Bridging the Gap Between Research and Practice: The Agile Research Network

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Abstract: We report an action research-oriented approach to investigating agile project management methods which aims to bridge the gap between academic research and agile practice. We have set up a research network of academics from two universities, through which we run focussed project-based research into agile methods. Organisations are invited to suggest an 'agile challenge' and we work closely with them to investigate how challenge affects them. Our approach is both academic and practical. We use appropriate research methods such as interviews, observation and discussion to clarify and explore the nature of the challenge. We then undertake a detailed literature review to identify practical approaches that may be appropriate for adoption, and report our findings. If the organisation introduces new practices or approaches as a result of our work, we conduct an academic evaluation. Alternatively, if we uncover an under-researched area, we propose undertaking some basic research. As befits the topic, we work iteratively and incrementally and produce regular outputs.

In this paper we introduce our approach, overview research methods used in the agile research literature, describe our research model, outline a case study, and discuss the advantages and disadvantages of our approach. We discuss the importance of producing outputs that are accessible to practitioners as well as researchers. Findings suggest that by investigating the challenges that organisations propose, we uncover problems that are of real relevance to the agile community and obtain rich insights into the facilitators and barriers that organisations face when using agile methods. Additionally, we find that practitioners are interested in research results as long as publications are relevant to their needs and are written accessibly. We are satisfied with the basic structure of our approach, but we anticipate that the method will evolve as we continue to work with collaborators.

Keywords: Agile software development; Project management; Research methods; Software development

1. Introduction

Agile project management methods have become increasingly popular and the agile community is a lively space for innovation, much of which has emerged from the practitioner community (Highsmith and Cockburn, 2001). Alongside this growth in popularity recent meta-reviews of the literature indicate there is a growing research base and include calls for more empirical research, more focus on mature agile contexts, and more research with industrial relevance (Dingsoyr et al., 2008, Abrahamsson et al., 2009, Dingsoyr et al., 2012) However, from our experience it seems that practitioners rarely access the academic literature and there is a gap between what they want and what academics provide. For instance, IT practitioners often want answers to straightforward questions such as 'What are the advantages and disadvantages of trying that new approach?'. In contrast academic researchers focus on conducting detailed studies, developing theory and formulating frameworks for understanding, as they are more interested in looking for generalisation than answering specific questions.

In this paper we report an action research-oriented approach to investigating agile project management methods which aims to bridge the gap between academic research and agile practice. We are a group of academics with a shared interest in understanding the nature and implications of agile methods for IT practitioners, IT projects, and organisations. From our previous experience we believe that it is important to work closely with practitioners in the workplace in order to gain such insights, and we have designed a research approach that facilitates this. The aim of our work is to undertake relevant industrial research that produces valuable outputs for the organisations with which we work, the agile community at large, and the academic community.

In this paper we introduce our research model, discuss one of our case studies and present reflections and lessons learnt from our experiences. The paper is structured as follows: section two summarises research into agile methods; section three introduces the Agile Research Network approach; section four reports one case study showing an application of the approach and section five reflects on our method and discusses lessons learned.

2. Research into Agile Methods

Agile methods emerged in the late 1990s and early 2000's, partly in response to the perceived failures of previous software development methods, but also during a time of relentless IT growth triggered by the Internet boom. The focus of agile methods is on frequent development of working software, using a lightweight, people-centred approach, and a flexible and reflexive mind-set. A critical early point in the history of agile methods was the publication of the agile manifesto in 2001 (www.agilemanifesto.org). From the early days there were a variety of methods, Extreme Programming (Beck, 2000), Scrum (Schwaber, 2004), Crystal (Cockburn, 2004), Dynamic Systems Development Method (DSDM) (DSDM Consortium, 2012) amongst others. Method authors were usually practicing consultants, which indicates that the roots of agile methods are grounded in practical experience (Agerfalk and Fitzgerald, 2006)

