A Performance Management Model for Agile Information Systems Development Teams

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Abstract The prevailing trend in ISD is one of poor project performance, with budget overruns commonly in excess of 300% and many failing altogether. To address this trend ISD research always focuses on the ISD process, user involvement, and the people involved. Rarely, if ever are wider organisational processes questioned. This paper argues for a cohesive and ongoing inclusion of wider organisational factors in efforts to address and improve ISD project performance. Given the poor budgetary performance of ISD projects, budgeting is one are we feel requires particular attention. Contemporary research in budgeting (e.g. Beyond Budgeting) and in ISD (e.g. agile methods) attempts to address similar issues albeit from a different angles. This paper draws on 2 case studies of 7 ISD teams to apply the Beyond Budgeting model to an ISD environment. We demonstrate the value of using the Beyond Budgeting model to develop a cohesive research agenda within ISD used to identify gaps and suggest improvements to agile methods, probably the most well known and accepted contemporary ISD approach.

Keywords: Information Systems Development, Project Failure, Beyond Budgeting, Agile Methods

INTRODUCTION

Despite over 40 years of ISD research, the statistics on project failure in information systems development (ISD) projects are still of significant concern. ISD projects often spiral out of control and far exceed original budget and schedule projections (Keil et al., 2007). The Standish Group's 2003 CHAOS Report which incorporates data from several thousand projects suggests that 43% of projects were over budget (Pan et al., 2006). The 2006 CHAOS study update, reveals that only 35% of IT projects started in 2006 were categorised as successful, 19% were judged to be outright failures, and the remaining 46% were completed over-budget, behind schedule or failed in some way to meet user requirements (Rubinstein, 2007).

When we examine budgeting theory and literature, it is perhaps not surprising that ISD projects are continuously running over budget. Indeed it is clear that effective budgeting is something that has not really been mastered in any discipline. In its own literature, the budgeting process has attracted much criticism in recent years (Hansen et al., 2003). The traditional budgeting process has been labeled as "broken" (Jensen, 2003), an "unnecessary evil" (Wallander, 1999), a "thing of the past" (Gurton, 1999), "ineffective and inefficient" (Hope and Fraser, 2003) and many have questioned the value of budgeting as a management control mechanism in contemporary environments at all (Bogsnes, 2009, Dugdale and Lyne, 2006, O'Brien, 1999). Contemporary budgeting research is attempting to fix these issues and in recent years an innovation from the management accounting literature called Beyond Budgeting has received a lot of attention (Bogsnes, 2009, Hansen et al., 2003, Hope and Fraser, 2003).
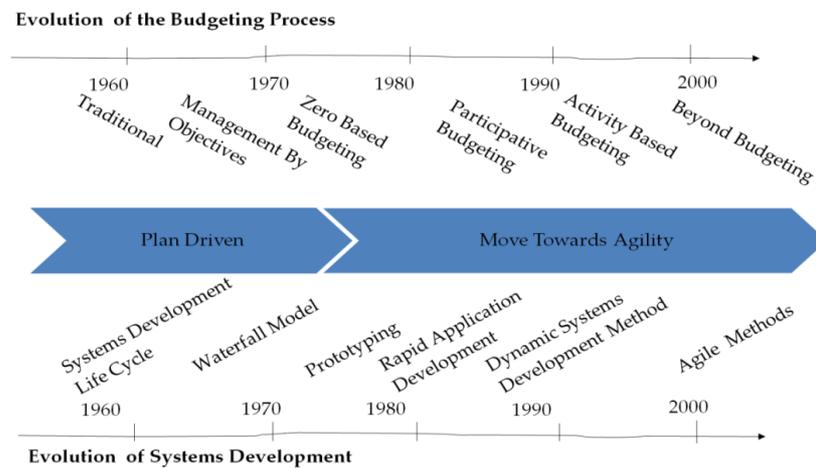

Fig. 1. The Evolution of Budgeting and ISD

Researchers within ISD have highlighted the pressing need to keep up to date with developments in other fields that have a direct impact on ISD in practice (Maruping et al., 2009). One area that has a direct impact on ISD in practice is the budgetary control process. The evolutionary path of the budgeting process shares many similarities with the evolutionary path of ISD approaches (*Fig. 1*) with both moving towards a distinctly agile or flexible state (McFarland, 2008, Poppendieck and Poppendieck, 2010). It is particularly interesting that the suitability and performance of more contemporary approaches to budgeting are not being studied in contemporary ISD contexts. Rather than reinventing the wheel we can extend the field of ISD by using contemporary budgeting approaches as a lens to examine contemporary ISD practices. Crossing the chasm into budgeting theory and literature offers an opportunity to explore contemporary ISD practices with a grounded

reference to wider organisational contexts (Abrahamsson et al., 2009, Agerfalk et al., 2009, Kautz et al., 2007) thus answering calls for a more cohesive research agenda within the ISD field (Conboy, 2009). The objectives of this study are to address this research agenda, specifically to:

apply contemporary thinking in budgeting to an ISD context and

to demonstrate the value of such an application to extend the ISD body of knowledge.

