A Study into the Adoption of, and Enthusiasm for Agile Development Methodologies Within Further Education.

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Abstract

This paper describes a survey of UK Further Education professionals in order to determine the uptake and use of Agile Methodologies. Thirty individuals, including directors, managers and developers, completed the survey. The results indicate a low level (<25%) of Agile adoption within the sector, and this mirrors findings in the wider public sector, despite there being a backdrop of reduced funding and government pressure towards carrying out Agile projects. Interestingly, where institutions have adopted Agile the level of impact measured shows little improvement over traditional processes. Despite the FE sector being a place where change and teamwork would find a natural home, the enthusiasm for Agile systems was also low in the respondents to this survey and given that these individuals were recruited from a mailing list for those interested in improving systems development practices, these results are particularly interesting.

Keywords: Agile Software Development, Agile Adoption, Further Education, UK Public Sector, Empirical Survey

1. Introduction

In 2007 a survey reported that 69% of companies approached were beginning to (or had adopted) adopt Agile methods [1], this correlates with a report of 72% adoption in a 2013 empirical study [2].

More recently, a survey amongst Agile professionals showed a 94% level of adoption of Agile methods with 80% still heading toward maturity [3].

The UK Government, back in 2012, had set a target that 50% of all major ICT initiatives were to be delivered using Agile methods, and that this should effect a 20% reduction in delivery times [4].

Presently within education and the wider Public Sector, few empirical studies of Agile methods exist [5]. However given an overall 25% reduction in funding since 2010 [6] it would be expected that Further Education (FE) colleges would begin to

adopt Agile approaches, in order to increase the efficiency and reduce the cost of their software development needs.

2.   Research Objectives

The overall aim of this empirical study is to assess the level of adoption and the perceived enthusiasm for Agile methods. The investigation is based upon the style of previous works [1, 2], and surrounds the following key questions and areas of interest:

- What is the level of awareness of Agile methods and techniques within the Further Education IT/Development community?
- Which high Agile-like business strategies are adopted within Further Education Colleges?
- What is the level of adoption of Agile for FE Colleges?
- What impact can be attributed to the adoption of Agile methods and techniques within the sector?
- From identification of these benefits can we elicit whether there is a strong level of enthusiasm for Agile amongst sector IT practitioners?

3.   Methodology

3.1.   Participants

Respondents were approached via email using the JISC College Management Information Systems mail group (cmis-network@jiscmail.ac.uk). This mail group is moderately active, seeing in the region of 20-30 topics and responses during a working day.

The group is populated with IT/IS professionals representing just over 200 FE Colleges [7] spread across the length and breadth of England[1]. This includes Managers, Developers, Report Writers, Data Analysts, Project Managers and Registry/Administrative Staff.

3.2.   Design

Survey Response Capture

The email which respondents received contained a link to a Google Form which collected the required data in a structured manner.

Survey Questions

The questionnaire is composed of seven major sections, the first section aims to confirm that the respondent is part of our target audience and works in the FE sector within an IT role. The second section gathers demographic data regarding the size of their institution and its IT staff and their physical location. delivery times [4].

The third section within the questionnaire seeks to identify the level of awareness of Agile Methodologies and Techniques and is followed by section four, exploring

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[1] Due to differences within the Education Systems of the United Kingdom's constituent countries only staff from English FE Colleges are members of the CMIS Network.

which particular agile Methodologies and Techniques are employed by the respondent or their institution. The fifth section explores the projects which an institution has run in an Agile manner.

Section six attempts to elicit whether any Agile-like business strategies are employed within the institution. The seventh and final section explores the impact of Agile Adoption covering Productivity, Quality, Cost, Satisfaction and Risk using Likert [8] type questioning.

The questions utilise follow the format of previous empirical studies [1-3] in order that comparisons can be drawn and evaluated. Individual questions related to this paper can be seen within Section 4 – Results, and the full questionnaire can be found online at https://goo.gl/forms/R0x9lV8fM44ec8x63.

