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Performance Management of Agile Software Development Teams

Abstract

Around the same time as the emergence of agile methods as a formalized concept, the management accounting literature introduced the concept of Beyond Budgeting as a performance management model for a changing business environment. Both concepts share many similarities with both having a distinctly agile or adaptive perspective. The Beyond Budgeting model promises to enable companies to keep pace with changing environments, quickly create and adapt strategy and empower people throughout the organization to make effective changes. This paper develops the Beyond Budgeting model within the context of agile software development teams. The twelve Beyond Budgeting principles are briefly summarized and a research framework is presented which is applied using one case study. The results from the study suggest that the model may be a suitable lens through which an organization can gain an understanding of the organizational level factors, which affect the implementation of agile. The paper discusses how the model was developed, applied and how the conclusions are reached.

Keywords: Performance Management, Beyond Budgeting, Agile Methods, Organizational Structures.

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Introduction

Continued uncertainty and rapid changes to business and technology environments have meant that a software development teams' ability to respond to changing user or customer requirements has become increasingly critical. As a means to respond to these changes, the software development community has moved from a traditional, plan-driven, structured approach to more agile development methods. Agile software development approaches such as XP (eXtreme Programming), Scrum, DSDM (Dynamic Systems Development Method), and FDD (Feature Driven Development) have been proposed as solutions to improve a software teams' ability to embrace and respond to the changing requirements. The emergence of these new methods has had a huge impact on the way software is developed worldwide (Conboy, 2009, Conboy and Fitzgerald, 2004, Dybå and Dingsøyr, 2008) with some reporting that almost 70% of organizations are currently employing an agile method and more expected to employ one in the near future (Ambler, 2007).

The widespread adoption of agile methods has meant that organizations that were traditionally used to working with the waterfall method are now finding it challenging to migrate processes and structures designed for waterfall development over to more agile methods (Nerur et al., 2005, Boehm and Turner, 2005, Boehm and Turner, 2004). Given the saturation levels of agile methodologies, it is of concern that so little research has focused on the interface between the agile team and the organization's legacy structures, processes and mechanisms. Many researchers have called for research in this area and for researches to develop a better understanding of the implementation of agile at the organizational level (Abrahamsson et al., 2009). This research helps begin to fill this gap in our understanding.

The Beyond Budgeting Model

An innovation from the accounting literature called, "Beyond Budgeting", has shown great promise as a performance management model for a changing business and operating environment (Bogsnes, 2009, Davila et al., 2009, Drury, 2008, Hansen et al., 2003, Hope and Fraser, 2003, Poppendieck and Poppendieck, 2010, Ferreira and Otley, 2009). This model is conceptually similar and appears to align well with agile methods (Larman and Vodde,

2008, Ambler, 2008, Bogsnes, 2009, Highsmith, 2006, Poppendieck and Poppendieck, 2010). The research objective of this paper is to examine the factors surrounding the implementation of agile methods in a large organization. To achieve this objective the following two research questions are posed and addressed in this paper.

- What mechanisms hinder the introduction of agile methods within an organization?
- What mechanisms facilitate the introduction of agile methods within an organization?

To answer these questions the Beyond Budgeting model is used as a lens through which to view the management model currently in place within one large organization implementing an agile method. The Beyond Budgeting concept was first introduced in 1997 as an alternative to the traditional command and control type performance management models, which were usually based on budgetary control mechanisms. Beyond Budgeting is more orientated towards fast changing operational environments and utilizes a sense and respond type of control mechanism, which allows an organization to keep pace with fast changing environments (Fraser, 2001, Hope and Fraser, 1999, Hope and Fraser, 2003, Hope and Fraser, 2003a, Hope and Fraser, 2003b, Hope and Fraser, 2003c). The emergence of this new concept coincided with the emergence of agile methods and both concepts share many similarities with both having a distinctly agile or adaptive perspective (Larman and Vodde, 2008). The model consists of six leadership principles and six process principles when taken together and used in an holistic manner help improve performance management within an organization (Hope and Fraser, 2003, Bogsnes, 2009). Table 1 lists the twelve principles are they are outlined in the Beyond Budgeting Round Table¹.

