

Agile Principles as Facilitators in the Effective Delivery of Digital Innovative Products in UK Firms?

Student Number: 3327583701

Goldsmiths University

IMS

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FOREWORD: This study was the culmination of months of exploration, hard work, and sacrifice. The support shown to me by family and friends is something I will never forget. I'd also like to use this space to thank my supervisor Chris Brauer whom showed great dedication in supporting and guiding me towards this final submission. His teachings have sparked off a new found interest in the topic of Agile which I hope to pursue further after graduation.

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ABSTRACT

The research undertaken for this study enabled the firms themselves to express openly and candidly how they have used Agile, how it affects the individual members of staff, the customers and their businesses. These actions have given meaningful insights into Agile. Agile is not easy, it requires dedication, commitment, a willingness to change and acceptance of new practices. No wonder it meets with resistance from the old school of NPD and approaches to justifying the development of innovative products. But for those interested in developing products that meet the fickle, potentially ever-changing needs of customers in the 21st Century new ways to bring products that meet those needs must be employed. Agile as its name suggests offers that capability. The research conducted at eight firms in London found that the twelve principles of Agile held true. However, it also became apparent that there were slight subtleties that also existed, such as, Cross functional team interaction over individuals and interactions; Validated software over working software; Vision over customer collaboration; Creating change over responding to change. Finally, an unexpected finding came in the form of several firms that emphasized Lean thinking as a complimentary mind set to Agile to better facilitate the effective delivery of innovative digital products.

ACRONYMS AND DEFINITIONS

CEO – Chief Executive Officer

CFO – Chief Financial Officer

CTO – Chief Technical Officer

Iteration: An iteration, in the context of an Agile project, is a time box during which development takes place, the duration of which may vary from project to project, usually between 1 and 4 weeks is in most cases fixed for the duration of a given project. ¹

JIRA – Jira is an issue tracking product, developed by Atlassian. It provides bug tracking, issue tracking, and project management functions.

KANBAN – A method for managing knowledge work with emphasis on just-in-time delivery while not overloading the team members

MoSCoW – Delivery of requirement prioritization (MUST, SHOULD, COULD, WON'T)

NPD – New Product Development

Prince 2 – PRINCE2 is a flexible method and is aimed at all types of projects

Product Backlog -

QA – Quality Assurance

SCRUM - Scrum is an **agile** methodology that can be applied to nearly any project; however, the Scrum methodology is most commonly used in software development. mountaingoatsoftware.com

SCRUMBAN- Scrumban combines Scrum and Kanban and contains the best rules and practices of both methods.

¹ <http://guide.agilealliance.org/guide/iteration.html>

CHAPTER 1: INNOVATION, AGILE AND UK FIRMS

1.1 Innovation and NPD Approaches

In the digital world the need to respond continuously to changing customer requirements is immense. Fierce competition brought about by distribution channels such as the Internet, mobile phones and hand-held devices, and dedicated connectivity means consumers are exposed to more options and choices than ever before in what is now a global digital economy (Flinders, 2012). External influence such as technology push and market pull make for an environment that causes faster and faster technology obsolescence. The situation is compounded by firms employing disruptive approaches to develop innovative new products and or services. Glassman, (2010), sees the shift from efficiency to innovation in competing firms evolving into what he terms “a development war”. He goes on to say that firms need more and better quality ideas and that innovation is the toolbox to achieve this. To assist firms in succeeding at new product development (NPD), which also encompasses services and software development, a number of methodologies have been developed over the years. The first methodological approaches relied heavily on controlling the NPD process. Hustad (1977) adopted a broad perspective when defining the NPD process, including market planning, product strategy, product line extension, market forecasting, product abandonment, and product liability. Another early proponent of managed NPD processes was Morris (Morris, 1990) who had spent forty years improving project management techniques and published his Management of Projects theory in 1990. In the 1970s Robert Cooper and his colleagues started looking at the difficulties businesses were encountering in bringing new products to successful fruition (Cooper & Kleinschmidt, 1986; 1987; 1990; 1991). Cooper and his colleagues developed the NewProd project, which broke down the NPD process into manageable portions and after each portion there was a hurdle that had to be passed before progressing to the next portion. Cooper named this process “the stage-gate process”. Cooper identified five main functions in the NPD process; scoping, building the business case, development, testing and validating, and product launch (Cooper & Kleinschmidt, 2001). However, one major disadvantage of the stage gate process was its rigidity and

control, as Davidson et al. (1999) via (Rainey, 2005, p. 557) pointed out the NPD process needs flexibility so that a process can be continually adjusted to an organisation's changing needs and desires. Never before has this point been more applicable as firms nowadays compete in ever increasing competitive markets where innovation is key to survival. New means of conducting the NPD process were needed and researchers began seeking other factors that could assist firms in their innovation strategies.