The next section of this paper briefly outlines the evolution of systems development and the evolution of budgeting, which culminate in the ASD and Beyond Budgeting concepts being introduced in the early 2000s. Section three describes the research methodology used in the study. Section four presents the findings and analysis and section five is a discussion outlining the implications for theory and practice.

EVOLUTION OF SYSTEMS DEVELOPMENT AND BUDGETING

Evolution of Systems Development

Information systems development is arguably the core topic for the field of information systems. Early development in the 1960s and 1970s occurred without explicit or formalised development methods (Avison and Fitzgerald, 2003). Although the exact origins of the traditional Information Systems Development Life Cycle (ISDLC or SDLC) are unclear, during the late 1970s and 1980s it became an established concept and was widely used for systems development. Critics of the SDLC model point out that it is difficult to gather and understand a complete list of requirements at the outset of the development project (Sommerville, 2007). Many viewed the SDLC as a troublesome, time consuming process and the call for a more flexible development approach has been around since the early eighties (Ahituv et al., 1984, Gladden, 1982).

It was the continued dissatisfaction with the available development methods that led to the introduction of the various agile approaches. The agile approach seeks to help address the key problems in software development, such as quality, time and cost (Fitzgerald et al., 2006). While having conceptual roots dating from the early twentieth century it was the formation of the Agile Alliance in 2001 and the publication of the Agile Manifesto (http://agilemanifesto.org) and principles behind the manifesto that formally introduced the term agility to the field of software development (Conboy and Fitzgerald, 2004). Agile methods include those that have entered into the spirit of agile. Among these methods XP and Scrum are the two most widely used in practice (Dybå and Dingsøyr, 2008).

Evolution of Budgeting

Since the establishment of modern enterprise there have been three major evolutions in the management and structure of organisations. The first took place between 1895 and 1905 with the introduction of professional management which distinguished management from ownership and established management as work and task in its own right. The second took place during the 1920s when Taylor's "one best way" and Henry Ford's assembly line production introduced the command-and-control organisations with their traditional budgeting and control mechanisms. The third evolution sees a paradigm shift from command-and-control to information-based organisations employing knowledge workers and operating in an ever changing knowledge economy (Drucker, 1988). Organisations can no longer rely on traditional budgeting and control mechanisms which were especially suited to a pre-information age era (Mintzberg, 2009). Researchers and practitioners in the field of management and management accounting have highlighted the issues with traditional control mechanisms such as the budget process and called for new and innovative approaches to managing in a knowledge based economy (Hope and Fraser, 2003, McFarland, 2008, Mintzberg, 2009).

While the traditional command-and-control management model based on a traditional annual budgeting process has been the main management control mechanism used to manage and control employees, the move to the knowledge based economy of the information age has seen organisations search for more flexible management control models (Bogsnes, 2009, Hope and Fraser, 2003). In the modern, turbulent and ever-changing business environment, organisations must develop a conscious agility competency in order to survive (Dove, 2001). Beyond Budgeting, an innovation from the management accounting literature, suggests that in a knowledge economy, organisations must go beyond the budgeting process and manage through a series of flexible controls and processes *(Table 1)* (Hope and Fraser, 2003).

Leadership Principles	Process Principles
Customers: Focus everyone on improving customer outcomes, not on hierarchical relationships.	**Goals:** Set relative goals for continuous improvement; do not negotiate fixed performance contracts.
Organisation: Organise as a network of lean, accountable teams, not around centralised functions.	**Rewards:** Reward shared success based on relative performance, not on meeting fixed targets.
Responsibility: Enable everyone to act and think like a leader, not merely follow the plan.	**Planning:** Make planning a continuous and inclusive process, not a top down annual event.
Autonomy: Give teams the freedom and capability to act; do not micromanage them.	**Controls:** Base controls on relative indicators and trends, not variances against a plan.

