ISSN 1744-1986

The Open University

Technical Report N° 2007/12

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12th September 2007

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Adopting Agile in a large organization: balancing the old with the new

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Abstract. Much has been written about adopting agile software development within a large organisation. A key aspect of this significant organisational change is to ensure that a common understanding of the new technology emerges within all stakeholder groups. We propose that an analysis framework based on the concept of Technological Frames (TFs) can identify where understanding is in conflict across different stakeholder groups. We used TFs to analyse data collected in one organisation in the process of adopting an agile development approach. In doing so, we identified several dimensions (called 'elements' in TFs) which characterise a group's understanding of agility. In this paper, we present these elements and describe the TFs for four distinct groups. We suggest that these elements may be used by other organisations adopting agile methods to help understand the views of different stakeholder groups.

Keywords: technological frame; human aspects; empirical study; qualitative study

1 Introduction

Many aspects have been identified as important in the process of adopting an agile development approach, especially in a large organisation. For example, which specific practices to adopt [1], how to accommodate restrictive regulations [2] and how to balance repeatable processes with uncertainty [3]. A key aspect underlying much of what is written in this area is the need to ensure that a common understanding of the new technology emerges within all stakeholder groups. But what conflicts will arise in this process? How can those responsible for introducing the change help different groups to converge on a common understanding?

In this paper we describe a novel perspective on the introduction of agile processes in a large organisation through a qualitative case study of one organisation. We propose an analysis framework based on the concept of Technological Frames (TF) [4]. Using this framework provides a snapshot of the assumptions, knowledge and expectations of stakeholders in the adoption of agile methods in an organisation, and the practices constraining, framing and emerging in this process. TF analysis helps us to identify the elements that shape the process of translation by the key stakeholders [5], and hence offers a way to characterize where differences and barriers may arise.

The paper first introduces some of the literature on adopting agile development in a large organisation. We then introduce technological frames. In section 4 we present a qualitative case study from one organisation based on documents, online fora, interviews with and observations of employees from different stakeholder groups.

After this, the analysis and interpretation of how “agile” is defined and implemented by the different stakeholders is presented. Section 6 discusses our results, and section 7 provides some conclusions.

2. Adopting Agile in Large Organizations

Software process changes represent complex organisational change and cannot be accomplished merely by replacing tools and techniques [6]. Adopting agile development is no different from other organizational change events in this sense, and several authors have identified key challenges from their experience.

Lindvall et al [7] identify the greatest challenge to adopting agile practices as being the need to integrate with the existing environment, while Cohn and Ford [8] say that from their experience, failing to persuade any stakeholder group to use the new process can impact negatively on the project’s outcome. Both of these emphasise the need to understand the wider organizational culture as well as the processes and structures that support it.

Boehm and Turner [9] report the results of workshops aimed at identifying barriers to agile acceptance in large organizations. They describe three groups of issues that act as barriers to agile adoption: development process conflicts, business process conflicts, and people conflicts. People conflicts are identified as the most crucial to the success of agile adoption.

At a more fundamental level, Weyrauch [10] points out that a common language needs to be developed between stakeholder groups. However this is not simply a matter of using the same vocabulary since this common language also needs to represent the same concepts.

3. Technological Frames

In the Sociology of Technology, Bijker has described a TF as referring to people’s interpretive frames (elements of interpretation) and practices (elements of practice) that lead to the attribution of meaning to technology [4]. Elements of interpretation include assumptions, knowledge and expectations about technology which shape a group’s understanding of the new technology, while elements of practices describe the constraints from their existing practices on adopting the new technology. The study of practices includes the existing network of artefacts, such as manuals, policies, etc., in a social group and the practices they represent. Members of a group share the same TF, to various extents, so understanding a group’s TF with respect to a particular technology such as ‘Agile’ uncovers how that technology is being viewed by that group.