4. Results

4.1. Responses & Respondents

A total of 32 responses were received, of these 32, two respondents identified that they did not work within the FE sector (one in a Higher Education Institution, one as an Agile Consultant), their responses were rejected and duly removed from the data set prior to analysis.

The sample represents slightly below 15 % of the 202 General FE Colleges in England (N=30, f=14.85%) [7] and may not be fully representative of the population [9].

The respondents mainly represented management positions within their institution, for example: Directors (N=8, f=26.67%) and Managers/Team Leaders (N=13, f=43.33%). Developers were the next best represented group (N=8, f=26.67%) followed by a single Business Analyst (N=1, f=3.33%).

4.2. Institutions

Respondents reported that their institutions varied in size from small (0-50) to very large (1000+) employees. Their IT teams ranged in size from small (0-10) to large (26-50) and this is represented below in **Table 1**. A moderate positive correlation (r=0.549, N=30, p=0.002) can be found between the size of an institution and its IT workforce which is to be expected.

Table 1. Institution Size vs IT Team Size.

		Number of IT Staff			
		0-10	**11-25**	**26-50**	
Total Staff Number	**51-100**			2 (11.76%)	**11 (36.67%)**
	101-200	1 (12.50%)		2 (11.76%)	**2 (6.67%)**
	201-500	1 (12.50%)		9 (52.94%)	**3 (10.00%)**
	501-1000	5 (62.50%)	3 (60.00%)	3 (17.65%)	**10 (33.33%)**
	1001-2000	1 (12.50%)	2 (40.00%)	1 (5.88%)	**4 (13.33%)**
		8 (100.00%)	**5 (100.00%)**	**17 (100.00%)**	

Respondents also reported a variance in the way their IT Teams are located, with just 20% of all institutions having a co-located IT team, though at 42.86% this was by far the most dominant structure for those institutions who had adopted Agile.

The breakdown of locality can be found in **Table 2** below.

Table 2. Location of IT Staff.

		Agile Adoption		
		Non-Agile	**Agile Adopters**	
Location of IT Staff	Everyone is co-located (same room)	3 (13.04%)	3 (42.86%)	**6 (20.00%)**
	Everyone works in the same building	6 (26.09%)	1 (14.29%)	**7 (23.33%)**
	Everyone works on the same campus	7 (30.43%)	2 (28.57%)	**9 (30.00%)**
	Everyone works within driving distance	6 (26.09%)	1 (14.29%)	**7 (23.33%)**
	Everyone works within same county	1 (4.35%)		**1 (3.33%)**
		23 (100.00%)	**7 (100.00%)**	

4.3.   Agile Awareness

Though only seven respondents reported actually carrying out an Agile project, just over half (N=16, f=53.33%) reported a Moderate to Very Extensive awareness of Agile Methodologies and Techniques. Of those respondents who have begun carrying out Agile projects, all reported that they had above a moderate awareness. These results are further expanded in **Table 3**.

Table 3. Agile Awareness

		Agile Adoption		
		Non-Agile	*Agile Adopters*	
Agile Awareness	*Very Limited*	9 (39.13%)		**9 (30.00%)**
	Limited	5 (21.74%)		**5 (16.67%)**
	Moderate	6 (26.09%)	3 (43%)	**9 (30.00%)**
	Extensive	3 (13.04%)	2 (29%)	**5 (16.67%)**
	Very Extensive		2 (29%)	**2 (6.67%)**
		23 (100.00%)	**7 (100%)**	

4.4.   Methodologies and Techniques

As very few respondents reported that their institutions had carried out Agile projects, the stand-out methodology used appears to be that of Waterfall (N=24, f=80%). Of the Agile methods and techniques identified Scrum, TDD and Pair Programming represented the larger proportions (N=5, f=16.67% each).

Interestingly, three techniques were applied by institutions who had not reported that they had carried out Agile projects. These are denoted by an asterisk in **Table 4.**

Table 4. Methodologies and Techniques Employed by Respondents.

