Exploring the Transient Nature of Agile Project Management Practices

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Abstract

Agile software projects have considerable freedom in shaping their emerging project management practices, and there are established ways to do that, e.g., with process retrospectives. The practices may change due to many reasons, such as (i) changes to critical system or process properties, (ii) process context, (iii) process capability maturity, etc. Maturity is not the only reason and a suitable wider perspective and support is necessary to handle the transient nature of agile practices. We propose to use a value-based approach and shift the discussion from the conventional solution space to the goal (value) space. Further we recommend an impact estimation approach for identifying current practice state (agile positioning) and a corresponding approach for navigating through the value (and solution) space as well as ways to visualize the results. This work underlies the ongoing development of an agile positioning and navigation tool including a survey approach to practice and tool impact analysis and estimation.

1. Introduction

Background. Two large software projects provided background to this research. One investigated agile processes for development of innovative urban services targeting usability and user feedback, in geographically dispersed city organizations of various levels of expertise and size, to be sharing a considerable part of the product and process technology. The other looked for agile management practices for distributed embedded software development projects with very short time to market. In both cases it was obvious that projects had considerable freedom in shaping their emerging project management practices but at the same time a suitable wider perspective and support was necessary to handle the transient nature of agile practices. The established ways, e.g., with process retrospectives were not sufficient.

The problem. Agile software development and evolution project practices may dynamically change due to many reasons, such as (i) changes to critical system or process properties, (ii) process context, (iii) process capability maturity, etc. Examples of specific contexts are distributed projects, geographically and organizationally motivated multi-cultural environments, etc. Examples of system properties are usability, time to market, feedback. On a more general level, the set of practices of an agile software development and evolution project may vary as a result of changes to agile values or principles. Any of these may reference new practices or de-commit previously used ones. A wider perspective for considering the transient nature of practices is needed, suitable for addressing all kinds of changes and going above the practice level to a value-based view of practices and their changes. Support is needed in selection and evolution of emergent processes – and not necessarily in terms of conventional capability maturity. An example of such support might be a dynamic process configuration service. The useful popular agile management process models such as Scrum [10] provide a general guidance while they may need more specific practices to meet the requirements of concrete projects.

From a multitude of practices possibly used on a project we are most interested in practices of highest impact on the project’s most important values and goals. A restricted set of such top important practices, values and goals will be called a practice “working set”. To determine the importance factors we need to know (a) the critical values and goals and their priorities; (b) the available practices and their impacts on the values and goals under current constraints, and (c) the policy of creating and maintaining the practice set. Part (c) will constraint, possibly dynamically, the “working set” practices, for instance some capability models prefer introducing practices in layers or levels,
and some evaluation methods have specific ways of resolving multiple impacts (e.g., architecture-oriented evaluation). Part (c) may also focus on “follow-up” policies aiming at producing multiple approximate copies of a process.

**Contribution.** In this paper we demonstrate selected results from the research work aimed at a broader transient practice perspective and development of agile practice support. We propose to use a value-based approach and shift the discussion from the conventional solution space to the goal (value) space. An impact estimation approach is proposed for identifying current practice state and a corresponding approach for navigating through the value and solution space as well as ways to visualize the results. This work underlies the ongoing development of an agile positioning and navigation tool including a survey approach to practice and tool impact analysis and estimation.

We look at changes in the working set of agile management practices in time and in space. The temporal transient nature may, in connection with variation (i)-(iii) above, result from changing the quality focus, process capability tuning efforts, moving towards more demanding tasks in a given project, etc. The changes in space refer to situations of related projects executed under different contexts, e.g., geographical contexts and organizational cultures. We use a general concept of project culture aggregating agile values and goals, principles and practices. We investigate a range of projects representing various agile values and goals, principles and practices. We use a general concept of project culture aggregating agile values and goals, principles and practices. We investigate a range of projects representing various agile values and goals, with various practices and tools. The investigation also includes the fundamental question whether such varieties in fact exist. We construct a suitable model and identify it by using project data.

We provide the following tool capabilities:

A. (Positioning and consistency) Positioning: Position yourself on a map of project values and goals, and on a map of agile cultures to see your and others value coordinates. Explain project values. Consistency: Check consistency between changes to different layers of project culture: agile values and goals, principles, practices and tools. Are your values consistent with your practices and tools?

B. (Navigation) See what measures can be taken (what measures others took or recommended) to reach new levels of project values and goals. Or to change an agile project’s management cultural status. Explain why you would use certain project practices. How successful are they going to be?