The TF concept was originally developed to understand the sociocultural processes that guided the interactions of groups of scientists and technologists in the invention and development of a number of technological artefacts - the bicycle, bakelite and the fluorescent lamp [4]. Subsequently, TFs have been used to investigate other kinds of technological change. The studies in [11-14] use the concept of TF to successfully explain in what ways groups differ in their interpretation of systems and how this leads to changes in the way they are designed and adopted. Others have used TFs to understand conflicts among stakeholders: between producers and users of ERP software [15]; in the adoption of intranets in large organizations [16]; and in

participatory design [17]. In this study, we use TFs to understand the conflicting perceptions of stakeholder groups adopting agile methods in one organization.

A key characteristic of sociotechnical change is that groups in favour of the new technology tend to view existing practices as problematic, whereas groups not in favour of the technology say that the problem lies in the new tools. This key element of TF construction is referred to as ‘problem locus construction’ [15], i.e. do groups see a problem with the new technology or with the old way of working.

4. The empirical study: data gathering and analysis

4.1 The Case Study Organisation

The organization studied here is in the business of providing voice and data services around the world, it is building a "new wave" business based upon networked IT services, broadband and mobility and is divided into several businesses, one of which focuses on software development. The organization employs approx 100,000 staff, about 7500 of whom are software developers. Their headquarters is located in the UK, although a large portion of development work is carried out off-shore.

At the time of the study, the agile adoption process had been running for approximately 2 years. The main thrust for agile adoption came from the software development business where the CEO mandated it, and it is here that most adoption work had been accomplished.

4.1. Data gathering

Data was gathered from a variety of sources including individual interviews, observations, face-to-face and telephone meetings, documents, and a wiki. We attached ourselves to one project (referred to as Project Z) within the organization and used this as our main point of concentration. This both helped us to identify the people and meetings to give attention to, and allowed our participants to illustrate their comments with specific examples which they knew we would understand.

Project Z was chosen because the individuals involved in the project had shown willingness and interest in adopting the agile approach, although they did not have an external agile coach working directly with them on a day-to-day basis. Also, the contractor working with the team developed code using some agile practices, which we thought might influence Project Z’s adoption of agile. We interviewed four people involved in Project Z: the delivery manager, the user experience manager, the technical architect, and an outside contractor. We observed one user stories meeting for Project Z which also included customer representatives, developers and agile advocates. We also observed two user interface design meetings (held over the telephone with an off-shore contractor), and two delivery meetings (again over the telephone with an off-shore contractor).

We interviewed three agile coaches, and members of a four-person agile development team not connected to Project Z. This team was also observed for two days. Our data consisted of interview summaries and transcriptions, meeting notes, observation notes, artefacts and images, wiki pages and documents.

In our interviews we were keen to investigate what the individual understood by the term ‘agile’, what their experience of ‘agile’ was, and what it meant to them in

their day-to-day work to apply agile principles. We therefore used a semi-structured interview style, allowing individuals to discus other agile-related issues if they seemed important to them.

During the observational studies we looked for examples of the use of agile terminology, evidence that an agile approach had been adopted to any degree, and whether the push to adopt agile methods had impacted on normal work patterns.

A key document we studied was a manual of agile development which captured the particular flavour of agile that the organisation was adopting. The wiki that we analysed was the online tracking system and repository of information for the four-person agile development team.

A particular emphasis in all our data gathering was to identify examples of conflict or breakdown [18]. TFs seek to understand how adopters interpret the new technology, and so the study of breakdowns is a way to explicate TFs.

4.2. Data Analysis

These data gathering techniques elicited qualitative data about the TF of each group, which was made up of two types of elements: those related to knowledge, assumptions and expectations – elements of interpretation – and those related to practices and coping strategies – elements of practice. These elements influenced how Agile was interpreted and experienced in each group.

Accounts about Agile and its uses were present in interviews, observational data, policy documents, and on the wiki. These were analysed through Critical Discourse Analysis [19, 20] with the aim of understanding the significance and function of discourse as an indicator of the social adoption of Agile. In this context, people's interpretive frames are considered to have discursive properties, in accordance with the ideas of Harré and Gillet [21].

TF analysis focused on the situations of instability and fluctuation in which the value and usefulness of agile methods was defined. This process enabled the comparison of stakeholder groups in terms of their different TFs. Although we present a simplified revision of Bijker's concept of TF to study the usefulness of Agile in our organisation's context, the benefit of this simplification lies in its basic categories – elements of interpretation and elements of practice.

