Towards the Strategic Analysis of Agile Practices

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Abstract. Agile methods are widely believed to have the potential to improve software processes. Given the variety of agile practices, organizations face difficult decisions on which ones to adopt. Recognizing that agile adoption is often motivated by strategic concerns such as market competitiveness or responsiveness to customer needs, this paper outlines a framework for the strategic analysis of agile practices. The framework aims to support the decision making process leading to agile adoption. The framework builds upon a knowledge base of experiences collected from empirical studies. Goal modeling techniques from requirements engineering are incorporated in the form of a Strategies Graph. The graph resembles the Strategy Map from Balanced Scorecards familiar to many managers.

Keywords. Agile Methods, Situational Method Engineering, Software Process Improvement, Goal-Oriented Modeling, Strategic Management

1 Introduction

Many organizations are changing their software development processes to Agile. A number of frameworks have been proposed to provide guidance for transitioning to agile [1-3], but none takes a strategic perspective to link business goals to the selection of agile practices. This paper introduces the SAAP (Strategic Analysis for Agile Practices) framework for analyzing a set of candidate agile practices from the strategic perspective of an organization. By performing this analysis before enacting any new practices, one can anticipate potential mismatches between organizational strategies and candidate practices.

The analysis procedures of SAAP are mostly focused on agile practices. The framework considers agile methods (either known methods such as XP and Scrum, or those which are custom-built) to be decomposable into agile practices, such as Pair Programming and Daily Meeting. The SAAP framework extends Situational Method Engineering [4], by taking into account organizational strategies as significant situational attributes, which affect the choice of method fragments. The framework takes advantage of a knowledge base of agile practices, containing experiences collected from empirical studies. The knowledge base [5] is created by systematic

review of empirical studies which report on the outcomes of different agile practices in various project situations.

The proposed framework consists of three main components: *the Strategies Graph*, the *Evidential Knowledge Base of Agile Practices*, and the *Strategic Analysis Process* (Figure 1). The core of the framework is the Strategies Graph, inspired by the Strategy Map concept from Balanced Scorecards (BSC) in strategic management [6].The fundamental idea in BSC is to attain a balanced state in dealing with strategic objectives. Similarly, the SAAP framework highlights the importance of keeping balance among the various types of strategic goals in an organization while adopting a new software process. The SAAP framework was developed in response to strategic needs in one of the R&D units at Ericsson Software Research. In this paper, we introduce the SAAP framework with illustrations from the Ericsson experience.

2 The (SAAP) Framework

Figure 1 shows the main components of the framework. In the first phase of the *Strategic Analysis Process*, important strategic goals of the organization are extracted, classified, and visualized. Then, the strategic knowledge of candidate practices is retrieved from the pre-developed knowledge base of agile practices. The knowledge base contains knowledge collected from empirical studies about how each agile practice contributes to different strategic goals under various project conditions. The developed Strategic Graph is used along the second phase of the strategic analysis process, in order to situationally analyze the strategic impacts of every candidate agile practices; as well as their overall impact as a new agile process.

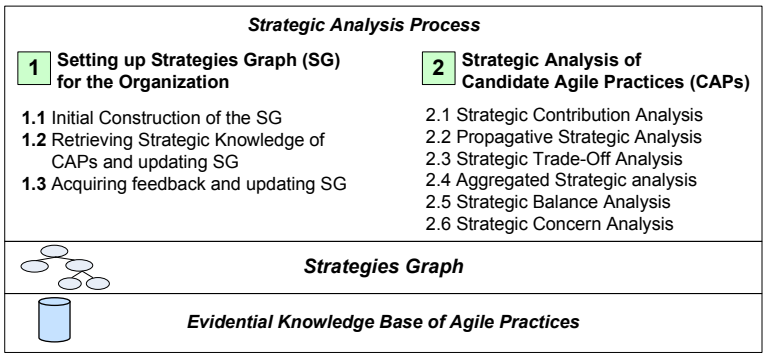

Figure 1: Overview of SAAP Framework

2.1 *Phase 1:* Setting up the Strategies Graph for the Organization

The Strategies Graph (SG) expresses the *decompositional* and *contributional* relations of strategies at different levels of organization. Decompositional relations represent the AND/OR decomposition of high-level strategies to low-level objectives. The

contributional relations represent the kind of impacts that strategic objectives might have on each other. The upper part of Figure 2 shows a portion of the SG, developed in one of the experiments of SAAP.