As the result of the investigation we propose a tool, referred to as APN (Agile Positioning and Navigation), offering the consistency, positioning and navigation capabilities. It is essentially a survey tool equipped with traceability (impact analysis), goal (value) space visualization, database functions, and a continuity function allowing for references to previously collected data or to a specially designed initial data set. A most important characteristic of the tool is its agile responsiveness which greatly improves usability of the tool. The responsiveness is a result of the value-based analysis level, the working set approach, and other assumed solutions. This paper presents an overview of the research approach. Research results are presented in a separate forthcoming publication.

**Structure of the paper.** The paper is constructed as follows. In section 2 we introduce and discuss the notion of agile culture. Section 3 discusses the survey which supports investigation of transient practices. In section 4 we consider a central research question for this discussion, of “Are there really many cultures and working sets?” Section 5 presents the tool which exploits the survey approach. The tool provides agile software projects with consistency, positioning and navigation capabilities. Section 6 discusses the results are reviews related work. Section 8 includes conclusions and an outline of future work.

**2. Agile cultures, culture transitions and transient practices**

Culture can be defined [11] as “a fuzzy set of attitudes, beliefs, behavioral norms and basic assumptions and values that are shared by a group of people, and that influence each member’s behavior and his/her interpretations of the ‘meaning’ of other people’s behavior”. The elements are linked with iterative dependences, from culture with its beliefs and norms, to values which depend on beliefs and then to behaviors (principles and practices) which reflect the values; behaviors in turn impact the beliefs and norms and so on [13]. The resulting data schema can be modeled as in Figure 1, including also tools supporting the practices.

The structure is consistent with that of the Agile Manifesto [1] and with other publications ([2], [9], etc.) Figure 2 shows a sample visualization of agile culture dependencies at instance level, with some available alternatives selected. For the purpose of this investigation agile project culture C can be modeled as a six,

\[ C = (\text{Stakeholders, Values}&\text{Goals, Principles, Practices, Tools, Rules}). \]
Stakeholders, Values&Goals, Principles, Practices, and Tools have similar interpretation as in Agile Manifesto [1] but can be more general. (Below, capitalized names as above will mean collections of respective instances.) Sample agile culture instances include EVO [7], Scrum [10], XP [4], and their specializations and extensions. However the culture instances considered here may represent particular project cultures which are occasionally much different from those declared in Manifesto.

The Rules state the dependency and consistency relations between the other elements. This model will be used to derive impact functions of form $v=c(p)$; $v$ representing current Values&Goals, $p$ representing current Practices, parameterized with other elements of the model. The following are examples of consistency relations between Values&Goals and Practices, and Practices and Tools, in the form of necessity and sufficiency rules. For Values&Goals and Practices they are:

Necessity rules of Values&Goals Importance:
- Values&Goals $\Rightarrow$ Importance
- In a simple case we can assume an ordinal scale for Importance,

Sufficiency rules of Practices Contribution to Values&Goals satisfaction:
- Practices $\times$ Values&Goals $\Rightarrow$ Contribution
- In a simple case we can assume, $\text{Contribution=}\{\text{Complete,Partial,\text{None}}\}$,

Importance=$\{\text{Required,Optional,NotRecommended}\}$, where:
- Required means a given Values&Goals instance must be satisfied in full
- Optional means a given Values&Goals instance may or may not be satisfied
- NotRecommended means a given Values&Goals instance should not be taken into account.

Figure 2. Example of agile culture dependencies with some available alternatives selected.
For consistency of Values&Goals with Practices we require that all Values&Goals instances with Required value have Complete contribution from Practices.

For Practices and Tools the rules are as follows.

Necessity rules of Practices ToolingImportance:
- \( \text{Practices} \Rightarrow \text{ToolingImportance} \)
- In a simple case we can assume an ordinal scale for ToolingImportance, ToolingImportance=\{Required,Optional,NotRecommended\}, where:
  - Required means a given Practices instance must have Tools support in full
  - Optional means a given Practices instance may or may not have Tools support
  - NotRecommended means a given Practices instance should not be taken into account.

Sufficiency rules of Tools Support for Practices:
- \( \text{Tools} \times \text{Practices} \Rightarrow \text{Support}\)
- In a simple case we can assume, Support=\{Complete,Partial,None\}, where:
  - Complete means a given Tools instance provides complete support for the corresponding Practices instance
  - Partial means a given Tools instance provides partial support for the corresponding Practices instance
  - None means a given Tools instance provides no support for the corresponding Practices instance
  - There is an aggregation rule stating that several (for instance, 3) Tools instances with Partial support of a corresponding Practices instance are equivalent to Complete support of that Practices instance.

For consistency of Practices with Tools we require that all Practices instances with Required value have Complete support from Tools.

These examples assume qualitative evaluation of Values&Goals, Practices and Tools. Our ultimate objective is to introduce a quantitative interpretation which is under development now. Examples of applicable quantitative scales are presented, for instance, in [7]. We assume here that Principles are merely informal annotations to Values&Goals and Practices. This coincides with their common interpretations as abstract summaries of Practices.