Table 1 The Beyond Budgeting Performance Management Model

Leadership Principles	Process Principles
Customers: Focus everyone on improving customer outcomes, <i>not on hierarchical relationships.</i>	Goals: Set relative goals for continuous improvement; <i>do not negotiate fixed performance contracts.</i>
Organization: Organize as a network of lean, accountable teams, <i>not around centralized functions.</i>	Rewards: Reward shared success based on relative performance, <i>not on meeting fixed targets.</i>
Responsibility: Enable everyone to act and think like a leader, <i>not merely follow the plan.</i>	Planning: Make planning a continuous and inclusive process, <i>not a top down annual event.</i>
Autonomy: Give teams the freedom and capability to act; <i>do not micro-manage them.</i>	Controls: Base controls on relative indicators and trends, <i>not variances against a plan.</i>
Values: Govern through a few clear values, goals and boundaries, <i>not detailed rules and budgets.</i>	Resources: Make resources available as needed, <i>not through annual budget allocations.</i>
Transparency: Promote open information for self-management; <i>do not restrict it hierarchically.</i>	Coordination: Coordinate interactions dynamically, <i>not through annual planning cycles.</i>

The expanded Beyond Budgeting Framework

In order to conceptualize the Beyond Budgeting model and contextualize it within the field of agile software development it was necessary to look at the applicability of each of the principles to agile development teams. To do this the main dimensions of each principle were examined along with their applicability in an agile context. This was achieved through a literature review of the main tenet of each principle (Lohan et al., 2010). This literature review highlights how the Beyond Budgeting model can be operationalized within the context of agile software development. Space constraints do not allow for an in-depth look at each principle in this paper. A brief summary is given below.

Leadership Principles

- **Customer Focus:** In order to gain an insight into the customer focus of an agile team it is necessary to understand the level of knowledge the team has of the customer domain, the level of involvement the

¹ www.BBRT.org Members of the Beyond Budgeting Round Table (BBRT) are individuals and organizations who are interested in managing without budgets. Membership in the BBRT is worldwide.

customer has with the development and the level of feedback received from the customer and how this feedback is utilised.

- **Organization:** The second principle states that the organization should organize as a network of lean accountable teams, not around centralized functions. This corresponds to the level of decentralization teams have. To understand how decentralized a team is, we look at the decision making rights of the team and its members. What decisions can they make regarding methodologies used, metrics utilised to determine quality or velocity and what spending decisions do the team make regarding training or equipment.
- **Responsibility:** This principle deals with the enablement of the team and the accompanying responsibility. In particular, how are team members encouraged to act and think like leaders. What coaching is carried out within the team. Enabling the team carries with it a risk, which can be neutralised by sharing the responsibility. Therefore, this principle also requires everyone in the organization to carry personal responsibility for his or her part in it. We need to look at how responsibility is shared among the team members.
- **Autonomy:** Giving teams the freedom and capability to act means empowering the team with decision-making rights. This is looked at previously under decentralization. However, empowering a team also requires that the team members actively participate in decision-making and that the members feel their contribution is valued.
- **Values:** This principle is about what values, goals and boundaries are used by the organization to govern the team's performance. The main interest here is how these values, goals and boundaries are decided, what level of input the team has into deciding them and how they are communicated to the team members.
- **Transparency:** Having access to information requisite for the team to perform in self-managing way is the main tenet of this principle. Here we are trying to see if the team is getting all the information it requires to perform effectively and make good decisions, both for the short and long term.

The above six principles are supported by the following surrounding processes and mechanisms which allow the team to operate in an agile and adaptive manner.