5. Results: making sense of agile

Data analysis led to the identification of four elements of interpretation and five elements of practice that were found to shape how Agile methods were defined and adopted within our study organization. These elements divided our participants into four groups each with a different TF. These elements and groups are shown in Table 1. In the discussion below, we summarise the key observations for each group.

5.1. Agile advocates and coaches

A group of Agile advocates and coaches is driving the Agile 'push'. Their mission is to disseminate knowledge of Agile methods and facilitate their successful adoption across the organisation. From a TF perspective, this means that advocates must persuade other staff to adopt the same elements of interpretation and practice to frame Agile adoption as their own. One of the biggest challenges they were facing was to

Table 1: Technological Frames relating to Agile for the four groups identified				
	Advocates and Coaches	**Agile Team**	**Project Z Team**	**The Business**
Elements of Interpretation				
The value of Agile for me is	Customer Satisfaction, Responding to changing needs of business and market. Re-use.	Customer Satisfaction, Business Value, Continuous Delivery	Faster delivery, Structure to what we do. Re-usability.	Redundant
Applicability of Agile	Entire business process	Software Engineering	Entire product process	N/A
Project Scope should be	Flexible	Flexible	Fixed (but understand rationale for flexibility)	Fixed
Increased collaboration for a better product	Agree	Agree	Agree	Agree
Elements of Practice				
How to be agile	In negotiation: coaching, workshops, training.	Highly defined	Ad Hoc (willing to bring Agile for structure)	Highly Defined User Research
Tools and Artefacts	Agile manual, change process documents, wikis, online resource. story cards, MRDs.	The wall, user story cards, charts, wikis, audio 'culture'.	Ad Hoc: excel sheets, wireframes, flowcharts, audio 'culture', MRDs.	Audio 'culture', MRDs.
User Input	Workshops and meetings before and during the production process.	Continuous, they should be part of the team.	Only before production process. Then deadlines more important - but want to change	Only before production process. Then deadlines more important.
Problem Locus Construction: Agile vs. Existing Production Process	Agile will improve production. Senior Management Confirms this.	Agile will improve production. Senior Management Confirms this.	Agile will improve production processes, but do not know how.	Agile is not adequate for our product research processes. On the contrary, it is redundant.
Workarounds on adoption	Translating Agile to entire business: - User stories from MRDs. - Business Scenarios	Retrospective writing of detailed documents to fit the organization official processes.	Extracting User Stories from MRDs	N/A

move Agile from the development teams into the rest of the business.

Elements of interpretation. Agile was seen by the advocates and coaches as a flexible development method that represents a natural way of doing things – as "*a subset of common sense*". They see Agile as delivering "*what the customer wants not what they asked for*", and this reflects their understanding of Agile as enabling an increased collaboration between developers and other stakeholders.

According to the advocates, increased collaboration does not mean letting customers and users fully steer the process of design and development, however. Instead, usability professionals and other user researchers from within the organisation should help customers and users to make decisions. We only saw one instance of this happening where a user proxy attended a user story workshop.

This group believed that the collaboration brought by Agile should benefit all areas of the business not just the development effort, including groups such as marketing and retail. They saw the applicability of agile as being across the entire business.

Overall, the value seen by this group for agile adoption is increased customer satisfaction. As one lead advocate reported, the motivation to bring Agile into the organization was "*to be responsive to the changing needs of the business*".

Elements of practice. One of the reported practices most directly aimed at introducing Agile methods was 'embedded coaching'. This involves one Agile coach joining a team of developers and transferring knowledge to them. However the number of teams was large, and there were insufficient trained coaches to go around, so new coaches were being trained from within the organization, an important aspect of which was an 'agile boot camp'. Translating Agile principles to the rest of the business was attempted through special workshops and other presentations organized by lead advocates. This is complemented by events of public recognition such as internal 'Agile Awards'.

A key tool which formed part of this group's TF was a manual of agile adoption which was generated by this group. However, it was not designed to carry agile methods beyond software engineering, i.e. into the wider business environment. There was one document we saw being circulated at mid-management level which contained some principles to make the whole of the business agile. According to one of the stakeholders, this was intended to provide guidance in "*getting rid of old projects and keeping new ones*". The logic for this is that "*other parts of the new business need to be agile also for the agile adoption to be successful*".