A range of reasons may cause culture transitions or practice transitions, such as the reasons (i)-(iii) above and also changes in specific stakeholder viewpoint, new technology, new regulations, new market situation, etc. Some practices are no more considered, temporarily or permanently, while new ones are coming into focus – not known before, or recurrent practices. The necessity values (importance) and sufficiency values (completeness of contribution or support) may change as well. In spirit of agile development, all such changes are rooted in Values&Goals, hence are value-driven, emergent and contextual.

In this approximate model, first of all and we are interested in most critical impacts, so that we take into account a “working set” (e.g., no more than 10 instances) of top priority instances - Values&Goals, Practices and Tools, and treat other elements of the culture model as parameters. We consider a dynamically changing working sets whose actual size may be static or dynamic following an assumed policy. For the working set of Values&Goals we prefer the instances which are Required or Optional. For the working set of Practices we prefer instances contributing to Required Values&Goals. For the working set of Tools we prefer instances supporting Practices with Required ToolingImportance. We try to avoid both under-design and overdesign.

To use the model in tools we need to populate it with data, e.g., corresponding to the impacts and support specified above. The survey presented in the next section provides us with the necessary data. The subsequent sections discuss support tools for monitoring and controlling practice transitions.

3. Agile practices survey

The agile practices survey has been developed to provide data necessary for tools supporting practice transitions. With its reporting facility, the survey provides immediate essential feedback regarding some important aspects of the agile process, in particular its positioning and navigation (cf. Section 5). This corresponds to one of the critical goals of the survey design was – its agile responsiveness – illustrated in Figure 3 along with the survey and questionnaire structure and the respondent process:

- The whole survey session takes on average no more than 3 min, including filling the questionnaire and producing the online respondent feedback report,
- Questionnaire of max. 3 pages (with Practices only 2 pages, with Practices and Tools 3 pages),
- 1 page summary online respondent feedback report.
Such agile operation of the survey has been achieved thanks to: (1) extensive reuse of experience information stored in survey database; (2) applying the culture selector approach which allowed for targeting a particular culture; (3) applying the “working set” approach to focus on most critical instances in each category; (4) each session usually started with a respective previous session results, so the actual answers addressed only changes since last session. Also administration aspects, such as configuring, setting initial database content, and off-line summary report, have been designed to minimize resource usage.

The questionnaire includes, in a compact form, sections for all basic data categories, namely Cultures, Values&Goals, Principles, Practices and Tools. There are two variants of the questionnaire. The shorter, 2-page questionnaire, including pages 1 and 2 (Figure 4) addresses Practices only. The more elaborate 3-page questionnaire includes all three pages 1, 2 and 3 (Figure 4), with the full scope of Practices and Tools. The shorter one is a subset of the more elaborate questionnaire.

Pages 2 and 3 include the impact analysis and estimation sections for investigating Practices contribution to reach Values&Goals and Tools support for Practices respectively. This version of survey uses a simple, qualitative approach. Impact analysis and estimation poses a challenge for user interface design, especially under the resource restrictions described above – as the impact tables tend to include many elements (number of working set Values&Goals times number of working set Practices, or number of working set Practices times number of working set Tools). On the other hand, having in one window the whole impact image helps in evaluating visually the overall effect. An approach that proved largely useful was a color-coded estimation illustrated in Figure 5: The impact value for a given cell of the impact table can be set with mouse clicks only, no key input is necessary. The consecutive clicks change the impact value cyclically, from None through Complete, Partial, Negative, etc.

In the currently available version of the tool, the online feedback report provides a 1-page summary in the form of a map of the project values and goals on top of a visualization of the entire active culture. It supports a form of consistency check between changes to different layers of project culture: agile values and goals, principles, practices and tools. It is a part of a more elaborate function which we call “agile positioning and consistency”, described in more detail in Section 5.

4. Are there really many cultures and different “working sets”?

This is a fundamental question for existence of transitions. The survey helps in resolving the issue. The question about existence of a variety of solutions is relatively common in software engineering. This section was inspired by a similar question regarding design decision rationale documentation by Falessi et al. [6]. Depending on the context of a particular culture
we expect that some Values&Goals and Practices will be more important than others and the resulting culture, and in particular the working sets, will be different. The investigation process is shown in Figure 6. The process is suitable for researching both cultures and working sets, for finding new cultures and working sets, as well as merging and decommissioning existing ones. The process can be applied off-line to derive an initial set of cultures, and then can be repeated with the current results collected in survey database.

Figure 6. The culture/working set research process.