Values: Govern through a few clear values, goals and boundaries, not detailed rules and budgets.	Resources: Make resources available as needed, not through annual budget allocations.
Transparency: Promote open information for self-management; do not restrict it hierarchically.	Coordination: Coordinate interactions dynamically, not through annual planning cycles.

Table 1. The Beyond Budgeting model

The Beyond Budgeting model is upper managements answer to achieving the flexibility the software development community achieved through the formalisation of agile methods. It highlights an evolution in management thinking from traditional command-and-control to leadership-and-collaboration management styles and has an extraordinary conceptual similarity to agile methods (Larman and Vodde, 2008, Poppendieck and Poppendieck, 2010). The Beyond Budgeting model has previously been conceptualised relative to ASD (Lohan et al., 2010). By applying the Beyond Budgeting model in its entirety to an ASD environment we begin to gain a more coherent understanding of how agile practices can be improved to foster agility in a wider context. The following section outlines the research methodology used in this study.

RESEARCH METHODOLOGY

Case studies are particularly suited to IS research and are increasingly used in the IS discipline (Walsham, 2006). We chose a case study method as the focus of our research is on contemporary events and the phenomenon is to be examined in a natural setting. Miles and Huberman (1994) suggest outlining a strategy for the selection of informants prior to data collection. We used what they call a comparable case selection strategy which allowed for replication of the results and added to the validity and analytical generalisability of the findings. Yin (2003) also suggests that having access to all relevant and required information is crucial to doing good case study research. Both organisations chosen for this study had implemented the Scrum methodology within the past three years and were eager to participate in the study. A confidentially agreement was in place with both sites and all data was to be used for academic purposes only.

To establish the reliability and validity of the case study evidence we followed the three principles of data collection outlined by Yin (2003):

Use multiple sources of evidence: Data was collected through on-site observation at iteration meetings and daily Scrums, review of documentation, three workshops and nineteen formal interviews. As well as this, several informal interviews took place and a continuous dialogue was established with key informants through emails, phone calls and site visits.

Create a Case Study Database: All formal interview transcripts were recorded and transcribed. The transcriptions were imported into QSR NVivo for coding. A tree structure of codes was developed using each of the twelve principles of the Beyond Budgeting model as the initial coding nodes. All notes, documents, interview protocols, and narratives were stored in this NVivo database.

Maintain a Chain of Evidence: A clear link was established between each step of the process. The case study objective was linked to the interview protocol questions, which are linked to the evidentiary sources in the NVivo database, which are in turn linked to a) the case study reports provided to the participating organisations and b) the findings discussed in this paper.

Data analysis was performed following established standards (Miles and Huberman, 1994). The Beyond Budgeting model provided a list of twelve seed categories for initial open coding. Data were partitioned into different sets or cases in NVivo to allow comparisons across cases. Documents created from cases were compared to reveal patterns in the data. Follow up phone calls, emails and site visits were arranged where possible and further documentation obtained when further information was needed or clarification was required. Precautions were taken to corroborate the interpretations made. Findings were discussed continuously with key informants in each of the case sites. Emerging 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 use of case nodes helped with cross case comparisons and provided external validity through analytical generalisation (Yin, 2003).

FINDINGS AND ANALYSIS

By applying the Beyond Budgeting model to an ASD environment we find that there are many areas where ASD may be extended. We demonstrate the value of the application by presenting the findings under each of the twelve headings of the Beyond Budgeting model and outlining a set of recommendations (represented by **R**) based on an analysis of the findings.

Customers: In the teams we studied, we found that the interface between the team and the customer was a source of potential problems. The role of the customer was played by either a customer representative or the product owner and this customer proxy acted as both a conduit and filter for information and ideas. Some developers felt that their suggestions were being filtered by the customer proxy while others felt that they did not receive quality and timely requirements. One developer points out that "*the proxy customer very much said she wasn't fully aware of everything the customer is going to do*". However, some teams were very happy with the relationship they had with their customer as one developer says "*there are some customers who are really eager, really involved, they really know*

the area and they know the tool". This highlights the importance of the role the customer or customer proxy plays in ASD and the need to have informed and trained customer proxies **(R1)**. All of the teams studied had specific project repositories where they could store and retrieve project information. However, there were no knowledge repositories specifically for customers. Research in other fields has shown that having specifically designed customer knowledge repositories **(R2)** helps develop a better understanding and relationship with customers (Gulati and Oldroyd, 2005). Given the importance of the customer to ASD it is interesting to note that this was not considered in any of our case sites.