Process Principles:

- **Goals:** In an agile environment, where the team needs to respond to and embrace changing requirements, setting stretch goals as outlined by goal setting theory is regarded as the optimum goal setting approach. To gain the maximum benefit from these stretch targets input is required from the team. The Beyond Budgeting model asserts that the goals set should include both technical and behavioural goals.
- **Rewards:** The reward process for an agile team needs to be based on sharing in the successes of the team. Group reward schemes or hybrids, which allow for individual improvement but also reward group success, are a fundamental part of the Beyond Budgeting and the agile way of doing things. Rewards should be relative in that hindsight is used when reviewing a team's performance to take into account external impact factors beyond the control of the team. The Beyond Budgeting model recommends that a peer review process be used to evaluate team performance.
- **Planning:** The planning process for an agile team fits exactly into what the Beyond Budgeting model suggests, i.e. flexible and inclusive planning. Daily stand-ups, iterations and retrospectives allow a team to plan for change and involves all team members.
- **Control:** As previously stated, boundary conditions are determined within the governance documents. It is only when these boundary conditions are not being adhered to that external entities influence a team. Adherence to these boundary conditions is monitored through key performance indicators.
- **Resources:** In a changing environment, resources must be available as needed in order for the team to be able to optimize performance. Annual resource allocations do not complement changing user requirements.
- **Coordination:** Continuous interaction between stakeholders is required to have all relevant information readily available. A changing environment means that the ability to react quickly is dependent on having open communication channels, which serve to provide information required to decision makers.

These twelve principles complement each other to form a cohesive performance management model for software development teams working in an environment where requirements change regularly.

Research Methodology

3.1 Site Selection

The organization chosen for this study had, within the past few years, implemented the scrum methodology into their systems development operations. The development teams had traditionally worked with a waterfall development and the transition to agile development processes raised questions on the suitability of the surrounding supporting processes. Organizational structures, which had supported the use of the waterfall method, meant that emphasis on customer collaboration, which is the norm in agile development, was a relatively new area for these organizations. In this organization, the end user was not the direct customer of the development team. The teams studied were part of a larger umbrella group and therefore their customers were more often than not an internal downstream function of the organization.

3.2 Data Sources

The literature review (Lohan et al., 2010) served as a basis for a questionnaire, which was developed to answer the two main research questions. Data were collected through a variety of methods: unstructured and semi-structured interviewing, document review and observation.

The study was conducted within the Information Services (IS) division of a large multinational financial consulting firm (FCC) which builds customised software applications for internal clients. The data was collected as part of a larger research project that consisted of an in-depth study conducted over four months. Three different scrum projects were studied. Data was collected through on-site observation at iteration meetings and daily scrums, review of documentation, three workshops and nine interviews.

3.3 Data Analysis

All transcripts were recorded and transcribed entirely. The transcriptions were imported into NVivo for coding. The data was analysed based on Strauss and Corbin's approach (1998) for open and axial coding, where the initial interview questions and subsequent data analysis was based on the twelve principle of the Beyond Budgeting model.

Precautions were taken to corroborate the interpretations made (Miles and Huberman, 1999, Yin, 2003). Categories were checked for representativeness by examining them across participants. For example, team members' reports of their experience with their customers were checked against the reports from other team members and the project managers or scrum masters. The participants in the study also provided commentary, correction and elaboration on drafts of the findings and framework. The next section presents the findings of the research.

Findings

Customer Focus

The customer focus of agile teams within FCC appeared to be entirely dependent on the level of experience the team had with the same customer. When a team was working with the same customer over a period of time, they gained an insight into that customer's needs, the relationship developed and the customer became more involved with providing feedback and forward looking information. While one team interviewed had developed a customer focus through an ongoing relationship with their customer, other teams felt that they did not know their customer at all and received relatively little input or involvement from the customer as the following quote from a team member indicates:

“We don’t have much interaction with them, our customer”

Organization

To a certain extent, the teams felt that they were able to make or be involved in decisions that affected them. Deciding on daily operating metrics, code coverage etc. is an example of the decision-making rights of the team members. Getting funding for training or for new resources was possible if as one developer said *“you could justify it”*. Others were not sure as the following quote from another team member demonstrates:

“You would have to go through an awful lot of hoops to get what you want and even then you could be wasting a lot of time. I mean an example at the moment is where as a team we are looking for a UNIX machine where we can use it as almost a testing system. We can do anything we want in there, we can run tests or we might want to install the latest version of oracle or anything we want purely for our own use. We’ve been trying to get that for 3 months now and we still haven’t got it.”