The diagram in Figure 6 denotes activities with rounded rectangles and the produced and consumed information with rectangles. We start with a predefined set of cultures. The analysis focuses on:

- Context (to figure out the probability that the culture case will occur in the business and system context),
- Measurable values and goals (to realize the benefits that such a culture case provides),
- Required practices and tools (to estimate the cost or the amount of effort to spend on adopting and maintaining a practice or tool); for the yes/no decision about possible inclusion of a practice in the working set of practices ROI is calculated [3] as follows:
  \[ \text{ROI}(s) = \frac{\text{OccurrenceProbability}(s) \times \text{Benefit}(s)}{\text{Cost}(s)} \]

The hypothesis testing applied the Kruskal-Wall test on all contexts. In case it was possible to reject the null hypothesis H0ij for some i,j (p-value<0.05), the Mann-Whitney test was applied for all possible combinations of i,j, with respect to that category of solution. The initial results confirm existence of different cultures and working sets within cultures.

5. Agile support tool

The survey may be interpreted as an agile process support tool which provides support with regard to the following agile process questions (the current working version of the tool addresses only question A):

A. (Positioning and consistency) Positioning: Position yourself on a map of project values and goals, and on a map of agile cultures to see your and others value coordinates. Explain project values. Consistency: Check consistency between changes to different layers of project culture: agile values and goals, principles, practices and tools. Are your values consistent with your practices and tools?

B. (Navigation) See what measures can be taken (what measures others took or recommended) to reach new levels of project values and goals. Or to change an agile project’s management cultural status. Explain why you would use certain project practices. How successful are they going to be?
The tool can support agile project management, at its various scopes, by recommending practices and tools contributing to values and goals particularly important with regard to the project stakeholders, context, maturity, etc. For instance, as illustrated in Figure 7, the tool, through its impact analysis and estimation capabilities, can support the selection of practices and tools assuring various planning activities of an agile project. (Note that this happens at the level of selecting entire practices and tools.)

![Image](image-url)

**Figure 7.** Support in selecting agile project planning practices and tools, oriented towards assuring business value.

**Positioning.** Positioning finds out the coordinates of a particular project in a goal space of Values&Goals, by analyzing the impacts of the project practices on declared Values&Goals. Moreover it checks consistency of the result with the intended specified Values&Goals. This is shown in the goal space. If the number of intended critical Values&Goals is too high special multidimensional visualization approaches such as Gilb’s radar [7] can be used. Positioning can show other related projects and compare them with the given one.

**Navigation.** Navigation provides a solution for the optimization task that finds Practices p which optimally impact the multi-criteria vector v of critical qualities and resources of Values&Goals:

- \( \text{Opt } \{ p(i) \in P(i) \} \{ v(i) \}, v(i) \in V(i), i=1,2,..., \)
- subject to \( v(i) = c(p(i)), v(i) \in V(i), p(i) \in P(i). \)

An extended Gilbert’s radar representation can be applied to visualize navigation. Individual radars can be linked together following the time (delivery) or the space integration principle. In contrast to positioning, which is focused on analysis, navigation is focused on controls and their synthesis.

### 6. Discussion and related results

Selecting practices and tools for agile projects is a subject of heated discussion, partly due to the emergent nature of such practice sets [8]. Instead of a maturity-related approach ([14], [12], [8], etc.) we suggest a wider perspective and support to handle the transient nature of agile practices. We recommend addressing the actual critical project values and goals, and considering transitions within or between agile cultures. We carefully consider such issues as various stakeholder viewpoints and project contexts. The results would support whoever takes decisions about configuring practices and tools for an agile project. The values and goals may also take into account the necessary transition resources, e.g., in the form of ROI. The area of value-based software engineering [5] to our knowledge hasn’t provided value-based methods of practice selection in relation to contexts other than capability maturity assessment and improvement. While there are numerous tools on the market to our knowledge none of them offers a type of functionality addressed here. An important advantage of this approach is its “agile” nature of tool support – the support can be obtained even with minimal resources.

### 7. Conclusions and future work

Agile software projects have considerable freedom in shaping their emerging project management practices, and there are established ways to do that, e.g., with process retrospectives. The practices may change due to many reasons, such as (i) changes to critical system or process properties, (ii) process...
context, (iii) process capability maturity, etc. Maturity is not the only reason for change and a suitable wider perspective and support is necessary to handle the transient nature of agile practices. We propose to use a value-based approach and shift the discussion from the conventional solution space to the goal (value) space. Further we recommend an impact estimation approach for identifying current practice state (aka. agile positioning) and a corresponding approach for navigating through the value (and solution) space as well as ways to visualize the results. This work underlies the ongoing development of an agile positioning and navigation tool that includes a survey approach to practice and tool impact analysis and estimation. Our foreground task for the future is to provide a fully quantitative variant of the method and tool support. Another necessary part of the work, ongoing now, is validation of the navigation part.

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9. References


