Rebalancing Your Organization's Agility and Discipline

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1. Abstract

In these days of rapid change, many organizations find that their current balance between using agile and disciplined methods is not what it should be. (We realize that "disciplined" is not the opposite of "agile," but it is our working label here for methods relying more on explicit documented knowledge than on tacit interpersonal knowledge).

In a forthcoming book [Boehm-Turner, 2003], we have analyzed many organizations' experiences with agile and disciplined methods, and have elaborated our previous characterization [Boehm, 2002] of the "home grounds" in which agile and disciplined methods have been most successful. This analysis has enabled us to determine five critical decision factors that organizations and projects can use to determine whether they are in either the agile or disciplined home grounds, or somewhere in between.

These five decision factors are size, criticality, personnel, dynamism, and culture. In this paper, we set the context by characterizing the agile and disciplined home grounds. We then define the five decision factors and their rating scales; provide a stepwise approach for assessing your organization's or project's location in the decision space and developing a strategy for rebalancing its agility and discipline; and illustrate its use with a representative organizational example.

2. The Home Grounds for Agile and Disciplined Methods

Table 1 summarizes what we have characterized as the "home grounds" for agile and disciplined methods —the sets of conditions under which they are most likely to succeed. The more a particular project's conditions differ from the home ground conditions, the more risk there is in using one approach in its pure form and the more valuable it is to blend in some of the complementary practices from the opposite method.

Most of the entries in Table 1 are self-explanatory, but the concept of "Cockburn levels" of development personnel deserves further explanation. Alistair Cockburn has addressed levels of skill and understanding required for performing various method-related functions, such as using, tailoring, adapting or revising a method. Drawing on the three levels of understanding in Aikido

(Shu-Ha-Ri), he has identified three levels of software method understanding that help sort out what various levels of people can be expected to do within a given method framework [Cockburn, 2002].

We have found these levels extremely helpful in creating a rating scale for our Personnel decision factor. We have taken the liberty here to split his Level 1 to address some distinctions between agile and disciplined methods, and to add an additional level to address the problem of method-disrupters. Our version is provided in Table 2.

Level -1 people should be rapidly identified and reassigned to work other than performing on either agile or disciplined teams.

Level 1B people are average, less-experienced, hard-working developers. They can function well in performing straightforward software development in a stable situation. But they are likely to slow down an agile team trying to cope with rapid change, particularly if they form a majority of the team. They can form a well-performing majority of a stable, well-structured disciplined team.

Level 1A people can function well on agile or disciplined teams if there are enough Level 2 people to guide them. When agilists refer to being able to succeed on agile teams with ratios of 5 Level 1 people per Level 2 person, they are generally referring to Level 1A people.

Level 2 people can function well in managing a small, precedented agile or disciplined project but need the guidance of Level 3 people on a large or unprecedented project. Some Level 2s have the capability to become Level 3s with experience. Some do not.

3. The Five Critical Decision Factors

Now that we have a common understanding of home grounds and personnel capability, we can develop our balancing criteria. Table 3 describes five major decision factors involved in determining the relative suitability of agile or disciplined methods in a particular project situation. These factors are the project's size, criticality, dynamism, personnel, and culture factors. A project which is a good fit to agile or disciplined for four of the factors, but not the fifth, is a project in need of risk assessment and likely some mix of agile and disciplined methods.

The five factors are summarized graphically in Figure 1. Of the five axes in the polar graph, *Size* and *Criticality* are similar to the factors used in [Cockburn, 2002] to distinguish between the lighter-weight Crystal methods (toward the center of the graph) and heavier-weight Crystal methods (toward the periphery). The *Culture* axis reflects the reality that agile methods will succeed better in a culture that "thrives on chaos" than one that "thrives on order," and vice versa.