Methodology/Technique Employed	
None / Traditional (Waterfall)	24 (80.00%)
Test Driven Development	5 (16.67%)
Scrum	5 (16.67%)
Pair Programming	5 (16.67%)

Active Stakeholder Participation *	4 (13.33%)
User Story Creation	4 (13.33%)
Code Refactoring *	3 (10.00%)
Continuous Integration	3 (10.00%)
Feature Driven Development	2 (6.67%)
Common Coding Guidelines *	2 (6.67%)
Agile Estimation e.g (Planning Poker, T-Shirt Sizing)	2 (6.67%)
Agile Prioritisation e.g. (e.g. MoSCoW, Bucket Prioritisation)	2 (6.67%)
Agile Unified Process	1 (3.33%)

4.5. Agile Projects

Less than a quarter of respondents (N=7, f=23.33%) reported that they had carried out any Agile projects. Of those who had, the majority (N=5, f=71.43%) had only carried out between one and five projects in an Agile manner. **Table 5** below shows the result of this particular question.

Table 5. Agile Projects

Number of Agile Projects	
0	23 (76.67%)
1-5	5 (16.67%)
6-10	1 (3.33%)
11-20	1 (3.33%)

A similar picture plays out when considering the time period in which Agile projects have been run. The majority (N=23, f=76.67%) of respondents again confirm that they have not adopted Agile. Of those who have, the largest proportion (N=7, f=42.86%) have been carrying out Agile projects for less than a year. **Table 6** highlights the breakdown of the durations of Agile adoption.

Table 6. Duration of Agile Adoption

Duration of Agile Adoption	
Not Adopted Agile	23 (76.67%)
Less than 1 year	3 (10.00%)
1-2 years	2 (6.67%)
3-4 years	2 (6.67%)

4.6. Agile Strategies

The respondents were also asked to identify which of a number of business strategies played an important part in their institution. These strategies align with the values set-forth in the Agile Manifesto [10]. The results of this section are shown in **Table 7.**

Table 7. Business Strategies

Business Strategy	
Deliver fully functional software	9 (30.00%)
Deliver software keeping to a strict schedule	7 (23.33%)
Discuss in groups the goals of the project	21 (70.00%)

Do the simplest thing that could possibly work	17 (56.67%)
Immediate feedback from the customer	17 (56.67%)
Regularly produce working software (each iteration/sprint/phase)	13 (43.33%)

4.7. Impact and Enthusiasm

Productivity

A series of Likert-type [8] questions focused on the Impact of Agility starting with assessing the impact on Productivity (Low=1 to High=5). A histogram showing the distribution of scores can be seen in **Figure 1.** A Mann-Whitney[11] test was performed and in this category there appears to be some statistical significance (U=46, p=0.013).
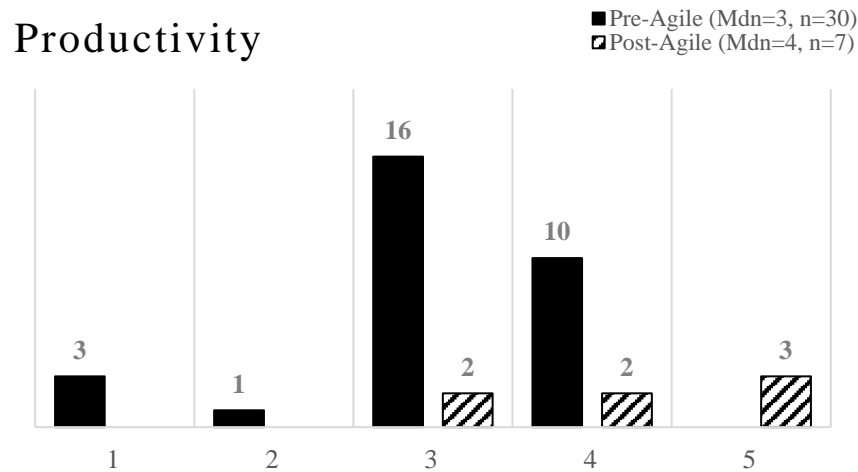
Figure 1. Impact of Agility on Productivity (Histogram)