So while the teams felt they had decision making rights during their day to day work, and that their immediate management was very open to suggestions, there were recommendations regarding methodologies, technology stacks and coverage tools which were as one developer says *“decided way up”* and the teams were encouraged to stick to those recommendations.

Responsibility

To some extent, FCC was strong on this principle. Most team members felt that their team leaders and management were supportive and that any issues or questions they had were addressed sufficiently. Team members felt they were being listened to and were able to develop personally. As one developer says:

“[Management] would be quite supportive, if we have issues or are working on something, its quite supportive there, you’d know that they have got your back”

Autonomy

Again, FCC agile team members felt that they had a lot of autonomy when it came to their daily work. Managers were easily approachable with ideas and the input of each team member was valued at the daily stand-up meetings, iteration meetings, etc. Participation was the norm as per the scrum methodology. As a traditional hierarchical organization, many larger decisions affecting the team were made at higher levels and many members spoke of decisions being made *“above our heads”* and *“at a higher level”*. That said, most members agreed that explanations for why decisions were made were readily available if requested, albeit as one member noted:

“Usually its explained but its explained as in its politics, and that isn’t much of an explanation but you understand why some people have to pandered to and if we wanted to get to somewhere we have to do this and that’s fine, but you know it can be frustrating.”

Values

Governance of the agile teams within the organization is based on a set of recommended methodologies, tools, technology stacks, etc., which were decided higher, up the hierarchical chain. There is leeway for the agile teams to suggest new recommendations and this is actively encouraged. As the organization is currently undergoing a transition to a newer more agile management model, it is understandable that a certain amount of alignment and streamlining is still required. For example, currently, higher-level yearly goals are communicated down to project managers and team leaders sometime as late as March. These managers have already discussed yearly goals with team members in January and it then becomes a matter of realigning the team members goals with those received

from higher management in March. This process is frustrating for managers and team members alike but it appears to be understood that the process is beginning to improve.

Transparency

There was a general consensus within all the interviewees that they had all relevant information they required for their daily operations. Some security features were in place protecting access rights to specific project information and data but all those interviewed felt that if they needed to or wished to see specific information they did not have access to then it would be no problem to get the relevant access rights.

Goals

The goal setting process worked well in this organization. Team members had a lot of input into setting their own performance goals, which included both technical and behavioral goals. Goals were set in conjunction with the project manager and were discussed on a one to one basis.

Rewards

Beyond Budgeting advocates the use of group reward schemes, which include hindsight reviews carried out by peers. FCC in this study came up poor when it came to the reward scheme. Reviews were carried out by managers and hindsight was used to evaluate performance over the previous year. While managers tried to evaluate the contribution the team member made to the team, team members pointed out that their managers would not be fully aware of their contributions to the team. The team members were evaluated on a curve basis creating competition within the team for higher gradings along the curve. Something that one manager pointed out became more noticeable closer to the review dates. Apart from the sabotaging games, which are likely to occur when individuals are dependent on team members to perform but are competing individually for rewards, demotivation is likely when the following real scenario occurs:

“Its very demotivating then because I’ve been in meetings where I know someone should be getting an (A) and they’ve been a (B) even though I’ve given them an (A). Its been downgraded by someone up the chain who actually has no exposure to that person and its from a pure numbers point of view....and you’re dealing with pretty clever people as well so I can’t necessarily go in and say you were given an (A) but have been downgraded to a (B) because that has all sorts of... well, you can see where that ends up.”

Planning

The scrum methodology being followed means that planning is a flexible and inclusive process. The planning process initially takes place at a higher level than the agile team. Major (usually yearly) milestones and timelines are developed without insight from the team members but if they feel these need to be changed then they have mechanisms to voice their opinions once they receive these high level plans. Within the higher level plans there is considerable flexibility for the team.

Control

Operational control is carried out by the project manager with one project manager saying that they are continuously “looking to see that everything is green”. The key performance indicators are not specified but as one manager stated: “The only thing we’re ultimately being measured on is that we’ve met those high level milestones”. These high-level milestones can be regarded as the boundary conditions for the project and in this instance; quarterly releases were viewed as important.