The problem locus of control focuses on where the group sees the barriers for adoption. In this organisation, the advocates highlighted the inflexibility of current production processes, while middle managers questioned the ability of Agile to be integrated with current practice. The main mind shift required according to them was the need to think of projects as having flexible as opposed to fixed scope. One of the advocates said in this respect: "*it is a big cultural change. We develop what we need and we keep things flexible.*" To overcome this, the advocates developed workarounds and ways of knowing how agile a team has become. The agile manual lists five principles of agility: customer involvement, user stories, iterative development, automated testing and continuous integration. Advocates have translated what each of these means to non-development staff but not all stakeholders find this translation logical or relevant to what they do.

One instance of this translation can be seen in trying to convert long and detailed requirements documents into user stories. Another example is creation of 'business scenarios', which attempt to capture not only the IT activities but other activities related to the product, including technical and market research. As one of the lead advocates said, "*there is no point in delivering an IT solution if the business has not done its job*".

Summary. In summary, the TF of this group of advocates and coaches constructs Agile as delivering a product of increased quality that responds to the changing needs of the market thanks to the collaboration and flexibility enabled by these methods. However, most of the knowledge publicly accessible refers to software development and not to product design and research.

5.2. The agile software development team

A small team of four developers following XP practices was observed and interviewed. Of the four groups described here, this is the one following most of the principles suggested by the Agile manifesto. This group has been mainly dedicated to deliver internal systems for the organisation. Their interpretation of Agile was more focused and consistent than that presented in the group of advocates and coaches.

Elements of interpretation. The team was proud of being Agile and valued the approach: "*It is not just doing one or two things to tick a box. It is the whole methodology that counts. We can deliver if we want every two days. The fact that we can do that shows that we are agile. The customer is very happy!*"

A central element in their interpretation of Agile was collaboration with the customer: they were able to discuss the product with customers on the same level, delivering a solution closer to their needs. The team leader developed this point by saying "*it is 'I need to speak to my customer and see what he says' rather than thinking 'this is my requirement I will go and do it'. The key change is to consider the customer as a part of the team and help them to get the most business value from the system.*" Customer collaboration was also seen as a technique able to deliver business value to the development process and its product. The team all believed that Agile requires a thinking shift where the scope of what is being delivered remains flexible.

Saving wasted effort was another defining idea: "*Being Agile is about continuously getting feedback. You deliver small things quickly and then you build on them so you save a lot of wasted effort. Historically we used to deliver things that were not used.*"

The team also used Agile to identify themselves as different from the rest by claiming that several areas within the organisation did not understand what Agile is. They saw agile as a set of software engineering practices that help to deliver business value, but not as an organisational 'change of mind'.

Elements of practice. This team was following most of XP's principles and techniques. They had practised agile working before the organizational adoption. Previously, the team had used a number of workarounds in order to be agile while having to comply with incompatible but established processes in the wider organization. For example, it was reported that long and detailed design documents were written in retrospect to fit the system rather than because they had any value. These workarounds have disappeared since Agile became supported by the organisation's CEO. Now the team uses this support to gain acceptance in different

areas of the business. As one developer said "*you can always play the CEO's card to discuss about whether Agile is convenient for <the organisation>*."

A key practice is continuous customer feedback, facilitated by the ability to speak on the same level. Most feedback was given through a wiki and fortnightly telephone meetings. The co-located team used a 'wall' where user story cards and charts were presented, and a wiki recorded their progress, including the user stories they were working on and related acceptance tests. This was especially useful for other project members who were working remotely, e.g. the testers who were based offshore.

From the interviews and observations conducted, it was not evident that this team has been directly influenced by any of the workshops or documents prepared by advocates introducing Agile to the organization. For instance, they confirmed being aware of the agile manual and sharing most of what it prescribes, but all confirmed they have not fully read it or used it as a guide. Interestingly, this team was awarded an Agile prize within the organisation, but they have not applied Agile techniques beyond their role as programmers and software engineers.