Organisation: Our findings suggest that agile practices give teams a large amount of control over their daily working practices as one developer says: "*The team is pretty much allowed to do whatever we feel would improve the quality of the code, the quality of the process, etc.*". However, the team has minimal input into decisions such as hiring new team members, what review process should be used, what methodologies , technologies and tools can be used, etc. In both sites however we found that developers used statements such as: "*that was decided way up*" [from a developer in Case A when asked about technologies and tools they could use] and "*that was mandated from farther up the food chain*" [from a developer in Case B when asked about why Scrum was introduced]. In both sites we found that top management support and understanding of an ASD environment **(R3)** was lacking. One project manager expressed concern that current legacy organisational processes do not show "*much understanding of personal qualities, dynamics in teams, competences built over time*" with another project manager agreeing that "*we are still not there in terms of complete buy in from the management using scrum*". In fact, in all seven projects we studied, all the project managers expressed concern about a lack of understanding of how agile teams function.

Responsibility: It was interesting to note that both of our case sites had single fixed project managers not the rotating shared leadership role promoted within the ASD literature (Moe et al., 2010). This worked well in practice as all team members felt that their immediate management provided a supportive and enabling environment. Comments from developers such as "*the managers are generally very good, yes they do direct but they certainly wouldn't in my opinion micromanage*" and "*it is quite a supportive environment*" were the norm across both sites. Project managers themselves all agreed that they tried to create a "supportive" environment. This shows that rather than having a shared and rotating leadership, ASD teams can work well when an enabling leadership style is utilised by project managers **(R4)**. Another reason why shared leadership is difficult is exemplified in Case B where consultants were used on a contract basis depending on the project needs. As the project manager points out, in this case it is difficult to have shared leadership as "*the consultants don't have the same kind of responsibility, they are responsible, but they are doing it according to a contract*".

Autonomy: There was agreement that teams had autonomy in their daily tasks but some decisions were out of their control. Many decisions around the use of

tools, technologies and methodologies, the hiring of staff, training budgets, long term planning, etc. were made outside of the team. Developers again used phrases like "*above our heads*" and "*at a higher level*" when asked if they had input into decisions which would affect them. In Case A one developer believes that when decisions are made that affect the team then it's explained to the team but not is a satisfactory way saying: "*Usually its explained but its explained as in its politics, and that isn't much of an explanation…it can be frustrating*". There was a feeling that the ASD teams were working within an agile bubble and they did not have sufficient support of the agile concept from mid and senior level management. Empowerment and autonomy are seen as essential components for agile development and people feel comfortable when they have the environment and support they need (Lee and Xia, 2010). By promoting an understanding of agile culture at every level of the organisation **(R5)** it will be easier to create the supportive environment ASD teams need.

Values: In both our case sites we found that the ASD teams operated within established flexible governance frameworks. This is facilitated in both sites by the development of project initiation plans which outlined operating guidelines within which the teams were expected to operate. These plans set out the high level goals and milestones which the team are expected to aim for. One Scrum master in Case B highlights this by stating: "*The product owner has made an effort in creating the vision, the vision has helped a lot in regards to that*". This vision, which is incorporated into the project initiation plan, gives the teams their boundary operation conditions as well as their high level goals and the teams in both of our case sites found this a useful governing mechanism.

Transparency: There was a general consensus from all interviewees that the ASD methodology used provided them with sufficient information for daily operational tasks. Tools such as burn down charts, Scrum walls and the project management tools used provided the teams with accurate and up to date information. Teams could see at a glance the status of the project and this helped them with the management of their daily tasks. One developer from Case A recognises the value of the Scrum methodology when it comes to the teams self management saying: "*You can see what everyone else is doing…. We update the project management tool everyday and this gives us pretty good visibility on where we are with the project at all times*".

Goals: In both sites team members felt that within the project duration their Scrum master would informally speak with them regarding their short term individual goals. Some senior stakeholders may have their own personal goals but generally, the team is viewed as having a team goal. A Scrum master from Case B explains: "*The goals are the Key Performance Indicators (KPIs). Every single department has their own KPIs*". In both case sites, the goal setting process which involved the setting of both behavioural and technical goals was well regarded by the team members. Project roadmaps are already in place when a team is assembled and project milestones outlined. The team members see these as their main

goals and within those boundaries they decide, as a team, along with the product owner their shorter-term goals.