Early critiques of the research identified a number of problems including a lack of empirical research, disparate topics of study leading to a lack of research depth, a focus on XP and agile adoption rather than mature teams, and little industrial impact (Dingsoyr et al., 2008, Erikson et al., 2005). A systematic review found that the lack of research meant there was little evidence about the benefits and limitations of agile methods (Dyba and Dingsoyr, 2008). The review resulted in a roadmap for research which proposed more empirical research, better connections with established research fields, looking at management-oriented methods and investigating core agile ideas. Later, in (2009) Abrahamsson et al note that while more research was being done, agile methods were still driven by consultants and practitioners, there was a lack of research rigour, and that researchers needed to address core questions such as what constitutes agility, how agile methods can be extended, and how mature teams use agile methods. More recently Dingsoyr et al (2012) chart a growing body of empirical research with increasing numbers of academic publications. The spread of publications indicates that research is being undertaken within diverse academic communities. The authors note that there is a more mature research environment in which a variety of themes are being investigated such as estimation, project management, team work, distributed cognition, user-centred design and patterns. A wide range of theoretical perspectives are also being used to inform this research including theories of knowledge management, personality, complex adaptive systems, teamwork, and game theory amongst others. They conclude that both the quantity and quality of agile research has improved while suggesting that more attention is paid to theoretical underpinnings.

A variety of research methods have been used to investigate agile methods. Case studies are common along with surveys and some experiments (Dyba and Dingsoyr, 2008). In the conference literature there is also a tradition of publishing experience reports which has attracted some practitioners to conferences, although the anecdotal nature of these reports has perhaps contributed to the perception that agile research lacks rigour. Surveys are often used to quantify trends across populations, and have been used to map the uptake of agile methods. Other quantitative approaches used include experimental research with students (Mendes et al., 2004), and constrained studies with practitioners (Arisholm et al., 2007). However, because agile methods are used in complex environments qualitative case study approaches are often used (Fitzgerald et al., 2006). Some studies use specialised qualitative research methods such as ethnography (Sharp and Robinson, 2004), grounded theory (Cao and Balasubramaniam, 2008) or action research (Svejvig and Fladkjær Nielsen, 2010).

Qualitative approaches share a common focus on studying social practice within a natural setting. This allows for a richer understanding of 'what' practitioners do and 'how' things occur as they do in order to then build theory. Action research is often used in industrial settings where "research informs practice and practice informs research" (Avison et al., 1999). An incremental approach of "plan, act, observe, reflect" is used to promote practical problem solving, expand knowledge and improve the skill levels of the actors involved. In the action research process "particular linked ideas (F - framework) are used in a methodology (M) to investigate an area of interest (A)"; these being declared at the beginning to ensure transparency and that the subsequent outcome can be judged (Baskerville and WoodHarper, 1996). Action research approaches have been used successfully in the fields of information systems and software engineering (Baskerville and Myers, 2004) and there are some examples of its use in

agile software development (Svejvig and Fladkjær Nielsen, 2010). It focuses on the social domain to be researched and the problems that need to be addressed, but often takes an organisational perspective (Checkland and Holwell, 2007). In contrast, Dittrich (2002) has developed a more practitioner-focussed approach, 'cooperative method development' that extends action research concepts. Cooperative method development seeks to address questions such as "How do software development practitioners tackle their every-day work" and "How can methods, processes and tools be improved to address the problems experienced by practitioners?" We also use an adaptation of action research that is not dissimilar.

3. The Agile Research Network Approach

Our approach is designed to help us work in a structured way with individual organisations on specific agile challenges. The aim is to time-box our studies so we can run a series of case studies either end to end or on an overlapping basis. When we set up the network we put out a general call asking companies to approach us with their challenges. We received lots of interest from our initial call, and followed up a number of options.

The approach is incremental and has four distinct phases: Collaboration kick-off, investigation, implementation and evaluation (see Figure 1). During each phase we work closely with the organisation.