The Strategies Graph adopts its main constructs from the *i** modeling framework [7]. *i** is a goal and agent oriented modeling framework which can be used to represent the strategic aspects of a modeling domain. The *i** concept of Softgoal is used to model strategic objectives. The contributional relations of strategic objectives are represented by a variant of *i** notation of Contribution Link: "++" For Strong Positive, "+" for Positive, "-" for Negative, and "--" for Strong Negative contributions. "AND" and "OR" links are used to represent logical decomposition of strategic objectives.

[Step 1.1] Initial Construction of the Strategies Graph

The first step in applying SAAP is to develop the SG. The initial version of SG is developed by selected members of the Analysis Team. The framework stresses the participation of representatives all organizational roles. A participatory approach is needed to bring various stakeholders' viewpoints into a model of the organization's strategies. The role of middle management representatives is crucial for creating the SG. The initial version of SG often contains the strategic objectives that matter most to the organization, and which are not well supported by the as-is development process.

[Step 1.2] Retrieving Strategic Knowledge of CAPs and Updating SG

The second step of SAAP is to enrich the Strategies Graph of organization with the strategic objectives, which are tightly bound to agile values. The SAAP framework is built on top of an evidential knowledge base of agile practices. This knowledge base (which was introduced in an earlier paper [5]) contains the strategic information of agile practices. The contents of this knowledge base have been collected by systematic review of extensive number of empirical studies, which had reported the behavior of different agile practices in various project situations. Therefore, the strategic objectives that are presented for each agile practice are all supported by references to peer-reviewed empirical research papers. Indeed, the content of this knowledge base is evidence-based as it provides a brief description of the situation in which a particular contribution from a practice to an objective was observed. This knowledge base is available online at www.ProcessExperience.org.

The SAAP framework uses the content of the content of the knowledge base for completing the strategies graph of organizations. The reason for incorporating the built-in strategic objectives of agile practices into the strategic model of the organization is rooted to the intention of organization for adopting agile. Such organizations should have a clear understanding of agile objectives, and find a right place of those objectives within their organizational strategic model. For instance, in our experiment, one of the strategic objectives of the R&D unit (which was expected to be improved) was the "Reduced Development Cost" (shown in Figure 2). The knowledge base of agile practices introduced a number of related objectives, defined in the Lean method, which by focusing on "Avoiding Waste" positively contributes to

the "Reduced Development Cost" objective. The content of this knowledge base will be also used in the later steps of the framework.

[Step 1.3] Acquiring Feedback and Updating the SG
The Strategies Graph is developed iteratively. In our experience at Ericsson, the initial version of SG was developed by selected members of the analysis team, and updated with the strategic knowledge of agile practices. Afterwards, the SG is passed to other members of the analysis team, as well as other organizational members in order to get feedbacks and complete the model. Group meeting is indeed an effective approach for completing the SG, by reflecting opinions of different organizational parties.

2.2 *Phase 2:* Strategic Analysis of Candidate Agile Practices

The purpose of this phase is to investigate impacts of candidate agile practices on the strategic objectives of organization. This framework takes a model-driven approach for the strategic analysis of candidate agile practices, and uses the Strategies Graph of the organization as the basis of most analyses activities. The framework introduces five types of strategic analysis:

[Step 2.1] Strategic Contribution Analysis
The foremost step of strategic analysis is to explore *contributions* of every Candidate Agile Practice (CAP) towards the organizational strategic objectives visualized on the Strategies Graph. As shown in the Figure 2, every contribution relation has two elements:

1. **Contribution Type** – For specifying how the CAP affects an objective. The framework, inspired by the *i** modeling framework, defines four types of contributions: *Strongly Positive* (++), *Positive* (+), *Negative* (-), and *Strongly Negative* (--), where in positive contributions the enactment of CAP would help the achievement of objective, and vice versa for negative ones.
2. **Contribution Rationale** – For specifying why the CAP affects the objective. For example, when a CAP like "Scrum Team Structure" is identified to be making Positive (+) contribution to the objective "Avoid Extra Features", its rationale is that "sell-organizing members of a Scrum team can better identify extra features and decide on their removal or replacement".

Two approaches are proposed for deriving the contribution relations: *evidence-based* or *consensus-based*. It is evidence-based if the strategic objective appears among the retrieved strategic knowledge of the CAP. Thus, the type and rationale of contribution can be extracted from the knowledge base. When the evidence is unavailable, or is judged to be inadequate or unreliable, the analysis team would take a consensus-based approach to derive this contribution relation, based on the original definition of the CAP.