Rewards: A reward system that rewards shared success is promoted by both the Beyond Budgeting and ASD literature. However, this was not how the reward systems worked in either of our case sites. The team members were reviewed individually by their managers and reports were then sent to either higher management or another department. In Case A the organisation worked on a bell curve reward system and one project manager found this to be problematic saying: "*It's very demotivating, 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*. Case B had individual contracts in place with each consultant but had only non monetary rewards in place for team success. Research on shared reward systems shows that when long term coordination is required, the optimal system is one where the team is rewarded based on relative performance. Individuals are motivated through peer sanctions and teams are incentivised through team rankings (Ishida, 2006, Knight et al., 2001). It is surprising that while a shared rewards system **(R6)** is appropriate for ASD (Boehm and Turner, 2004) both our case sites used individual based reward mechanisms thus running the risk of promoting dysfunctional behaviour and destroying intrinsic motivation (Cockburn, 2007).

Planning: The Scrum methodology used in both sites ensured that planning is a continuous and inclusive process and all of our interviewees felt that it was such. Although the teams were not part of the long-term planning process in Case A, they felt they could have some influence on long-term plans if they felt they needed to change them. Once a project got the go ahead, high-level, long term plans were put in place. These plans were presented to the teams and the team members were provided with the opportunity to discuss the plans and contribute ideas and suggestions. In Case B, long-term planning was not considered by team members as they were mainly consultants hired for the duration of the project. A budget was in put in place and they were given a contract based on this budget. They did not know where they would be once their current contract finished. This induced myopic thinking among team members as one Scrum master pointed out: "*we only have a short horizon here; we only have a budget for the rest of the year which means we can't think any longer*". To promote long-lasting ASD teams **(R7)** future research should examine the impact inclusive long term planning has on an ASD team. This is particularly important when projects are staffed by consultants hired only for the duration of a particular project.

Control: In both sites, high level project milestones were driven by the project budget. These were outlined at the project initiation phase and using the Scrum methodology provided clear indicators as to where the project was against these high level milestones. If these were in danger of not being met then the project management had to make a decision about what actions to take depending on the constraints of the project. One project manager describes the process when budget costs are the main project constraint: "*So, if we have this triangle of cost, functionality and resources, we are stuck on resources because that's the main cost.*

We have been able to hold cost exactly at budget and quality we uphold by taking out of the box as much as possible". However, in some projects the budget was not the main constraint and "*out of the box*" was not an option. In these instances the delivery dates could be pushed back to accommodate unanticipated delays. The use of these flexible budgeting control mechanisms **(R8)** allowed the teams deliver the required functionality without compromising the quality of the system.

Resources: In both sites a fixed resource budget is assigned for each project and while there are mechanisms in place to apply for additional funding the ASD teams are not encouraged to do so, as one project manager points out: "*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 a second time*". One Scrum master shows how the fixed budget meant they had to break up a high performing ASD team when the project budget was running out: "*They were good, they were doing so well and they were delivering excellent IT products…We really saw how good a team can be if they're allowed to stay in the same team for almost 2 years*". Here again the use of flexible budgeting control mechanisms would allow teams to ramp up and ramp down their capacities depending on customer demand.

Coordination: In both of our Case sites, the organisations provided both formal and informal communication mechanisms. Wikis, intranets, video conferencing facilities, etc. were designed to encourage coordination. The co-location of the team meant that intra-team coordination was carried out on a daily basis. This is has already been shown to be beneficial to ASD teams by Mishra and Mishra (2009) who found that an appropriate workspace environment had a positive impact on ASD team coordination. There was concern raised about inter team communication and coordination **(R9)** with one Scrum master saying: "*I still think there is quite a lot that could be benefited for better coordination between teams at a team level*". According to coordination theory, actors in organisations face coordination problems that arise from dependencies that constrain how tasks can be performed (Crowston, 1997). In Case B a Scrum of Scrums was used as a coordinating mechanism on one project and this was found to be beneficial for coordinating and communication between teams. However the project manager on this project stated that inter-team coordination on large projects was still one of the main areas of concern.

CONCLUSION

This study applies the Beyond Budgeting performance management model to an ASD environment. The findings suggest that contemporary thinking in Budgeting resonates strongly with contemporary thinking in ISD. The Beyond Budgeting model shares many similarities with ASD with both having a distinctly agile and flexible feel. The findings suggest that ASD teams operate within environments that are affected by traditional organisational processes and structures. By using

the Beyond Budgeting model as a lens to examine 7 ASD teams we explored how legacy processes have a direct impact on the daily operations of the ASD teams. We suggest ways in which ASD may be extended and improved upon to take into consideration these wider organisational influences.

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