Quality

The second aspect explored was that of Quality (Low=1 to High=5), and here the Mann-Whitney [11] test reveals there is no statistical significance between the Pre and Post Agile groups (U=80.5, p=0.306), the resulting distribution can be seen in **Figure 2**.
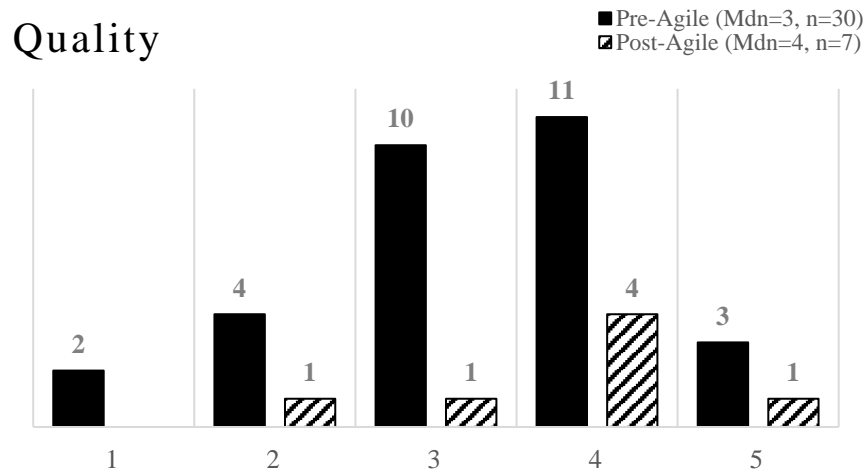
Figure 2. Impact of Agility on Quality (Histogram)

Cost

Cost (High=1 to Low=5) was the third aspect investigated, and again the Mann-Whitney [11] test shows there is no statistical significance (U=110, p=0.981). **Figure 3** shows a histogram of this data.
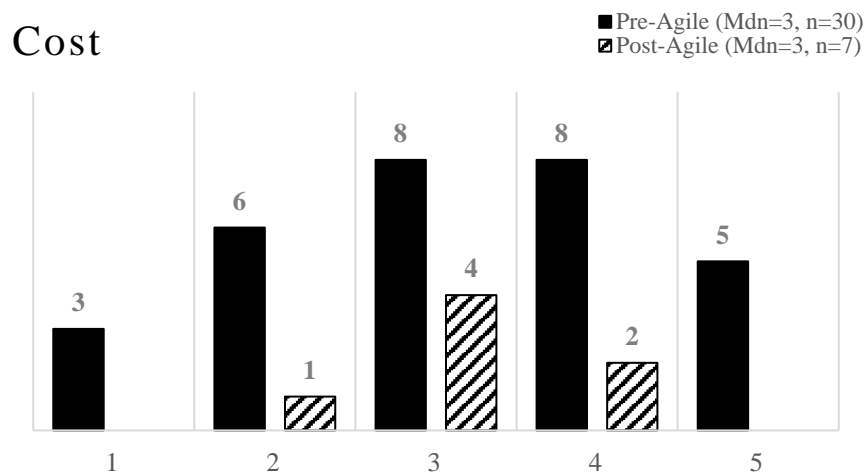

Figure 3. Impact of Agility on Cost (Histogram)

Satisfaction

When considering Satisfaction (Low=1 to High=5), again no statistical significance was revealed by the Mann-Whitney [11] test (U=76.5, p=0.277). Figure 4 displays the distributions of scores.