In specifying the type of a contribution relation, the analysis team should consider the possibility of *situational behaviors*. It is possible that a CAP, in some particular situations, impacts an objective differently from its general behavior. For example, the contribution of the CAP "Pair Programming" towards the objective "Be On-time

to Market" is situational, in that in some cases the CAP would help, and in some other cases in would hurt the objective. This information is retrieved from the Knowledge Base of SAAP. In this example, the knowledge base states that "when the market pressure is not high, and there is adequate number of developers, pairing programmers would help the project to be on time for market, whereas in other cases it hurts." Knowing the situational behaviors of a CAP towards an objective allows the analysis team to choose contribution values that are best matched with their own organization and project context.

[Step 2.2] Propagative Strategic Analysis

Propagative Strategic Analysis allows anticipating the impacts of an agile practice on higher-level strategic objectives. To perform this analysis, the value of contribution relations will be propagated along the strategies graph. For instance, as shown in Figure 2, enacting the CAP "Scrum Team Structure" would make positive contribution to the objective "Reduced Waiting Time", which consequently makes positive impacts over strategic objectives: "Avoid Waste", and "Reduced Development Cost". The propagative analysis of SAAP is based on the *i** forward propagation algorithm [8].

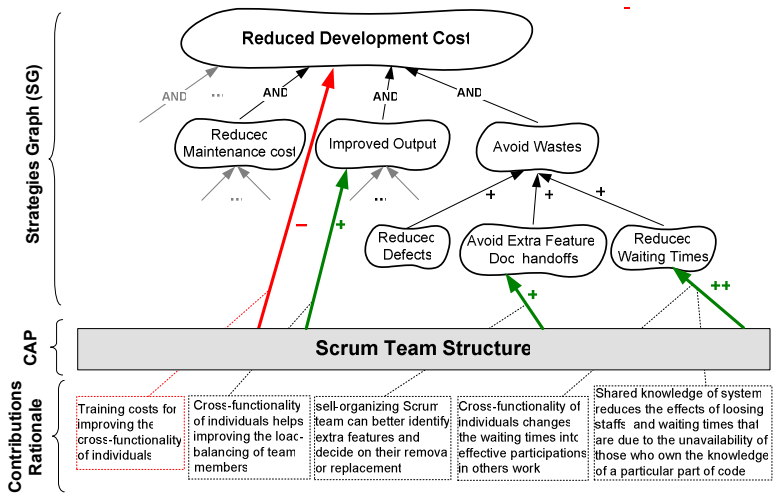

Figure 2: Strategic Contribution Analysis of the Candidate Agile Practice (CAP) "Scrum Team Structure" to a portion of the SG of our experiment case

[Step 2.3] Strategic Trade-Off Analysis

Strategic Trade-Off Analysis allows comparing alternative agile practices with respect to their contributions to the strategic objectives of an organization. In SAAP, alternative practices are compared with respect to their positive and negative contributions to the strategic goals of organizations, and the significance of every contributed goal. For instance, "Pair Programming" and "Peer Review" are two alternative practices that are often suggested for "Reducing Defect Rate" in source

code. However, there are other strategic goals which will be influenced by the enactment of any of these practices in an organization, depending to the project situation, e.g., "Cost of Development", "Time to Market", "Productivity of Individuals", "Novice Developers' Training", and "Knowledge Sharing".

SAAP uses a model-driven approach for trade-off analysis, and benefits from the *Propagative Strategic Analysis*. In this regard, the trade-off analysis would be performed not only with respective to the lower-level objectives, but also for the higher-level strategies of the organization. One approach for trade-off analysis in goal graphs is presented in [9].