Resources

A resource budget is assigned at the beginning of each year and when a team member requires a resource, they will generally send that request to the budget holder (project manager). As the budget is annually assigned, the project manager makes a decision and either accepts or rejects the request. Additional resources can be applied for but as one project manager states:

“you would probably have bandwidth to do it once a year but if you have to go back looking for additional funds you don’t go back looking for them a second time.”

Coordination

The organization has mechanisms in place such as intranets, video conferencing facilities, knowledge wikis, etc. designed to encourage continuous interaction. Most team members interviewed felt that coordination was only when groups were working on the same program and an integration was taking place. Some members felt that there was a poor level of interaction with teams outside their own. However, as the organization has several initiatives encouraging coordination and interaction both formal and informal (in the form of on site social events) it appears that interactions with other teams outside their own group is dependent on each individual and perhaps their characteristics or their workload.

Conclusions

The organization is currently undergoing a transition from the waterfall methodology to an agile method and many of the processes, structures and mechanisms are still suited to a traditional waterfall methodology. The Beyond Budgeting model is presented here as the optimum management model to complement the introduction of agile methods into an organization. Based on this premise, table 2 below shows where the case studied is currently situated when it comes to having complementary management structures, processes and mechanisms in place to accommodate an agile way of working.

1. It seems that focusing on customer relationships was not formalised in any structured way and customer focused teams would be dependent on the length of time the team worked with the same customer.
2. Teams had a lot of freedom when making decisions about their daily operations, larger decisions that affected the team, such as which methodology or tools to use were often made without consulting the team.
3. Team members were enabled and encouraged by their immediate superiors
4. Team members were not micromanaged but again some larger decisions affecting the team were made by upper management with little consultation with team members
5. There is a misalignment between governance values and goals from upper management, which are communicated to the team in March and those the teams work with until they receive the new set of values and goals.
6. There was a consensus that transparency was not an issue within this organization.
7. The goal setting process was open and valued by all interviewees
8. The reward process is not designed to support teamwork and more suited for individual achievement.
9. Planning is an inclusive process with all members having an input into project planning
10. Controls are based on hitting yearly milestones and the team have considerable flexibility within those milestones to make changes, implement corrective action plans or even if the case was strong enough, to extend yearly milestones
11. Resources are made available through annual budget allocations. If a team requires new resources there are mechanisms in place to apply for these. However, most felt that it was not something that was encouraged. The consensus was that budgets were set in stone and it would be difficult to get additional resources. This

strategy may cause the organization to miss value-enhancing opportunities due to the perceived inflexibility of the resource allocation process.

12. While teams did not always coordinate in a dynamic and efficient manner, the organization has mechanisms and processes in place to encourage teams to do so.

Table 2

Current Status of FCCs Management Model for Agile Methods			
Principle	Unsuitable	Needs Improvement	Suitable
1. Customer Focus		●	
2. Organization		●	
3. Responsibility			●
4. Autonomy		●	
5. Values		●	
6. Transparency			●
7. Goals			●
8. Rewards	●		
9. Planning			●
10. Control			●
11. Resources	●		
12. Coordination			●

This study has shown that many of the processes and mechanisms employed by FCC are complementary to an agile environment, the two notable exceptions being the reward process and the resource allocation process. Other areas such as customer focus, organization, autonomy and values also need addressing but as the organization is in a transition period and agile methods are relatively new it would be expected that many areas are in the process of improving.

This paper used a management model (Beyond Budgeting) which claims to be a suitable model for a flexible and changing operating environment. While the model may not cover all aspects of managing an agile team and introducing agile methods into an organization, it appears to cover all the main performance affecting areas and highlight areas where there may be issues. Further research could further test and validate the model.