Satisfaction
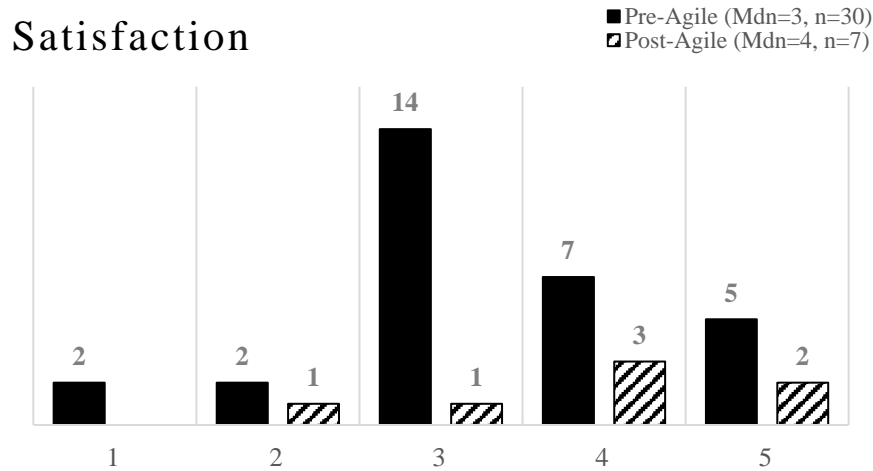
Figure 4. Impact of Agility on Cost (Histogram)

Risk

The final element respondents were asked to consider was that of Agile's impact on Risk (High=1 to Low=5). A Mann-Whitney [11] test was conducted and again revealed no significant statistical significance between the Pre and Post Agile groups (U=79.5, p=0.506).
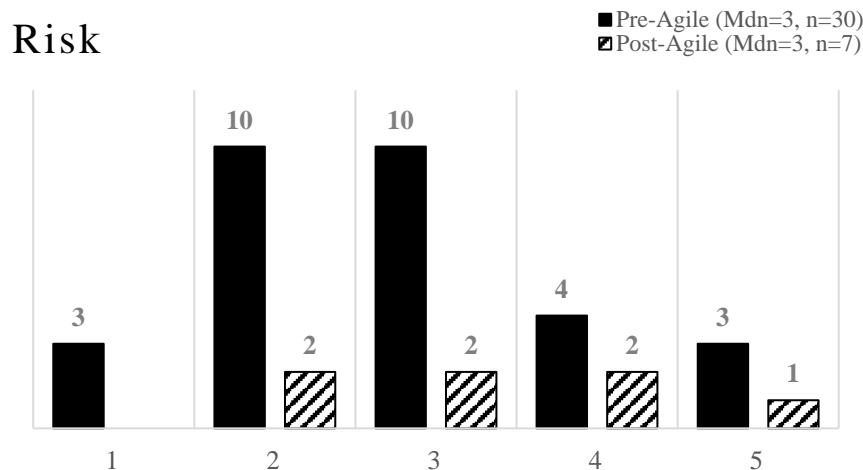
Risk

Figure 5. Impact of Agility on Risk (Histogram)

Impact/Enthusiasm

Though Likert-type questions produce data of an ordinal type, there is precedence for summation of the values to provide an overall score [12]. The values for each of the five categories were summed to provide an Impact/Enthusiasm score for both Pre and Post Agile adoption. **Figure 6** depicts a histogram showing the distribution of these scores. Again as with the individual areas of Impact, a Mann-Whitney [11] test was conducted. As with all but Productivity, the test revealed no statistical significance (U=12.5, p=0.133).

Statistical significance testing was also carried out on the overall score between the Agile and Non Agile groups (U=96.5, p=0.441) and between the Pre and Post Agile scores of those Adopting Agile (U=12.5, p=0.133). In both cases the Mann Whitney [11] test revealed no significance.
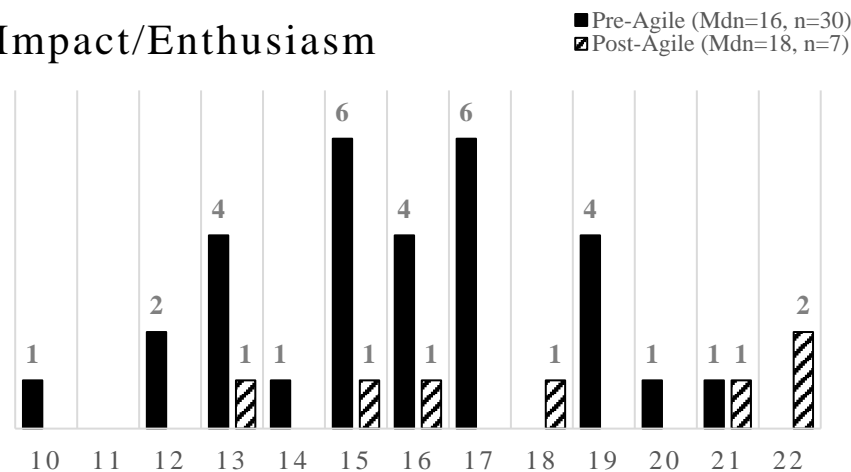
Figure 6. Impact/Enthusiasm Scores (Histogram)

