achieving the highest level of agility depends on project circumstances outside of an organization's control, the first step in project level assessment is to identify those agile practices and concepts that rely upon those circumstances for their successful adoption. These agile practices are known as *limiting agile practices*, because if the project characteristics needed to support these practices are not present, the inability to adopt the practice constrains or limits the level of agility attainable by the project. In Table 1, which illustrates the SAMI, the limiting agile practices are underlined.

The assessment process defined by stage 2 focuses on determining the target level of agility for a project. More specifically, it examines only those factors associated with the limiting agile practice, and measures the extent to which they are present. The assessment is conducted using the indicators associated with each limiting agile practice. The process starts by examining the limiting practices at agile level 1, and then moves upward on the scale. Once factors needed for the adoption of a limiting practice are found to be missing, the assessment process stops, and the highest level of

agility attainable for the project is set to be the level at which that limiting practice is found.

In summary, the target level of agility is determined at the point when the assessment process discovers that one of the project characteristics needed to adopt a limiting agile practice or concept is missing, and neither the project nor organization can do anything to influence or change this circumstance. After the target agile level for the project is identified, the next step in the journey is to conduct an organizational readiness assessment to determine the set of agile practices (for the project) that *can* be adopted.

3.2.2 Stage 3: Organizational readiness assessment

Identifying the target level for a project does not necessarily mean that that level is *achievable*. To determine the extent to which that target level can be achieved, the organization must be assessed to determine whether it is ready to adopt each of the agile practices and concepts associated up to, and including, the target level. Investing time and effort in this type of pre-adoption assessment of each agile practice increases the probability of success for the overall transition to agility [14], because it significantly reduces the risks associated with the agile adoption process.

Similar to stage 2, stage 3 of the process also relies on the Sidky agile measurement index (SAMI). The indicators play a critical role in determining the extent to which the target level can be achieved. To save time and money during this assessment stage, instead of assessing how ready the organization is relative to adopting the practices in all five agile levels, only those within the target agile level and below are used. The assessor uses the set of indicators (questions) associated with the agile practices to measure the extent to which each of these organizational characteristics are present.

For example, *collaborative planning* is an agile concept in level 1. To assess the readiness of the organization to adopt this concept, the following are some of the organizational characteristics that need to be present: (a) collaborative management style, (b) management buy-in to adopt the agile practice, (c) transparency of management, (d) small power-distance in the organization, and (e) developers buy-in to adopt the agile practice.

Each of these organizational characteristics is assessed using a number of different questions. Depending on the question, a manager or developer within the organization, or the assessor himself or herself answers it. The SAMI incorporates approximately 300 indicators to measure the various organizational characteristics related to agile practices and concepts [40].

The result of the organizational assessment stage is a table that depicts the extent to which each organizational characteristic is achieved (see Table 2). This format for displaying

Table 2 Organizational assessment results

Agile practices	Organizational characteristic needed	NA	PA	LA	FA
Reflect and tune	.....				
Collaborative planning	Transparency of management			X	
	Small power-distance in the organization				X
	Developers buy-in				X
	Collaborative management style		X		
	Management buy-in	X			
Coding standards	.....				

NA: Not Achieved (0%-35%)   **PA:** Partially Achieved (35%-65%)
LA: Largely Achieved (65%-85%)   **FA:** Fully Achieved (85%-100%)

results is beneficial to executives and decision makers as it draws attention to the characteristics of the organization that might cause the adoption of a practice to fail. Resembling project level assessment, determining the highest agile level an organization is capable of achieving is dependent on the organization's readiness to adopt the practices in that agile level. If the organizational characteristics needed for a practice are found to be *not achieved* or only *partially achieved*, then this is an indication that the organization is not ready to adopt that practice. As a result, the highest level of agility the organization can reach becomes the level at which a necessary organizational characteristic is missing. For example, in Table 2 since *collaborative planning* is in agile level 1, and since two of the characteristics that it needs are deficient, the highest level of agility for that organization is level 1.

3.2.3 Stage 4: Reconciliation

Following the organizational readiness assessment, the agile level achievable by the organization is known. Prior to that, stage 2 had identified the agile level that the project aspires to adopt. Therefore, the final step, reconciliation, is necessary to determine the agile practices the project will adopt. During this phase the differences between the target level and the organization's readiness are resolved to determine the final set of agile practices that will be adopted/employed. Three different scenarios are possible during this stage:

- *Organization readiness level > project target level*: No reconciliation is needed and all the practices within the project's agile level and below become the chosen agile practices for adoption. This is a rare case because the project environment is usually contained with the organization.