Summary. Most of the elements of this group's TF led to a definition and practice of their development methods very close to the agile manifesto. However, they have used this to differentiate themselves from the rest of the organisation and have employed workarounds in order to comply with an incompatible sociotechnical network. Although the organization has become more tolerant of agile practices most of the existing production activities remain difficult to integrate with Agile.

5.3. Project Z

The project team described in this section is a bigger and more complex team than the Agile team presented in the previous section. This team is made up of different stakeholders located in different areas of the organisation. In addition, most of the development work has been done by an outsourcing partner. In consequence, this project has many external dependencies.

The introduction of Agile was received positively by Project Z in the early stages. At the user stories workshop the team were enthusiastic and could see various opportunities in using Agile, although we also observed some conflicts between marketing and other groups. Six months later, we could not identify a consistent Agile approach or influence in what they had produced. However, they still stood by their initial perceptions of what Agile methods could offer them.

Elements of interpretation. Their recurrent element of interpretation in describing the main benefit of Agile was that it would allow them to deliver solutions much faster than they normally do. This idea was shared by developers, delivery and usability managers, product managers and technical architects. Another element used especially by usability and user interface designers, was the opportunity to bring end users closer to the design and production process as well as giving the user experience group a more coherent role in the production cycle. The usability manager for Project Z expressed this by saying: "*The key is getting user experience people involved earlier, it's not about getting requirements and handing them over the wall*". This perception coherence extended for the whole process.

Despite these positive perceptions, we identified frustration because the team had not been able to fully adopt Agile. One clear indication of the lack of adoption was the absence of user stories in the discourse, or in any physical or electronic

representation. The staff did not feel 'touched' by the organisation's Agile revolution, and there was a general feeling that "*decisions were made at the top but it is not coming down*" according to one delivery manager. He said: "*big executives say you do this but people on the ground do not understand what it is all about*".

Another element of interpretation was the need for greater collaboration and communication across all stakeholders and the problems associated with it, especially between marketing managers and IT delivery managers. The IT delivery manager characterized the differences by saying: "*I (marketing says) want that box and I want that now, whereas we (IT delivery) unpack the box*". The technical architect agreed that all communities need to engage earlier in the process so that decisions make sense from a customer, business and technical point of view.

Elements of practice. Some of the practices shaping Agile adoption reflect the interpretative elements discussed above, the most obvious being the need for increased collaboration and communication across all stakeholders, including customers, that is made difficult by a vertical structure in all divisions. One consequence is that the process of user input was already constrained once the product requirements were identified and the project started. User testing was seen by some members as a 'threat' to meeting deadlines.

There was some evidence of behaviors such as stand up meetings and user story workshops, and we identified several workarounds attempting to integrate Agile into the current way of working. One was the 'hothouse'[1], a kind of workshop that supports the principles of collaboration with the objective of producing business scenarios. Extracting user stories from existing, very detailed 'marketing requirements documents' (MRDs) was another workaround. These MRDs were a prominent artifact found across the organization. Leaders of Project Z claimed that it was very difficult to work with such detailed documents in a project whose scope could change rapidly; one Agile developer described MRDs as "*not based in reality at all*".

Another key issue was the existence of "engrained processes". This phrase was mentioned by most members of the project team, and arises from existing practices. According to the delivery manager, such processes cover contracts and integration with larger systems which are an issue when adopting Agile.

In this organization, it was common for staff to be geographically distributed. Agile methods have been used in distributed teams, but co-location remains the favoured situation. A number of roles such as 'home workers' and 'off-shore testers' made the production processes more complicated. The team used wikis and encouraged an 'audio culture' of phone meetings, including for stand ups.

A practice identified by technical architects, delivery managers and usability managers was that staff were trying to deliver in 90-day cycles, which meant that they had only 'shrunk' the Waterfall process without any qualitative change.

Summary. Examining the interpretive frames and practices of this team, we can see a less refined understanding of what these development methods are and a number of engrained processes that hinder adopting Agile. However, we also found a positive perception of Agile and efforts to integrate Agile into what they do that respond to this basic understanding.