[Step 2.4] Aggregated Strategic analysis

The purpose of aggregated strategic analysis is to explore the overall impact of the new agile method over the strategic objectives of an organization. In this analysis, for each organizational strategic objective, all the contributions from all candidate practices of new method are combined to produce the contribution of new agile method to that specific objective. After aggregation of contribution relations, every organizational strategic objective will take one of the following statuses:

- *Supported* – received homogeneous positive contributions
- *Declined* – received homogeneous negative contributions
- *Strongly Supported* – a supported objective with strongly positive contributions
- *Strongly Declined* – a declined objective with strongly negative contributions
- *Conflicted* – received heterogeneous contribution types from different practices
- *Unaddressed* – not contributed to by any practice, neither directly nor indirectly

[Step 2.5] Strategic Balance Analysis

Following Balanced Scorecards, one of the goals of the SAAP framework is to investigate whether the new agile method makes a balanced contribution to all categories of objectives. More specifically, in this framework, the transition to a new method is considered to be unbalanced if its positive contributions to one category of strategic objectives lead to significant bad effects on some other category of objectives. The balance of a transition does not imply that the selected set of practices is the optimum set, but an optimum set should make balanced impact over the strategic objectives. In [10] we introduced the concept of *Strategically Balanced Process Adoption* (SBPA), and specified its details. The SBPA considers a process adoption to be balanced, provided that it meets the following conditions:

1. It positively contributes to the strategic objectives, which are expected to be improved.
2. It does not cause uncontrolled negative impacts on the strategic objectives, which are not within the focus of improvement.
3. It does not cause overall deterioration of a particular category of strategic objectives, for the sake of improving some other categories.
4. It results in homogenous impacts over all categories of strategic objectives.

Detailed algorithms have been proposed in [10] to anticipate the attainability SBPA criteria.

[Step 2.6] Strategic Concern Analysis

Software process improvements are often motivate by the emergence of inefficiency symptoms in the current development process. These symptoms in a broader sense can be referenced in terms of *as-is process concerns*. When designing a new (to-be) development process, organizations should have an understanding of whether it will properly address their current concerns. SAAP is proposing the *Strategic Concern Analysis* in order to first, investigate the impacts of as-is process concerns on the strategic objectives of organization, and second, analyze whether the candidate set of agile practice would address the existing process concerns. The result of this analysis is key to the acceptance of CAPs, as if they fail to address the current concerns they cannot form an effective process.

To investigate the impacts of current process concerns on the strategic objectives of the organization, a similar approach of [step 2.1] can be applied. In this approach the identified process concerns are visualized next to the SG, and their negative contributions to the strategic objectives are investigated. This activity also requires the participation of representatives of different organizational roles, in order to come up with a right set of strategic objectives, which are affected by every process concern. The model driven approach (the visual aid of SG) facilitates this activity, and reduces the overhead of analysis.

To analyze whether the current set of CAPs are addressing as-is process concerns, the strategic contribution models of CAPs and process concerns is used. This analysis is based on the heuristic that when a strategic objectives is negatively contributed by a process concern PC_i, and positively contributed by the candidate agile practice CAP_j, it is possible that the CAP_j strategically addresses the PC_i. Further analyses of CAPs in regard with the as-is process concerns, requires root-cause analysis of process concerns, and investigation of the impacts of every CAP on the roots of process concerns.

3 Discussion and Future Work

The importance of acting strategically in transition to agile would become apparent when we observe the change of a method as a consequential strategic decision, which influences not only the technological, but also business and organizational objectives of an organization. The proposed framework of Strategic Analysis of Agile Practices (SAAP) investigates the impacts of a new agile method on organizational strategic objectives. The SAAP framework is proposed for the early stages of transitioning to agile, where organization would decide on the trade-offs of new method. The approach of this framework in the strategic analysis of agile practices is inspired by the idea of Balanced Scorecards [6], which emphasizes the establishment of organizational strategic model as the basis of a decision making framework in an organization.

The SAAP framework can be combined with most of the current frameworks of transition to agile, and complement their lack of attention to the strategic aspects of the transition process. It can be also used as a stand-alone framework for strategic

analysis of a set of candidate agile practices, in order to find their potential compliance and conflicts with strategic interests of an organization.

A number of issues have been identified as threats to the validity of the results of SAAP framework, which some of them can be mitigated. The reliance of framework to the knowledge base on agile practices can pose a risk to the framework, as there might not adequate information about all of the agile practices. However, this knowledge base in under expansion, and will cover a wider range of agile practices in future. The other risk to the SAAP is *Over-Pessimistic or -Optimistic Evaluations* – where there is no evidence for the contribution of an agile practice to a strategic objective, yet the contribution is perceived possible, in some cases the subjective evaluations might be unrealistic. Of course the level of familiarity and experience of chief members of Analysis Team in regards with agile practices and their built in objectives can influence the validity of Analysis results.

As for future work, the framework is going to be expanded for covering the full lifecycle of transitioning to agile. The framework has been tested so far in one study, further case studies will be an essential part of future work.

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