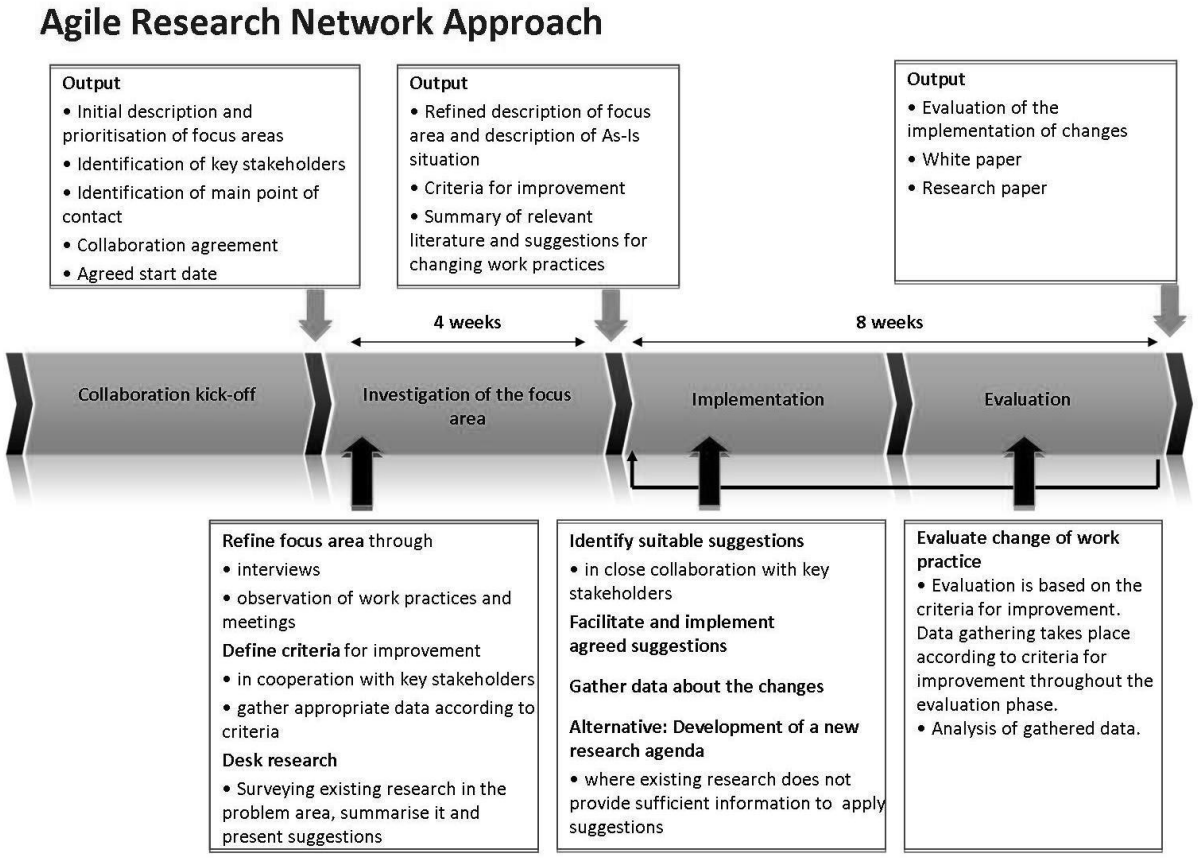

Figure 1: The Agile Research Network approach

3.1 Collaboration kick-off

During the initial collaboration kick-off phase, the organisation discusses their challenge with the research team to establish an initial understanding of the research area. The Agile Research Network takes on the investigation of the challenge if:

- the researchers have already some level of understanding or expertise in the area,
- there is already at least a basic amount of existing literature in the agile community or a related area about the challenge that the researchers can draw upon,
- the challenge is significant to the organisation so that they remain engaged throughout the investigation.

The next step is to identify a main point of the contact in the organisation for the research team, set up a collaboration agreement and agree on a start date. Before the investigation starts the organisation

identifies the key stakeholders for the challenge and key events related to the challenge to provide the research team with a starting point for the investigation.

3.2 Investigation

During the investigation phase, the researchers spend time at the organisation scoping and defining the problem in detail. Depending on the challenge different research methods including quantitative and qualitative methods can be applied to get a better understanding of the challenge and to identify how improvements could be evaluated at a later stage (evaluation). Once an understanding of the challenge and possible criteria for improvements are established the research team survey relevant existing research and literature in the problem area and summarise it along with their empirical observations. The team present their tailored literature review and suggestions to the stakeholders.