Table 1. Agile and Disciplined Method Home Grounds

Characteristics	Agile	Disciplined
Application		
Primary Goals	Rapid value; responding to change	Predictability, stability, high assurance
Size	Smaller teams and projects	Larger teams and projects
Environment	Turbulent; high change; project-focused	Stable; low-change; project/organization focused
Management		
Customer Relations	Dedicated on-site customers; focused on prioritized increments	As-needed customer interactions; focused on contract provisions
Planning and Control	Internalized plans; qualitative control	Documented plans, quantitative control
Communications	Tacit interpersonal knowledge	Explicit documented knowledge
Technical		
Requirements	Prioritized informal stories and test cases; undergoing unforseeable change	Formalized project, capability, interface, quality, forseeable evolution requirements
Development	Simple design; short increment; refactoring assumed inexpensive	Extensive design; longer increments; refactoring assumed expensive
Test	Executable test cases define requirements, testing	Documented test plans and procedures
Personnel		
Customers	Dedicated, collocated CRACK* performers	CRACK* performers, not always collocated
Developers	At least 30% full-time Cockburn level 2 and 3 experts; no Level 1B or -1 personnel**	50% Cockburn Level 2 and 3s early; 10% throughout; 30% Level 1B's workable; no Level -1s**
Culture	Comfort and empowerment via many degrees of freedom (thriving on chaos)	Comfort and empowerment via framework of policies and procedures (thriving on order)
* Collaborative, Representative, Authorized, Committed, Knowledgable ** These numbers will particularly vary with the complexity of the application		

Table 2. Levels of Software Method Understanding and Use (After Cockburn)

Level	Characteristics
3	Able to revise a method (break its rules) to fit an unprecedented new situation
2	Able to tailor a method to fit a precedented new situation
1A	With training, able to perform discretionary method steps (e.g., sizing stories to fit increments, composing patterns, compound refactoring, complex COTS integration). With experience can become Level 2.
1B	With training, able to perform procedural method steps (e.g. coding a simple method, simple refactoring, following coding standards and CM procedures, running tests). With experience can master some Level 1A skills.
-1	May have technical skills, but unable or unwilling to collaborate or follow shared methods.

The other two axes are asymmetrical in that both agile and disciplined methods are likely to succeed at one end, and only one of them is likely to succeed at the other. For *Dynamism*, agile methods are at home with both high and low rates of change, but disciplined methods prefer low rates of change.

The *Personnel* scale refers to the extended Cockburn method skill rating scale discussed earlier, and places it in a framework relative to the complexity of the application. This captures the situation where one might be Level 2 in an organization developing simple application but Level 1A in an organization developing highly-complex applications. Here the asymmetry is that while disciplined methods can work well with both high and low skill levels, agile methods require a richer mix of higher-level skills [Highsmith, 2002, p.360].

Table 3. The Five Critical Agility/Discipline Decision Factors

Factor	Agility Considerations	Discipline Considerations
Size	Well-matched to small products and teams. Reliance on tacit knowledge limits scalability.	Methods evolved to handle large products and teams. Hard to tailor down to small projects.
Criticality	Untested on safety-critical products. Potential difficultiies with simple design and lack of documentation.	Methods evolved to handle highly critical products. Hard to tailor down to low-criticality products.
Dynamism	Simple design and continuous refactoring are excellent for highly dynamic environments, but a source of potentially expensive rework for highly stable environments.	Detailed plans and Big Design Up Front excellent for highly stable environment, but a source of expensive rework for highly dynamic environments.
Personnel	Requires continuous presence of a critical mass of scarce Cockburn Level 2 or 3 experts. Risky to use non-agile Level 1B people.	Needs a critical mass of scarce Cockburn Level 2 and 3 experts during project definition, but can work with fewer later in the project—unless the environment is highly dynamic. Can usually accommodate some Level 1B people.
Culture	Thrives in a culture where people feel comfortable and empowered by having many degrees of freedom.	Thrives in a culture where people feel comfortable and empowered by having their roles defined by clear policies and procedures.

For example, a disciplined project with 15% Level 2 and 3 people and 40% Level 1B people would initially use more than 15% Level 2 and 3 people to plan the project, but reduce the number thereafter. An agile project would have everybody working full-time, and the 15% Level 2 and 3s would be swamped trying to mentor the 40% Level 1Bs and the remaining Level 1As while trying to get their own work done as well.