'Fail often to succeed sooner' is reportedly one of the mottos of the successful product design firm IDEO (Kelley, 2001, p. 232). Other new factors found to be important in the NPD process include team integration, experimentation and prototyping (Barczak & Wilemon, 2003). With the rapidly changing technological advances of the past decade there is a growing interest in the role of NPD processes that were created to handle uncertainty and changing customer needs and wants; among these new methods Agile NPD is leading the way.

A previous online survey-based study by Williams, (2012) found that agile principles were still relevant in the marketplace of 2011. William analysed the Agile principles and ranked them in order of importance based on her opinion of the comments made within the questionnaire and on respondents ticking boxes to question she had set. While the research is important and offers valuable insights into Agile in NPD, this failure of William's work to remain independent and unbiased questions the validity of her findings. To address this deficit in knowledge this study takes an in-depth look as to why and how Agile principles are important in today's marketplace by adopting a qualitative approach using open ended semi-structured questions encouraging respondents to offer their opinions in full.

1.2 Aims and Objectives of this Research

The aim of this research is to evaluate how Agile principles help facilitate the effective delivery of innovative digital new product development (NPD) in UK based firms in 2014. This will be achieved through the following objectives:

- Review of the original Agile Manifesto and Agile Principles and evaluate how they are employed in businesses in 2014.
- Through case study research identify and report on how the case studies themselves see the link between innovation and Agile principles in NPD.
- Analyze how Agile, based on the findings from the case studies and literature reviews, contributes to the effective delivery of innovative digital products.

1.3 Contents of Dissertation

Chapter One introduces the subject of New Product Development (NPD) and provides an overview of the processes and methodologies that have been developed over the last fifty years to help businesses improve their new product launch successes and identifies areas requiring further in-depth research. The Chapter continues with a statement of the Aims and Objectives of the study, terminating with a description of the chapters of the dissertation.

Chapter Two provides an in-depth literature review of the state of play of research in the areas of NPD and the processes and methodologies developed and further explores gaps in the knowledge on the subject under investigation.

Chapter Three describes the methodologies employed in identifying the sample population, the processes employed in collecting the research data, and the processes used to evaluate the findings.

Chapter Four reports and describes salient points from the research findings from the interviews of the strategic and operational staff of the case study firms.

Chapter Five discusses the findings in relation to previous research by other authors into NPD and the methodologies available to businesses to improve their success rates and the observations the author has drawn from the research.

Chapter Six culminates the dissertation with the conclusions to be drawn from the research and proposes other areas for further research and investigation.

The Appendices contain detailed accounts of the survey instruments employed, the software analysis tools and additional photographs highlighting the lengths the case study firms employed in their support for the NPD methodologies used.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

Agile was introduced in 2001, targeted at the software industry, this raises the questions “How is Agile used in NPD now?” and “How effective is Agile in NPD software and other industries?” This research project seeks to answer these questions.

2.2 Traditional Approaches to NPD versus Agile

Traditional approaches to NPD revolve around the concept that it is possible to define the specifications of a new product that will meet customer requirements at the start of the NPD process. The NPD process then follows a set of pre-defined stages akin to a set of cascading waterfalls, hence the term the Waterfall model. In the manufactured goods sector this has been an effective approach to design; identify customer requirements, then design a product to meet those requirements. For the software industry the Waterfall model and its upfront planning is not conducive to NPD. Software development is not a predictable or a mass manufacturing problem.

Table 1.1 Comparison between a defined process and an empirical process	
Predictable manufacturing (defined process)	New product development (empirical process)
It's possible to first complete specifications and then build.	It's rarely possible to create up-front, unchanging, detailed specs.
Near the beginning, you can reliably estimate effort and cost.	Near the beginning, it isn't possible to reliably estimate effort and cost. As empirical data emerge, it becomes increasingly possible to plan and estimate.
It's possible to identify, define, schedule, and order all the detailed activities at the start of the project.	Near the beginning, it isn't possible to identify, define, schedule, and order activities. Adaptive steps driven by build-feedback cycles are required.
Adaptation to unpredictable change isn't the norm, and change rates are relatively low.	Creative adaptation to unpredictable change is the norm. Change rates are high.

