A Methodology for Assessing Agile Software Development Methods
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Abstract – Agile methods provide an organization or a team with the flexibility to adopt a selected subset of principles and practices based on their culture, their values, and the types of systems that they develop. More specifically, every organization or team implements a customized agile method, tailored to better accommodate its needs. However, the extent to which a customized method supports the organizational objectives, i.e. the ‘goodness’ of that method, is questionable. Existing agile assessment approaches focus on comparative analyses, or are limited in scope and application. In this research, we propose a structured, systematic, and comprehensive approach to assessing the ‘goodness’ of agile methods. We examine an agile method based on (1) its adequacy, (2) the capability of the organization to support the adopted principles and practices specified by the method, and (3) the method’s effectiveness. We propose the Objectives, Principles and Practices (OPP) Framework to guide our assessment. The Framework identifies (1) objectives of the agile philosophy, (2) principles that support the objectives, (3) practices that are reflective of the principles, (4) linkages among the objectives, principles and practices, and (5) indicators for assessing the extent to which an organization supports the implementation and the effectiveness of that practice. In this paper, we discuss our solution approach, preliminary results, and future work.

Key words: Agile Assessment; Adequacy, Capability, Effectiveness; Linkages among Objectives, Principles, and Practices; Indicators

I. INTRODUCTION
The agile philosophy provides an organization or team with the flexibility to adopt a selected subset of principles and practices based on their needs. It is often the case, however, that the necessary agile principles and associated practices are not reflected in the customized method. Moreover, organizations may also lack the supporting environment to effectively implement the adopted practices. As a result, the benefits afforded by agile practices are not fully realized [1]. Hence, we find it prudent to ask: To what extent does an agile method or customized approach really satisfy the needs of an organization? In effect, we are questioning the ‘goodness’ of an adopted agile method.

Existing methods for assessing the ‘goodness’ of agile methods are either limited in scope or application, or focus primarily on comparative analyses. Furthermore, because the agile philosophy stresses “working software” as being the primary measure of progress [2], many assessment approaches place an emphasis on measuring product characteristics, and tend to ignore potential measures reflecting process, project, and people characteristics. Those few approaches (or frameworks) that do address the process, e.g., the Sidky Agile Measurement Index (SAMI) [3] and the Agile Adoption and Improvement Model (AAIM) [4], assume the adoption of an initial set of practices. Unfortunately, this has an unintended consequence of reducing an organization's flexibility to tailor its agile method to best fit its goals. Finally, third party agility measurement tools such as Comparative Agility [5] and the Thoughtworks Agile Assessment survey [6, 7] focus on assessing the extent to which an organization or a team is successful in adopting and using agile methods. As individual tools, however, they provide little guidance as to whether or not the employed practices are appropriate for an organization.

Hence, we envision the need for a more comprehensive approach to assessing the ‘goodness’ of agile methods, that is, assessing (a) the adequacy of an agile method to support its stated objectives, (b) the capability of an organization to implement its adopted method, and (c) the effectiveness of that method.

The remainder of this paper is organized as follows. Section 2 provides an overview of the OPP Framework, its components, and our assessment methodology. We discuss preliminary research results in Section 3. Future work is outlined in Section 4. Finally, Section 5 provides a summary of our work.

II. OVERVIEW OF THE ASSESSMENT METHODOLOGY
Our research is motivated by the lack of a comprehensive approach to assessing agile methods. We assess the collective ‘goodness’ of an agile method adopted by an organization based on (1) its adequacy, (2) the capability of the organization to provide the supporting environment to implement the method, and (3) the method’s effectiveness. We define adequacy, capability and effectiveness as below (definitions adapted for current context from [8, 9]):

- **Adequacy** - Sufficiency of the method with respect to meeting its stated objectives.
- **Capability** – Ability of an organization to provide an environment supporting the implementation of its adopted method. Such ability is reflected in the characteristics of an organization's people, process and project.
- **Effectiveness** – Producing the intended or expected results. The existence of necessary process artifacts and product characteristics indicate levels of effectiveness.

We have designed the Objectives Principles and Practices (OPP) Framework to assess the ‘goodness’ of an agile method from the three perspectives described above.

A. The OPP Framework
The agile manifesto provides four focal values and twelve principles that define the agile philosophy. Using the
manifesto as a guide, we have evolved the OPP Framework to reflect the viewpoint that each agile method should

- strive to achieve an enunciated set of desirable objectives,
- embrace process principles that support the achievement of those objectives, and
- employ accepted agile practices to implement those principles.

In concert with the above, the OPP Framework identifies five objectives that are reflective of the agile philosophy, nine principles that govern an Agile software development process and support the achievement of those objectives, and 27 practices that help implement the principles (see Figure 1).

We note, however, that the list of practices shown in Figure 1 is not necessarily exhaustive nor complete; we do expect that it will change over time. We also recognize that different practices can be used to implement the same principle.