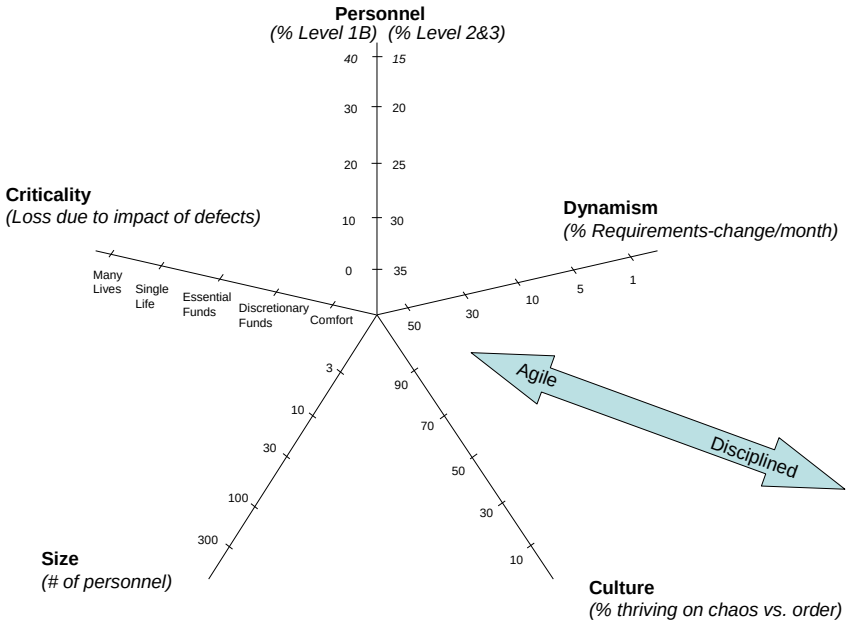

Figure 1. Dimensions Affecting Method Selection

By rating a project along each of the five axes, you can visibly evaluate its home-ground relationships. If all the ratings are near the center, you are in agile method territory. If they are at the periphery, you will best succeed with a disciplined approach. If you are mostly in one or the other, you need to treat the exceptions as sources of risk and devise risk management approaches to address them.

4. A Stepwise Approach for Balancing Agility and Discipline

The steps below provide a simple recipe for balancing agility and discipline. Be sure, however, that you perform them in consultation with your key stakeholders.

1. Use Figure 1 to assess where your projects currently are with respect to the 5 key axes. If you have different organizations with different profiles, make separate assessments. Also, assess the likely changes in your organization's profile over the next 5 years. Key stakeholders to consult include your users, customers, developers, suppliers, and strategic partners. Key future trends to consider include:

    - the increased pace of change and need for agility;
    - the increased concern with software dependability and need for discipline;
    - your ability to satisfy your stakeholders' evolving value propositions, and to keep up with your toughest competitors;

- the increasing gap between supply and demand for Cockburn Level 2 and 3 people;
- your ability to cope with existing and emerging technical challenges such as COTS integration, evolving Internet and Web capabilities, distributed and mobile operations, agent coordination, and multi-mode virtual collaboration.

2. If your assessments show you comfortably in the agile or disciplined home ground now and in the future, your best strategy is to embark on a continuous improvement effort to become the best you can at agility or discipline. To start such an effort, the best next steps are:
    a. Convene a representative working group of key stakeholders to assess alternative agile or disciplined improvement approaches and recommend an approach that best fits your situation.
    b. Identify a reasonably tractable project, staffed with capable and enthusiastic people, to be trained in using the approach, to apply it, and to develop a plan for both dealing with problems encountered and for extending the approach across the organization.
    c. Execute the plan for extending the approach, always including evaluation and feedback into continuous improvement during and after each project.
3. If your Figure 1 assessments leave you mostly in the agile or disciplined home grounds, but with some anomalies, treat the anomalies as risk factors to be added to the charters of the groups performing steps 2a-c. Examples of potential anomalies are:
    a. Operating mostly in a disciplined home ground, but in an increasingly dynamic marketplace.
    b. Operating with agile fix-it-later developers with a growing, increasingly enterprise-integrated and dependability-oriented user base.
    c. Finding that your technical people are successfully adapting to dynamism, but that your contract management people are not.

    The first two anomalies can be addressed via risk assessment and managerial techniques. The third would involve a more specialized approach to change management in the contracting organization, but done with their collaboration and the support of upper management.

    If you have several organizations and several profiles, it is best to prioritize your approach to work on those you believe are most important and likely to achieve early successes. An exception is if there are projects in crisis that need, and are receptive to, significant help and redirection.

4. If your Figure 1 assessments leave you with a highly mixed agility-discipline profile, you need to develop an incremental mixed strategy to take you from your current situation to the one you have chosen as a goal. For example, suppose that your organization primarily does 50-person, essential-funds critical projects with a mix of 20% Level 2 and 3 and 30% Level 1B personnel, with dynamism rapidly increasing from 5%/month to 10%/month, a culture only 30% oriented toward thriving on chaos, and a corporate steady-state goal to do all software internally. This profile is shown in Figure 2.