3.3 Implementation

At this stage, the organisation decides whether to adopt any of the suggestions presented. If they do, the research team facilitates the implementation of new ways of working. Alternatively, where existing research cannot provide suggestions or the suggestions are not suitable for the context, a research agenda to investigate the challenge area in more detail can be developed.

3.4 Evaluation

During the evaluation phase, the research team evaluates the changes implemented at the organisation. The evaluation can include quantitative or qualitative measurements.

All four phases have an iterative nature as suggested for action research approaches by Coghlan and Brannick (see figure 2).

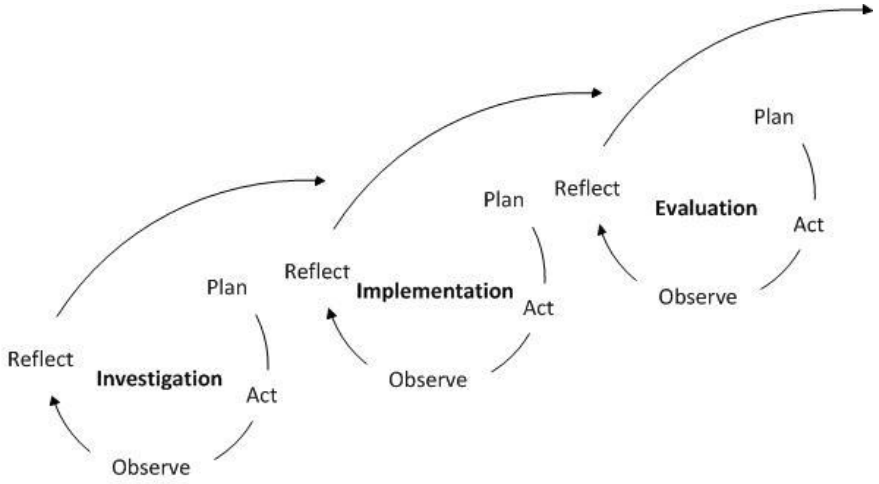

Figure 2: Action research at each stage of the ARN model. Adapted from (Coghlan and Brannick, 2010)

3.5 Outputs

The Agile Research Network approach provides outputs relevant for the collaboration partner, the agile community and the academic community. These take the form of a confidential report about the work undertaken and details of the resulting analysis and recommendations for the collaboration partner, an anonymised white paper for the wider agile community, and a research paper summarising our findings and contributing to research in the agile field for the academic community.

4. An Example Case Study: Integrating UX design and DSDM

This approach has been applied in two case studies to date. One of these is described below together with the outputs produced, indicators of success, and the challenges faced. This illustrates an application of the approach that followed the first option in the 'implementation' phase: identify suitable suggestions. A second case study (not described here) resulted in the second option: identification of an under-researched area that could form the basis of a new research agenda.

4.1 Background: Problem Area and Collaborator

User Experience (UX) design is about designing interactive products (Garrett, 2011). It involves producing wireframes, visual designs, interface widgets, and user characterisations, and performing user research and usability testing. It includes designing the interface, but it also encompasses designing the entire user interaction experience. The main agile methods, including DSDM, do not provide practices or recommendations specifically to support the integration of UX concerns in the project, and so this has been a concern of UX and agile practitioners and researchers for many years (Constantine, 2002, Chamberlain et al., 2006)

The collaborator who approached us with this problem area is a hi-tech software development company that works across a broad range of industries, languages and platforms. Due to the wide variety of projects they produce, their software engineers regularly work with external experts and additional teams such as partner agencies or client-owned teams, who are often not co-located, for an entire project. In this case study, their UX design work was completed by a UX design agency with some agile experience but not specifically DSDM. The agency is a separate commercial entity, located in a separate building.

4.2 What Happened?

This case study started in April 2013 and proceeded largely according to the plan shown in Figure 1. In response to the email invitation discussed above, we were invited to meet with the senior management of the company, and the collaboration kick-off phase started. During this first meeting several possible investigation areas were discussed. The decision to focus on the integration of UX and DSDM was arrived at jointly. From the company's side, this was a considerable challenge, and from the research side, there was adequate research literature to draw upon to address the challenge. Two more meetings were held before the detailed investigation started. At the end of the kick-off phase the research agreement, contracts and non-disclosure agreement were agreed and the case study began in earnest.