References

- Abrahamsson, P., Conboy, K. & Wang, X. (2009) Lots done, more to do: The current state of agile systems development research, *European Journal of Information Systems*, **18**, 281-284.
- Ambler, S. W. (2007) Agile has crossed the chasm. pp.
- Ambler, S. W. (2008) Architecture and Design. In: *Dr Dobb's Journal*, pp. Available at <http://www.drdoobs.com/architecture-and-design/212200803>, March 9.
- Boehm, B. & Turner, R. (2004) *Balancing Agility and Discipline: A Guide for the Perplexed*, Addison-Wesley, Boston.
- Boehm, B. & Turner, R. (2005) Management challenges to implementing agile processes in traditional development organizations, *Software, IEEE*, **22**, 30-39.
- Bogsnes, B. (2009) *Implementing Beyond Budgeting: Unlocking the Performance Potential*, J Wiley & Sons, New Jersey.
- Conboy, K. (2009) Agility from First Principles: Reconstructing the Concept of Agility in Information Systems Development, *Information Systems Research*, **20**.
- Conboy, K. & Fitzgerald, B. (2004) Toward a conceptual framework of agile methods, *Extreme Programming and Agile Methods - Xp/ Agile Universe 2004, Proceedings*, **3134**, 105-116.
- Davila, A., Foster, G. & Li, M. (2009) Reasons for management control systems adoption: Insights from product development systems choice by early-stage entrepreneurial companies, *Accounting, Organizations and Society*, **34**, 322-347.
- Drury, C. (2008) *Management and Cost Accounting*/ London: South-western, 2008.
- Dybå, T. & Dingsøy, T. (2008) Empirical studies of agile software development: A systematic review, *Information and Software Technology*, **50**, 833-859.
- Ferreira, A. & Otley, D. (2009) The Design and Use of Performance Management Systems: An Extended Framework for Analysis, *Management Accounting Research*, **20**, 263-282.
- Fraser, R. (2001) Figures of hate, *Financial Management (14719185)*, **22**.
- Hansen, S. C., Otley, D. T. & Van der Stede, W. A. (2003) Practice Developments in Budgeting: An Overview and Research Perspective, *Journal of Management Accounting Research*, **15**, 95-116.
- Highsmith, J. (2006) An Adaptive Performance Management System. In: *Cutter Consortium Executive Summary*, pp. Available at <http://www.infoq.com/resource/articles/Adaptive-Performance-Management/en/resources/apms0606.pdf>, March 9.
- Hope, J. & Fraser, R. (1999) Take it Away, *Accountancy*, **123**, 50-51.
- Hope, J. & Fraser, R. (2003) *Beyond Budgeting: How Managers can Break Free from the Annual Performance Trap*, Harvard Business School Press, Boston, Mass.
- Hope, J. & Fraser, R. (2003a) New ways of setting rewards: The beyond budgeting model, *California Management Review*, **45**, 104-119.
- Hope, J. & Fraser, R. (2003b) Who needs budgets?, *Harvard Business Review*, **81**, 108-+.
- Hope, J. & Fraser, R. (2003c) Who needs budgets? Response, *Harvard Business Review*, **81**, 132-132.

Larman, C. & Vodde, B. (2008) *Scaling Lean & Agile Development*, Addison-Wesley, Upper Saddle River, NJ.

Lohan, G., Conboy, K. & Lang, M. (2010) Beyond Budgeting and agile software development: A conceptual framework for the performance management of agile software development teams. In: *International Journal of Information Systems (under review)*, pp., St Louis.

Miles, M. & Huberman, A. (1999) *Qualitative Data Analysis*, Sage, London.

Nerur, S., Mahapatra, R. & Mangalaraj, G. (2005) Challenges of migrating to agile methodologies, *Communications of the Acm*, **48**, 73-78.

Poppendieck, M. & Poppendieck, T. (2010) *Leading Lean Software Development: Results Are Not the Point*, Addison-Wesley, Upper Saddle River, NJ.

Strauss, A. & Corbin, J. (1998) *Basics of Qualitative Research: Grounded Theory Procedures and Techniques*, Sage, Thousand Oaks, CA.

Yin, K., Robert. (2003) *Case Study Research: Design and Methods*: Sage, Thousand Oaks, California, 2003.