Because the OPP Framework is intended to support an assessment process, it also defines a set of linkages that (a) connect objectives to supporting principles and (b) bind principles to the practice(s) used to implement them. As described in Sub-section B below, these linkages are fundamental to the measurement process. Consider, for example, ‘Maximal Adaptability’, an objective of agility identified by the OPP Framework. Our working definition for ‘Maximal Adaptability’ is maintaining (a) the flexibility to support change and (b) the freedom to choose among appropriate practices. We have substantiated through the work of others that one of the principles which supports the attainment of Maximal Adaptability is ‘Accommodating Change’. Subsequently, as shown in Figure 2, there exists a linkage between the objective ‘Maximal Adaptability’ and the principle of ‘Accommodating Change.’ To help implement this principle, we have also identified (or linked) a corresponding set of appropriate practices (also shown in Figure 2), among them are evolutionary requirements, iterative and incremental development, on-site or co-located customer, continuous feedback, and minimal Big Requirements Up Front.

We have used our own experience, experience reports of others, white papers, books, etc., to identify and confirm many of those relationships. Currently, we have substantiated approximately 70% of the identified linkages viz-a-viz independent sources.

B. Assessment Methodology

Given the Framework described above, we assess the ‘goodness’ of an agile method by (a) assessing its adequacy, (b) the capability of the organization to provide the supporting environment to implement the method, and (c) the effectiveness of that method.

Assessing Adequacy

Adequacy is defined as the sufficiency of an agile method to meet its stated objectives. Assessing adequacy is independent of any organizational characteristics. More specifically, we can assess the adequacy of standalone agile methods such as eXtreme Programming (XP) [10], Lean [11], Crystal [12], Feature Driven Development (FDD) [13], or any tailored instances thereof, with respect to the agile values and

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Figure 1. Objectives, Principles and Practices identified by the OPP Framework

<table>
<thead>
<tr>
<th>Objectives</th>
<th>Principles</th>
<th>Practices</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value driven</td>
<td>Technical Excellence</td>
<td>Pair Programming</td>
</tr>
<tr>
<td>Minimal Waste</td>
<td>Continual stakeholder communication and collaboration</td>
<td>Continuous Integration</td>
</tr>
<tr>
<td>Maximal Adaptability</td>
<td>Continuous innovation and learning</td>
<td>Agile values</td>
</tr>
<tr>
<td>Continuous innovation and learning</td>
<td>Frequent delivery of working software</td>
<td>Agile values</td>
</tr>
</tbody>
</table>

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Figure 2. Example linkages in the OPP Framework

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Figure 3. Assessing Adequacy, Capability, and Effectiveness

Assessing Adequacy

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principles each espouses. As illustrated in Figure 3, to assess adequacy, we follow the linkages in a top-down fashion from the objectives to the principles, and finally to the practices. That is, for each objective stated by a method, we ask: are the necessary principles also present as prescribed by the OPP Framework? Similarly, for each principle enunciated by the agile method, we also ask: are the recommended practices prescribed by the OPP Framework present? If necessary principles and practices are missing, then adequacy is suspect.

Assessing Capability and Effectiveness

Unlike adequacy, both capability and effectiveness are assessed from an organizational perspective. That is, capability and effectiveness are assessed for agile methods that have been adopted by an organization. Capability assessment examines the extent to which an organization has the means to implement its adopted method. Effectiveness, on the other hand, is measured relative to how well the adopted method actually achieves its stated objectives. The two assessment approaches are computed independently using both a top-down and bottom-up traversal of the linkages (see Figure 3). The top-down traversal is necessary because method adequacy directly impacts capability and effectiveness. Bottom-up traversal, however, is predicated on the identification of people, process, project, and product properties that reflect the presence, implementation and use of an associated practice. More specifically, for bottom-up assessment we examine the environment, process, or product for properties that definitively attest to the presence and usage of a specific practice. In turn, this information is used to determine adherence to stated principles, and ultimately, the achievement of a stated objective. We refer to each practice, property pair as an indicator. Indicators are the fifth, and final, major component of the OPP Framework. The difference between assessing capability or effectiveness, however, lies primarily in the type of indicators used. That is, we use people, process, and project indicators to assess capability; we use process artifacts and product indicators to assess effectiveness. As shown in Figure 3, by following the linkages upward from the indicators, we can infer the use of proper principles and the achievement of desired objectives.

For more information about the OPP Framework, its components, and our assessment methodology see [14, 15].

III. PRELIMINARY SUBSTANTIATION RESULTS

The OPP framework guides our assessment process. Our goal is to substantiate both the components of the OPP framework, and our process for assessing adequacy, capability, and effectiveness. The research outlined in this section is work in progress.

A. Substantiating the components of the OPP Framework

The OPP Framework identifies five objectives of the agile philosophy, nine principles that govern the achievement of those principles, and 27 practices that help implement those principles. To substantiate these foundational pieces, we developed an online survey instrument to gather practitioners’ opinions about the identified objectives, principles, and practices. In designing the survey, our goal has been to determine if the objectives, principles, and practices identified by the OPP Framework are consistent with practitioners’ views of the agile philosophy, its values, principles, and effective practices.