- *Organization readiness level = project target level*: No reconciliation is needed and all the practices within the project's agile level and below become the chosen agile practices for adoption. This is the ideal case since the project is achieving 100% of its agile potential.

- *Organization readiness level < project target level*: Reconciliation is necessary. As discussed below, the framework provides two options for reconciling this situation.

Option 1:
The first option relies on the how ready and willing the organization is for changes and improvements. The results of the organizational assessment have identified exactly which characteristics are hindering the organization from reaching higher levels of agility (i.e., the project's target level). If changing any of these characteristics is within the control of the organization, then the organization can undertake the necessary steps to improve these characteristics. Once all the recommended changes have been successfully made, the organization can support agile practices at the project's target level.

Option 2:
The second option is suitable for organizations that are not willing to invest time, effort or money towards change, and only wants to adopt those agile practices that are within their current capacity. In that case, it is recommended to adopt only the agile practices for which the organization is ready. The obvious downside to this approach is that the project is restricted to operating at a lower level of agility than its potential.

This reconciliation stage helps the organization realistically identify the agile practices it can adopt. At the same time, if the organization is able and willing to improve, then this stage guides it as to where the improvements need to occur so that the project can operate at its full agile potential. Moreover, by utilizing this approach, the organization prepares itself sufficiently before starting the process of introducing agile practices into the development process, thereby decreasing the impact of the adoption process.

The next section provides a brief overview of the results gathered from the substantiation of the agile adoption framework by the agile community.

4 Quantitative feedback on the agile adoption framework

A longitudinal study is the ideal way to validate the agile adoption framework. In particular, comparing development processes in organizations that implement the agile adoption framework to those that do not, can generate the empirical evidence needed to substantiate the validity of the framework. However, the challenge with this type of study is the

extensive amount of time and monetary resources needed. Moreover, in order to gather enough empirical evidence, multiple organizations must agree to participate. This latter requirement exacerbates the problem, because most organizations are hesitant to adopt a framework that is new, and for which no validation evidence exists.

Therefore, instead of a longitudinal study, we have elected to substantiate the "goodness" of the framework by presenting it to members of the agile community, and eliciting feedback as to its objectives and its ability to achieve those objectives. More specifically, the agile adoption framework was presented to 28 members of the agile community. Feedback was gathered throughout 90-min personal visits with the participants (or a group of them) which included a presentation of the framework, discussion, and a period of time to complete questionnaires. Results of that feedback are provided in the remainder of this section, and are presented from two perspectives: the role or position of the participants, and their years of experience. Additionally the feedback for the SAMI is presented separately from that of the four-stage process.

4.1 Results for the SAMI

The questionnaire concerning the SAMI focuses on gathering feedback about its comprehensiveness, practicality, necessity, as well as whether the practices are placed at appropriate levels.

Figure 4 indicates that over 75% of the respondents, either agree or strongly agree that the SAMI is comprehensive, practical, and necessary. However, the response to the question on the relevance of the agile practices to the agile levels in which they are defined shows an agreement rate that drops
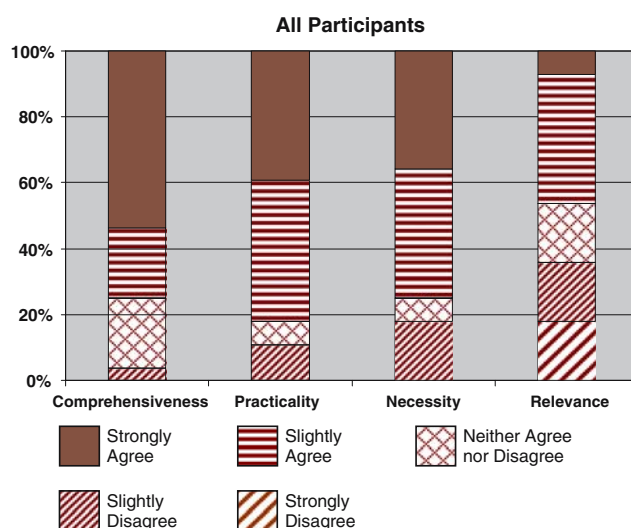
below 50%, while the rate of disagreement rises to approximately 37%; the remaining respondents neither agree nor disagree.