During the investigation phase, observations and interviews were conducted with software engineers and designers. We kept field notes and voice recordings of this data. The research team worked iteratively to analyse the data through group discussions, pull out key themes and confirm our findings with the company. After some time access problems arose with the designers and they withdrew from the case study. While this was unfortunate, the project continued with a focus on the software engineers only. Having developed a clearer understanding of the challenges faced by the team, desk research was conducted in order to identify research that could potentially address the challenges faced by this company. The findings were presented to the company at a meeting which was attended by a large proportion of the project team. The presentation characterised the challenges we had identified through the data gathering, and suggested alternative ways of working based on research literature. This marked the end of the investigation phase.

The presentation was positively received, and the project moved into the implementation phase. Some of the suggestions were accepted and implementation was planned. Unfortunately, the nature of the project changed during this period and the interaction with UX designers lessened considerably. This resulted in the planning of an evaluation of changes and relevant instruments being deployed, but no data have yet been collected. This is on hold until the project circumstances change again.

In line with the plan shown in Figure 1, there were several final outputs from the case study – both for the company being studied and the wider agile community. Because we were working alongside the developers, there were many informal feedback opportunities, which allowed us to understand the situation better, and helped the practitioners to reflect on their day-to-day working. There were two formal feedback sessions. At the first, initial observations and identified challenges were shared with the management and they helped to identify key stakeholders to be interviewed. The second was the presentation at the end of the Investigation phase.

Two written outputs (in addition to this current paper) have been produced from the case study: a white paper and a research paper. The white paper was written and published jointly with company members. This allowed us to validate the interpretation of our observations, and to gain further insight into their own perspective (ARN 2013). The paper was disseminated through the DSDM membership and the ABC conference in October 2013. The research paper has been submitted for publication. At present a further written output is planned: a DSDM pocketbook on UX in DSDM. In addition, our findings have

influenced the evolution of the DSDM Agile Project Framework itself; the new release of which is due in Spring 2014.

4.3 Reflection and Challenges

This example case study was successful in terms of:

- The company's reactions to the engagement were positive and they found the systematic approach and objective perspective of the ARN researchers valuable and helpful
- Two written outputs (apart from this current paper) have been produced, and a third is being drafted.
- The DSDM Board found the work useful and informative for the development of the method
- According to Google Analytics the white paper has had over 300 unique downloads between October and December 2013

The challenges we faced included:

- Securing collaboration and time from the stakeholders to progress the work was challenging.
- Having just one gatekeeper lead to delays when the person was on leave.
- The original approach did not allow sufficient time for developing the outputs
- The case studies were based on 'live' projects and changing project priorities required flexibility from the researchers.
- Working with stakeholders in a separate company resulted in access problems.

Despite these challenges, the overall approach we took appears to be sound. Provided that the need for flexibility is accepted, both parties benefit from the engagement, as does the wider agile community.

5. Discussion

We are still in the early days of using this approach as we have only fully reached the end of the investigation stage with two projects. However, both have yielded valuable results and led to the integration of research and practice in line with our initial objectives. There are similarities between our approach and that of other action research-inspired models in the information systems and software engineering literature (Dittrich et al., 2008, Checkland and Holwell, 2007, Baskerville and WoodHarper, 1996), although we did not set out to emulate any previously published method. However, our approach is also inspired by agile methods. We work in a self-organising team, use an iterative and incremental approach, produce regular outputs and run retrospectives. We note that agile methods themselves incorporate the plan, act, review, reflect cycle proposed in the action research and systems literature. This reflects some common theoretical roots underlying these fields (Baskerville and Myers, 2004). We found several advantages to working in this way: our increments helped us to produce regular outputs, we were able to adapt to changes in our collaborators circumstances, and we have been able to run two projects in a time period that would not have been possible if we were using a more traditional research approach.