The three questions provided below were asked of each survey participant:

1. To what extent (maximally, considerably, moderately, somewhat, or marginally) should an Agile Software Development approach embrace each of the objectives identified by the OPP Framework?
2. To what extent (maximally, considerably, moderately, somewhat, or marginally) should an Agile Software Development process promote each of the principles suggested by the OPP Framework?
3. How important (very important, considerably, moderately, somewhat, or marginally important) are each of the identified practices in supporting an effective Agile Software Development process?

Currently, 45 practitioners have completed the survey. Demographically, 29 of the respondents have been developers, 21 have coached agile teams, and 21 have managed projects in the capacity of a scrum master. 21 (or 47%) of the practitioners have been working within the agile community for 7 or more years. 40% of the survey respondents have 3 to 6 years experience working in agile environments.

More than 85% of the survey respondents state that an Agile Software Development approach should "maximally" or "considerably" embrace each of the objectives identified by the OPP. Moreover, with the exception of Constant Development Pace, 80% of the respondents also state that an Agile Software Development process should "maximally" or "considerably" promote each of the principles identified by the OPP Framework.

With respect to the identified practices, however, the practitioners state that only a subset (14/27) of the identified practices are very important to Agile Software Development, and that the remaining ones are relatively unimportant. We hypothesize that some of the difference and variation is due to the fact that (a) the set of practices adopted by a team is guided by an organization’s culture and values, and practitioner preference, and (b) practices often overlap relative to their support for implementing a principle. Guided by this insight and other survey results, work is currently underway to evolve an improved OPP Framework, and one that includes a revised set of core practices.

B. Substantiating the assessment process

Currently, we have substantiated only one piece of the assessment process – adequacy. Recall that adequacy is defined as the ‘sufficiency of an agile method to meet its stated objectives.’ Hence, given an agile method we examine its structure and composition to determine its adequacy. That
is, guided by the OPP Framework, for agile method X we ask the following questions:

1. Does Method X tout objectives that are consistent with those stated by the OPP Framework? (A subset is certainly acceptable.)
2. Does Method X state principles that support the achievement of those touted objectives?
3. Does Method X express practices that implement its stated principles?

Currently we have examined the adequacy of three agile methods: XP, FDD, and Method A. XP is an agile method that most completely reflects the agile philosophy. Method A is a modified instance of XP, and is currently being used by an organization involved in agile software development. FDD is advertised as an agile method that is intended for medium to larger scale systems development; it touts a blend of agile values and conventional software engineering principles.

We have applied the top-down, adequacy assessment process to answer the three questions given above. In a relative sense, we have determined the following:

- XP is more adequate than FDD or Method A with respect to supporting its objectives, and
- Method A is more adequate than FDD with respect to supporting its objectives.

These preliminary results are consistent with our observations, but further independent confirmation by subject matter experts (SMEs) is still needed.

**IV. FUTURE WORK**

We address the assessment of agile methods from three perspectives – adequacy, capability, and effectiveness. We realize that in order to effectively substantiate our assessment approach, the OPP Framework has to be applied within an organization.

Our more immediate goals, therefore, are (a) to elicit additional feedback concerning the components and structure of the OPP Framework, and (b) to perform a capability assessment on one or more agile organizations. The latter necessarily implies an adequacy assessment on the respective agile methods. More specifically, we intend to first interview project managers and request that they provide a walkthrough of their process. We then plan to observe one or more development teams to gain a better understanding of their software development approach. This would provide us with key insights about the development process and the supporting environment, and thereby, facilitate an assessment of both the adequacy of the adopted agile method and the capability of the organization to implement its adopted agile method. Following the adequacy and capability assessment, we then intend to present our findings to members of that organization. The intent is to determine (a) to what extent those findings are consistent with perceptions, and ultimately, (b) the validity of our results. We have initiated contact with several prospective companies.

A more long term goal is also to validate the OPP Framework and its assessment process as it relates to evaluating the effectiveness of an instantiated agile method. This would, of course, require a longitudinal study, but is also necessary to fully validate the assessment process.

**V. SUMMARY**

Our research is motivated by the need for a comprehensive approach to assessing the ‘goodness’ of agile methods. We assess ‘goodness’ by examining (a) the adequacy of a method, (b) the capability of an organization to provide the supporting environment for implementing the method, and (c) the effectiveness of that method. To guide our assessment, we propose the OPP Framework. The Framework identifies objectives, principles, practices and properties, and linkages between them to support the assessment process. We recognize that the Framework must evolve based on future research findings. Our proposed substantiation approach includes a study of one or more organizations to assess the ‘goodness’ of their agile methods and to compare the findings with the perceived reality.

**REFERENCES**