For further analysis, Fig. 5 provides a breakdown of the overall data by participant experience and by role (developers, management and coaches/consultants). As shown, the feedback is mostly in agreement with regard to the comprehensiveness, practicality and necessity of the SAMI.

However, some variability is observed among the participants concerning relevance. The most prominent concern is the position of the agile practices within the levels. We conjecture that this is due to the fact that each participant has different experiences, depending on their role, years of experience and the projects in which they have been involved. Subsequently, each participant places a different priority on the use of practices. This beneficial feedback and subsequent insight have led us to recognize the utility of, and need for, the flexibility to tailor the SAMI to fit (a) individual experiences, and perhaps (b) business goals.

When examining the results according to participant roles, it is also important to note that agile coaches and consultants had more positive feedback, in general, than participants in other roles.

Finally, based on an examination of comprehensiveness, practicality and necessity, Fig. 5 indicates that there is indeed a need for structure and guidance on how to organize these agile practices and concepts—in fact, this is exactly what the SAMI is intended to provide.

Figure 6 summarizes the feedback for participants having over six years of experience in leading agile adoption efforts. The figure illustrates that 80% of these experts strongly agree with the comprehensiveness of the agile levels defined by SAMI, while the remaining 20% neither agree nor disagree. They all agree to the practicality of the levels of agility, with 80% indicating strong support. Also, 80% agree to the necessity of the levels of agility, while only 20% slightly disagree. As for the relevance of practices to levels, 60% agree that the practices are more or less in the right levels, while 20% chose to remain neutral until they have studied the five levels more thoroughly. The remaining 20% strongly disagree.

In summary, the agile community recognizes the utility and need for the SAMI. This is important because it is the foundational component of the four-stage adoption process. The next section presents the feedback obtained about the four-stage process (the main component of the agile adoption framework).

4.2 Results for the four-stage process

Figure 7 depicts the overall feedback relative to the four-stage process. That feedback focuses on the understandability of the four-stage process, its practicality, necessity, complete-
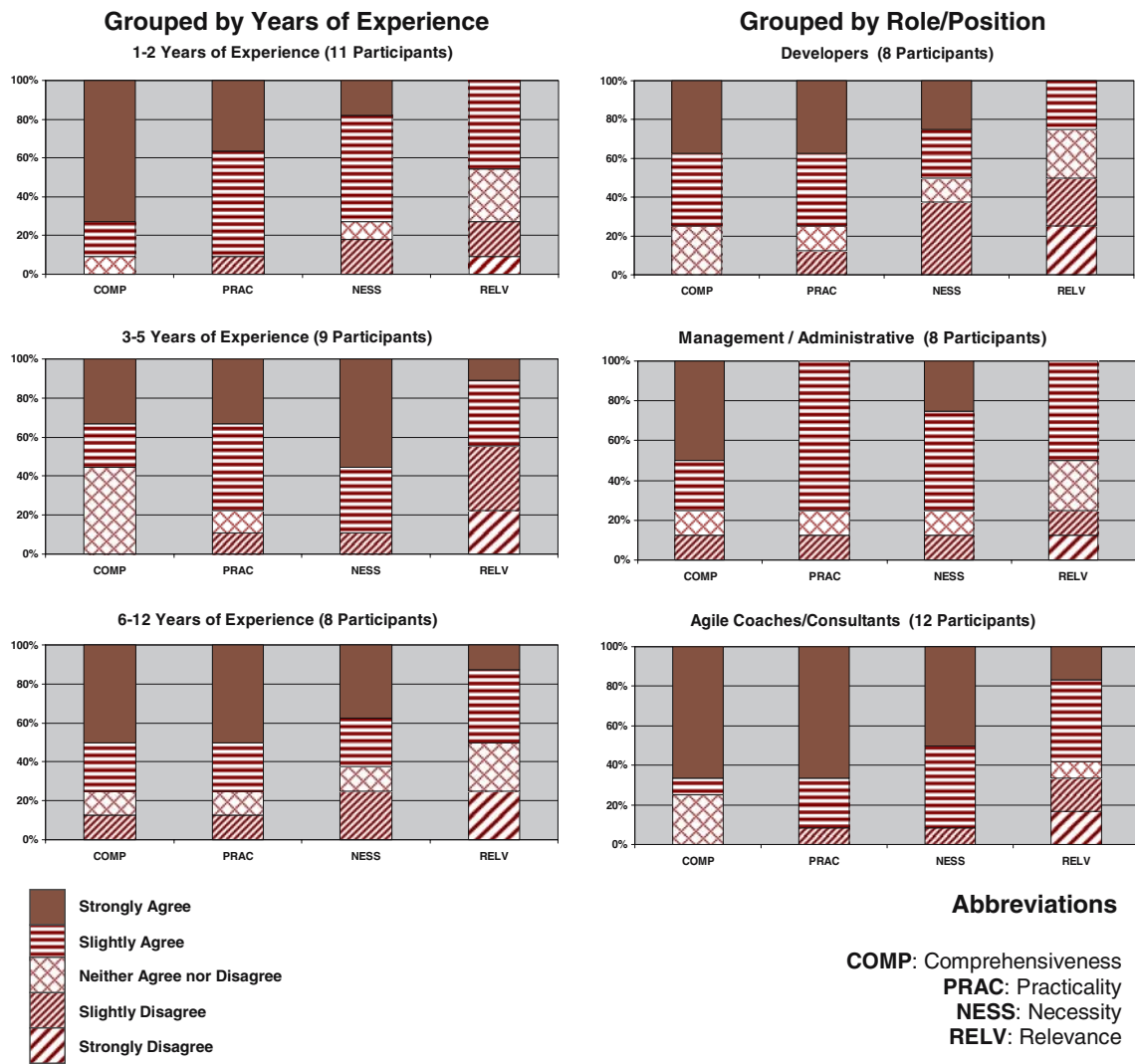