[1] A hothouse brings together all the key stakeholders to engage, build and refine prototypes and use these to agree on the next 90-day delivery.

5.4. The ‘business’

We did not have the opportunity to interview and visit the premises of the ‘business’ companies within the organization, i.e. those parts who were closest to the customer. However, they played a major role in the first user stories workshop, our interviewees made reference to them, and we had the opportunity to meet representatives of this group informally, which helped us to confirm the validity of other accounts that we gathered. Although we have less data from this group, we consider them here as they represent an important reference point in trying to describe and understand Agile adoption.

Elements of interpretation. The main interpretation of Agile in this group, is that they did not see any value in creating user stories. From their perspective, the MRD already reflected their work on user research and did not need to be repeated. However, there was no discussion or comment on the value of continuous user or customer feedback during the production process from this group which may indicate an expectation of fixed scope projects.

Elements of practice. Comments that reflect marketing’s bias towards fixed scope projects comes from other Project Z team members who comment that marketing prefers to meet dates over customer input. However, we do not have direct evidence to confirm this. Marketing have historically and physically been separated and distant from the IT division. This affects the amount and quality of collaboration between the two groups. The most obvious consequence of Agile adoption, as expressed by the usability manager of Project Z, is that they now have more pressing deadlines.

Summary. Overall, marketing’s perception of Agile is very basic. This might be the product of not being as involved in the adoption process as the IT division. For them to have a more developed understanding of the value of Agile requires a higher interaction with other groups in the organization, especially advocates and mature agile teams. This contact might have an impact on the elements of interpretation of their TF about product development processes.

6. Discussion

Table 1 shows that the TFs of the four groups we have studied are quite different, but there are also similarities. In terms of emerging frames, Advocates and the Agile team have a clear agile frame as part of their described production methods whereas Project Z shows an initial transition from their ad hoc methods towards agile. In the case of the business’s TF, we could not find any strong indication of agile integration.

Three of the groups saw Agile as having value for them, while ‘the business’ apparently do not see the value of Agile at all. One of the challenges faced by this organization is how to extend an agile way of thinking beyond the developers, and both the Agile Advocates and Project Z believed that agile should cover the entire process, while the development team were content with focusing on implementation only. This shows a tension in the process of sociotechnical change: trying to translate principles created for the development of software into broader knowledge and processes to an audience with different roles, understandings and expectations, sharing a contrasting TF. One thing (the only thing) which all groups agreed upon was that increased collaboration would result in a better product.

There is more variability evident in the elements of practice for each group, which is a consequence of each working to adapt to their own circumstances. As might be expected, the problem locus constructions for the first two groups identify problems in existing practices, while Project Z is unsure how to proceed and 'the business' blame agile itself. Agile advocates, the Agile team and Project Z, agreed that the biggest cause of resistance to adopting the new methods lay in the need for cultural change in middle management.

According to Bijker, TFs show power dynamics in the constitution of technology. These dynamics are manifested as relative power and constraints. Powerful members of a social group try to frame other members with their own meanings and prescribed uses for a technology. For example, Advocates are trying to bring staff into their TF by rewarding mechanisms and faster delivery targets. Constraints are placed on members' interpretive frames and actions through artefacts and practices.

7. Conclusion

The Technological Frames developed here provide a snapshot of how Agile was being interpreted and adopted in our study organization at the time of the research. They have identified some clear issues faced by the organization and have highlighted areas of confusion and uncertainty. Our analysis reinforces others' findings regarding the adoption of agile processes within a large organization. In particular, the importance of ensuring that all stakeholder groups are consulted and engaged in the adoption process, and that existing practices need to be understood and taken into account in devising new procedures. A key issue that is faced by individuals and groups appears to be coming to terms with what adopting 'agile' means to every day processes: What do I do when I get up in the morning? But also, what does it mean for the whole business to adopt Agile?

The use of the TF framework has provided a different way to analyse the issues of integrating agile into an organization. The elements of the TFs presented here emerged from the data and hence are specific for this study, but they provide initial indications of where others may find areas of conflict.

Acknowledgements

We would like to thank all our collaborators for their time and patience in helping us perform this study.

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