   In this case, you would like to function internally like the successful ThoughtWorks discipline-extended XP lease management application team described in [Elssamadisy-Schalliol, 2002; Elssamadisy, 2003; and Schalliol, 2003]. If your staffing profile had 30% Level 2 and 3 and 10% Level 1B people and your culture was 70% toward thriving on chaos, then you could apply their recommended processes and succeed internally. Unfortunately, your current staffing profile and culture make this infeasible.

   One option for you would be to start on a long-term internal effort to upgrade your staff and change your culture. But a quicker and less risky approach to rebalance your agility and discipline would be to enter a strategic partnership with an agile methods company to serve as near-term trainers, co-developers, and mentors for your staff. This would expedite an initiative to bring as many of your Level 1A people up to Level 2 as possible, and to bring as many of your Level 1B people up to Level 1A, at least in some niche area. The agile methods company people could also serve as change agents in making your organizational culture more thrive-on-chaos oriented.

   In other cases, you might be a growing pure-agile company with a need to add more discipline to accommodate larger and more critical products. You could employ a similar strategy with a disciplined services company to rapidly rebalance your operations, staff profile, and culture.

5. Your organization should complement whatever agile/disciplined balancing options it pursues with sustained effort to improve your staff capabilities, value-oriented capabilities, and communication capabilities. It is also important to track your progress with respect to your plans and apply corrective action whenever new opportunities come up. A good checklist for staff capabilities is the People CMM [Curtis et al., 2002]. A good starting point for value-oriented capabilities is *Value-Based Software Engineering* [Boehm, 2003; Boehm-Huang, 2003]. A good mechanism for tracking multi-criteria, multi-initiative programs is the Balanced Scorecard technique [Kaplan-Norton, 1996].

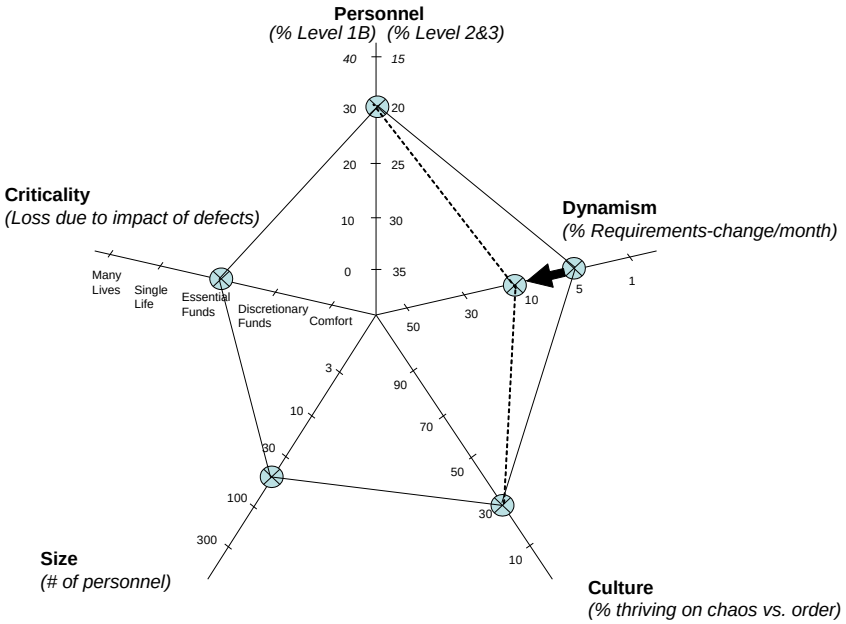

Figure 2. Sample Highly-mixed Profile

5. Summary

We have defined a set of criteria and a process for using them to help organizations plan how to balance their agility and discipline. By looking at the current profile and comparing it with the desired profile, a gap analysis can show the critical areas where the organization needs to change. An illustrative example provides some specific guidance on how to apply the process.

6. Biographies

Barry Boehm is the TRW Professor of Software Engineering at USC, and Director of its Center for Software Engineering. He is a Fellow of the ACM, AIAA, IEEE, and INCOSE, and a member of the National Academy of Engineering.

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