Fig. 4 Overall feedback about the SAMI

Grouped by Years of Experience

1-2 Years of Experience (11 Participants)

3-5 Years of Experience (9 Participants)

6-12 Years of Experience (8 Participants)

Legend:
- Strongly Agree
- Slightly Agree
- Neither Agree nor Disagree
- Slightly Disagree
- Strongly Disagree

Grouped by Role/Position

Developers (8 Participants)

Management / Administrative (8 Participants)

Agile Coaches/Consultants (12 Participants)

Abbreviations

COMP: Comprehensiveness
PRAC: Practicality
NESS: Necessity
RELV: Relevance

Fig. 5 Results of the SAMI grouped by role and experience

Over 6 Years Experience Leading Agile Adoption

Legend:
- Strongly Agree
- Slightly Agree
- Neither Agree nor Disagree
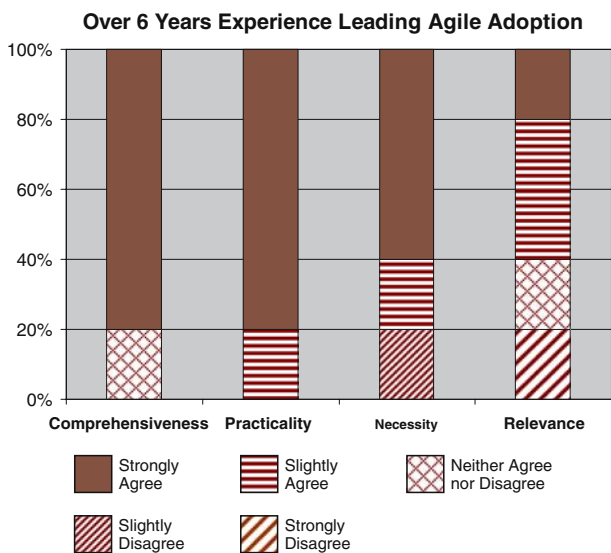- Slightly Disagree
- Strongly Disagree

Fig. 6 Feedback about the SAMI from participants with over 6 years of experience leading agile adoption efforts

ness, and effectiveness. As shown, the majority of the participants (approximately 80%) either agrees or strongly agrees with all five of the characteristics mentioned above. What is promising is that not a single participant strongly disagrees with any aspect of the four-stage process, and only one participant slightly disagrees with its completeness.