5. Discussion

The survey analysis has revealed that less than a quarter of institutions within the FE sector have adopted Agile (N=7, f=23.33%), this contrasts with the results of previous surveys outside of the sector which had revealed far higher adoption rates (72% [2] and 69% [1]). It is worth noting however that the respondents in the above survey [2] were contacted via mailing list held on the Agile Manifesto website. It had been expected that in light of ever reducing real-terms funding [6] that this figure would be far higher.

The distributions of scores related to the level of expertise between the two groups (Agile & None Agile) appears as expected. A bias towards extensive knowledge in the Agile group mirrors the results found in [2].

"Group discussion", "doing the simplest thing that could possibly work" and obtaining immediate feedback" have shown to be the top three business strategies in operation within the institutions surveyed whether they be Agile adopters or not. Similarly a previous survey [2] reported a similar spread albeit placing "delivering working software in every iteration" in first place.

The use of techniques attributed to the Agile software development paradigm within the respondent's institutions harks back to the concept of Agile being a toolbox [13] from which developers can pick and choose Methods and Techniques. However, the Scrum methodology, Pair Programming and Test Driven Development can be highlighted as being used by the majority of Agile adopting institutions (N=5, f=71.42%).

Coupled with the lack of adoption within FE institutions appears to be a lack of Enthusiasm or a perceived positive impact of Agile. It is difficult to speculate with any degree of certainty why this may be. A recent study [14] showed that if an institution's values and culture are akin to that of Teamwork, Learning and Feedback, then it is likely that they will be successful in adopting Agile. Reference is made by the same to Public Sector bodies being hierarchical, inflexible and formal, and that should this be the case the likelihood of a successful Agile adoption decreases.

A recent literature review [14] into Agile adoption within the public sector sighted several limiting factors: reluctance to change, the effects of complex procurement rules, the desire for 'big bang delivery' and lack of empirical evaluation.

> *"…adoption or rejection of Agile seems sometimes to be based more on a questionable understanding than on a critical, well-informed decision making process."[15]*

Considering the research aspects, a considerable proportion appears to take the form of case-studies though the proportion of empirical studies is beginning to increase [16].

> *"Agile has become overall in terms of common perception: a myth, an ideology, a religion even, whose "evangelists" preach about across many fields and disciplines, well beyond software engineering boundaries."[15]*

Following the availability of more concrete studies the balance may shift toward the public sector, and specifically the FE sector beginning to embrace and adopt Agile more fully. Meanwhile, akin to a religion, it may be that Agile is primarily adopted by those swayed by 'Evangelists' [15].

6.   Conclusion

This paper reports the outcomes and findings of an empirical study into the Adoption of; and Enthusiasm for Agile Methodologies and Techniques within the UK Further Education sector. It was found that the rate of Agile Adoption (<25%) lacks behind that of development teams and organizations as a whole, and that a clear view of the positive Impact of Agile Adoption is yet to be established in this sector.

Whilst Agile Adoption rates were seen to be low, Agile awareness exceeded 50% and it is apparent that Agile-esque business strategies are employed within the Further Education sector (>40%).

The ever changing arena of Further Education in the UK has the potential to push institutions towards more Agile ways of delivering projects and it is clear that the UK Government has adopted this approach centrally.

Further work to explore via the use of a variety of research methods, the reasons for the lack of adoption, and any limiting factors is needed before further insight can be drawn.

Acknowledgements

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