We work as outside researchers collaborating with practitioners in an organisation. This is distinct from another action research tradition in which the practitioner is also the researcher (Reason and Bradbury, 2001), but it is a common approach in the information systems field (Bryman, 2012). We work with a range of people who hold different roles within the organisation. For instance in our UX project we worked with the Managing Director, project managers, software developers and designers. We acknowledge that we cannot be fully objective as we are working 'within' the problem situation to understand and change it. We therefore position ourselves within the interpretive research tradition (Walsham, 1995). However, we do not restrict ourselves to only using qualitative methods. Our intention is to use whatever research methods are appropriate. For example in the investigation stage of our case study we collected qualitative data, but for the evaluation stage we set up a survey, which included the collection of quantitative data. Despite working closely with practitioners, we maintain a clear position as researchers and distinguish our work from consultancy on a number of grounds: we have time to investigate, observe and understand the problem situation in a way that a consultant cannot (Dittrich et al., 2008); we work cooperatively with our collaborators but they remain fully in charge of any changes they wish to make; we use a model to structure our intervention (Baskerville and WoodHarper, 1996); we carefully deliberate and document our process throughout; we are funded by our universities and the DSDM Consortium so we are not answerable to management as a consultant is (Dittrich et al., 2008); we are not selling a particular methodology, and we have not held back from highlighting deficiencies in methods where we have found them (ARN 2013)

We have learned some practical lessons from our experiences. We need committed stakeholders as the work involves us observing challenging situations, and this is not always comfortable for stakeholders. We need to set up a secondary contact, as in both of our initial projects we had problems when our contact was on holiday. We found that our time-boxes should be measured in elapsed time rather than calendar time, as we are not all full time and visits are arranged at the convenience of collaborators. However, we are aware that timely completion is important to ensure relevance; so we need to improve this. Our iterative data analysis approach is effective for the investigation stage, but we would work differently during evaluation. We have not yet completed an evaluation stage. We need more time to prepare outputs, and are considering adding an extra stage at the end of our model for this purpose.

We now discuss how we have achieved our aim of engaging in relevant industrial research that produces valuable outputs for organisations, the agile community, and the academic community.

5.1 Benefits for our collaborators

We give benefit to our collaborators by giving detailed verbal and written feedback. Our suggestions include an analysis of our own observations plus a summary of what we have found in the academic and practice-based literature. This discussion is vital for achieving our aim of bridging the gap between research and practice. By using existing research we can provide rapid feedback. However, this does not preclude us from conducting new research when we identify an under-researched area. Although we have not worked completely through the approach, we have noticed that change starts happening as soon as we start to engage with practitioners. The organisation makes decisions about which changes to enact, so the implementation cycle belongs to the organisation more than to us.

5.2 Benefits to the agile community

By publishing a white paper from each case study we feed back the findings from our individual case studies to the agile community, as well as members of the DSDM consortium. The white paper is written with a practitioner audience in mind, highlights the challenges found in the case study, summarises the relevant literature and identifies successful changes and areas of best practice. By doing this we hope to have impact, show other agile practitioners that they're not alone, and enhance understanding of how methods are used in practice. We have also been working with the DSDM Consortium, a not-for-profit organisation, where our research findings have influenced the evolution of the next increment of the method. An unexpected outcome from our first case study was a decision to write a pocketbook about UX in DSDM.

5.3 Benefits to the academic community

By looking at real situations our work has industrial relevance and we gain insights into the richness and complexity of challenges faced in organisations. We have found that focussing on work practices allows us to observe what really happens in the work place, which in itself yields valuable research results (Dittrich et al 2008). We contribute to the research community by writing up our case studies as research papers, identifying under-researched areas, and investigating these further. We also promote existing research knowledge by making it available to industry through our white papers.

6. Conclusions and Further Work

In summary, we have used an action research-based approach to doing collaborative research into agile methods with industrial partners. The rationale for taking this approach is that we wish to bridge the gap between agile practice and research. We are satisfied with the basic structure of our approach, but we anticipate that the method will evolve as we continue to work with collaborators. Areas for change include adding a final stage for writing outputs, finding ways to organise our time more flexibility and making practical changes to the way we manage contacts with collaborators. We are keen to disseminate our findings to as wide an audience as possible, as we believe that there are benefits to be gained from building bridges between academic and practitioner communities.

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