Figure 8 provides a breakdown of the participants by years of experience and by role. From the depiction, we note that the agreement level is proportional to the years of experience and the roles of the individuals: the more experience and direct involvement with agile adoption, the higher the agreement rating. In particular, all of the highly experienced people strongly agree that the process is clear and easy to understand. This is expected, because the process is designed to model their particular activities. The completeness of the four-stage process has the lowest agreement percentage when compared to the other aspects of the process. We conjecture that a major factor contributing to this is the process used to gather the feedback. In particular, only 90 min were allot-
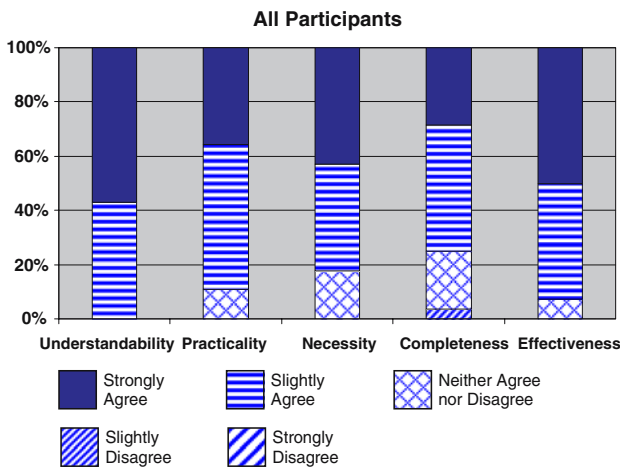
Fig. 7 Overall feedback about the four-stage process

ted for presenting the framework to the participants, having follow-up discussions, and conducting the survey. We expect that this timeframe was too short for the participant (or anyone) to fully grasp the essence of the complete framework and the substantial set of relationships among its constituent components. This expectation is somewhat confirmed by the participants that returned the questionnaires at a later time (not immediately after the presentation)—they both strongly agreed that the four-stage process is complete.

Figure 9 summarizes the feedback on the four-stage Process gathered from the participants having more than 6 years of experience in leading agile adoption efforts. What is truly noteworthy about these results is that 100% of this group of experts agree with all five aspects of the four-stage process being surveyed (understandability, practicality, necessity, completeness, and effectiveness). These results
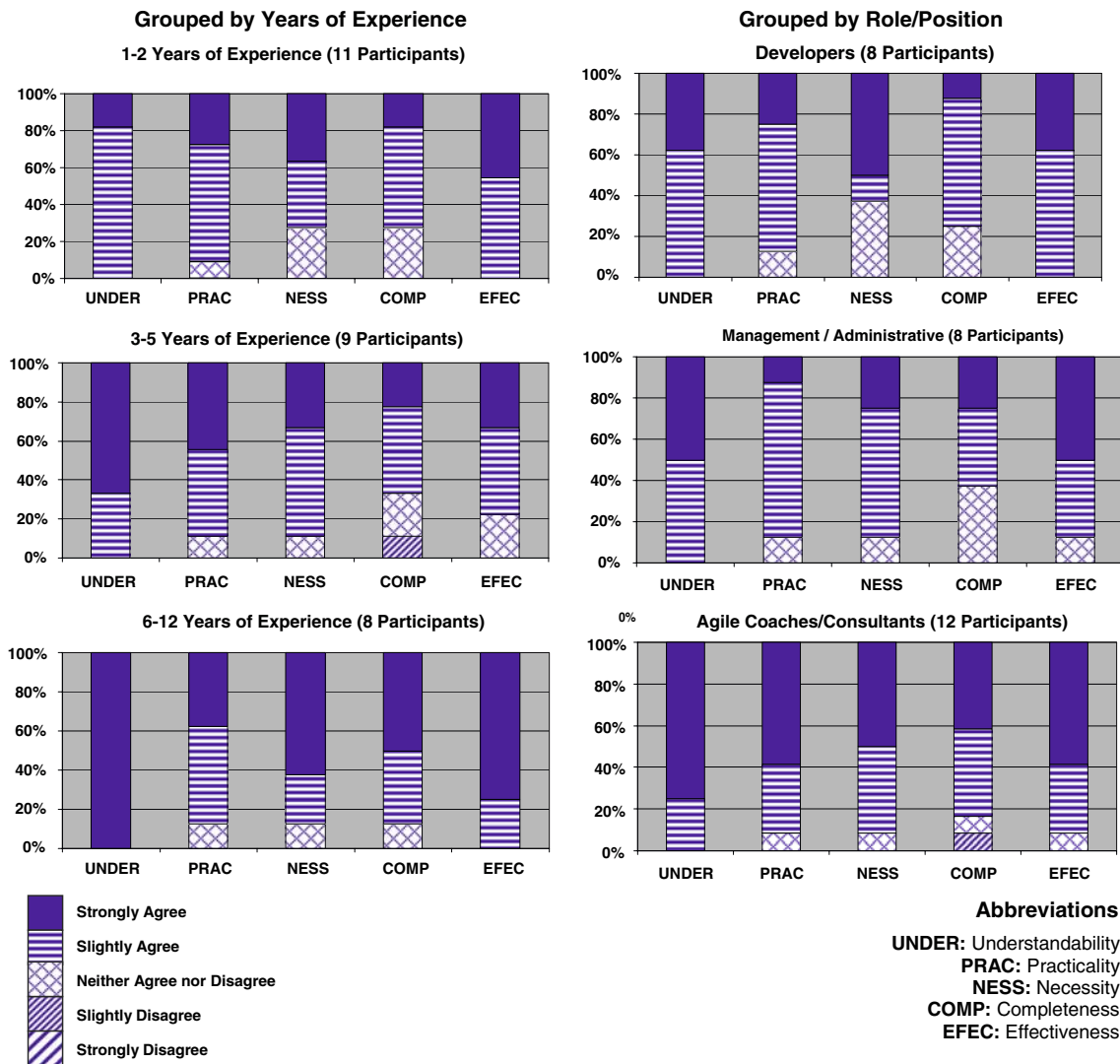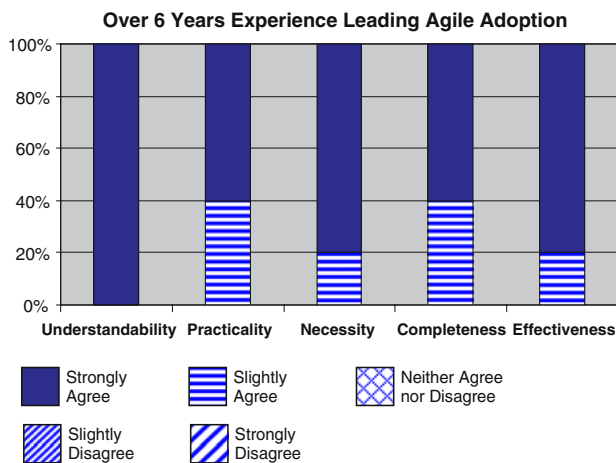

Fig. 8 Results of the four-stage process grouped by role and experience

Fig. 9 Feedback about the four-stage process from participants with over 6 years of experience leading agile adoption efforts

underscore the perceived utility of the four-stage process and help substantiate its validity.

Finally, the feedback obtained from the presentations, discussions and surveys tend to indicate (and confirms our own perceptions) that the agile adoption framework (the four-stage process and the SAMI) has yet to reach its full potential. Nevertheless, we are encouraged by some of the qualitative comments received concerning the agile adoption framework:

- *"I think this is fantastic (work)"*—agile consultant with 12 years' experience
- *"This is the RIGHT time for this work! Excellent Job"*—agile consultant with 8 years' experience
- *"Overall this is first-class work and I endorse this work as legitimate in its interest and merit to our industry"* (paraphrased due to length)—XP Coach with 6 years' experience

5 Conclusion

The agile adoption framework is a first step toward addressing the need for providing organizations with a structured and repeatable approach to guide and assist them in the move toward agility. The framework is independent of any one particular agile method or style, there are no restrictions on using XP or SCRUM or any other agile style within the framework. Moreover, the framework has two levels of assessment: one at the project level and another on an organizational level. Hence, it accommodates the uniqueness of each project, and at the same time, recognizes that each project is surrounded by, and is part of, an overall organization that must be ready to adopt the requisite agile practices. We view the agile adop-

tion framework as an initial contribution towards answering the complex question of *how* to adopt agile practices. In summary, we propose this framework as an approach to guide and assist organizations in their quest to adopt agile practices. Through identifying and assessing the presence of *discontinuing factors*, organizations can make a go/no-go decision regarding the move toward agility. By determining the *target level for a project* and then assessing the *organization* to determine the extent to which it is ready to achieve that target level of agility, the framework manages to provide coaches with a realistic set of agile practices for the project to adopt. The four-stage process assessment, through its utilization of the SAMI, provides an extensive outline of the areas within the organization that need improvement *before* the adoption effort starts.

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