Table 1: Comparison between a defined process and an empirical process (Smith & Sidky, 2009, p. 11)

For instance, Software development has a high degree of novelty, creativity, change, and no previous identical cases from which to derive estimates or schedules. (Larman, 2004, pp. 2–3). As such, Agile has become an option to better manage conditions of fast paced change and uncertainty. Smith & Sidky, (2009, p. 11) list a comparison between Waterfall (defined process) and NPD (empirical process) – see table 1.

Additionally, selecting an optimizing approach such as the Waterfall model for NPD (where uncertainty is high), increases risk of settling too early on a particular solution and stifling innovation (Highsmith, 2009). It also leads to a situation where difficult work is pushed toward the end of the project, where issues emerge late. Larman (2004) describes this as the “fail-late” method. See figure 1.

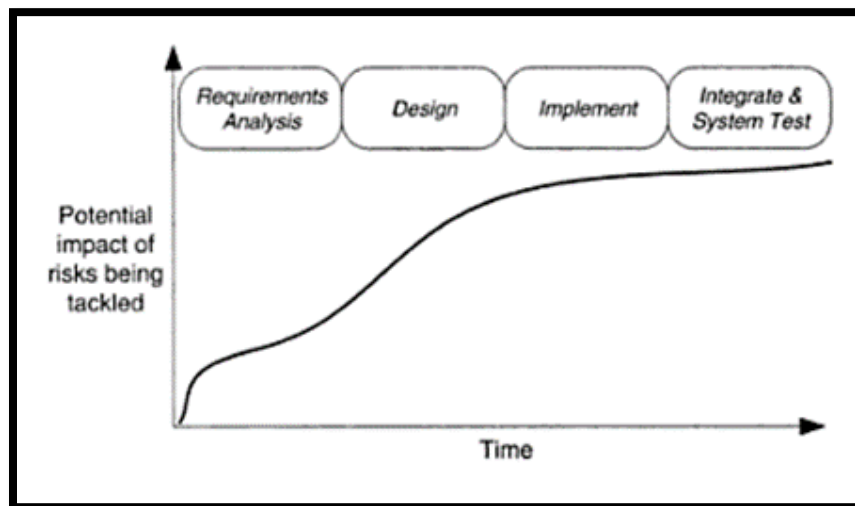


Figure 1: Risk profile of Waterfall Model (Larman, 2004, p. 39)

Waterfall is often associated with Big Upfront Design and this can result in a product that is based on untested assumptions, which do not meet the customer requirements being produced and the flaws only realized once the product has been launched. For example see Fig. 2: Perceptions of success (Humphreys, 2012, p. 7)

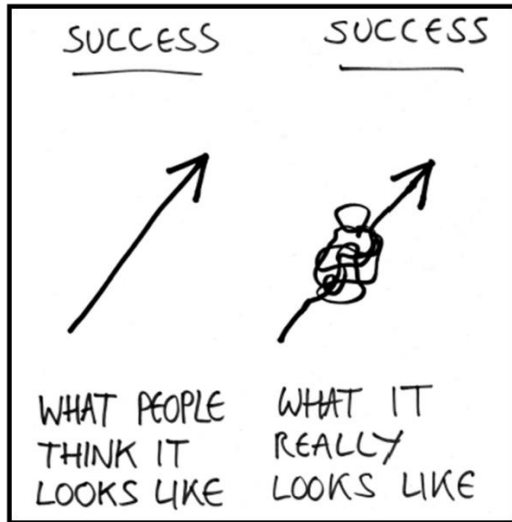


Figure 2: Perceptions of success

The Waterfall model deals mainly with concepts that are based on human perceptions and assumptions, and this can lead to variations in what a successful digital product looks like, culminating in a skewed end product. A commonly utilized method known as the stage-gate model to reduce fail-late scenarios made use of gates at each stage of development for decisions on whether to go forward or kill a product in its tracks. However, whilst this model has enjoyed success throughout the years, it has some issues, such as, projects are rarely killed past the financial analysis stage gate (Gassmann, Oliver, Schweitzer, Fiona, 2014), evaluations are not as stringent for cultural reasons, and screenings at each gate typically involve large bulky evaluation documentations (Cooper, 2014)

Interestingly, Robert Cooper (Cooper and Kleinschmidt, 1986), originator of the stage gate model, wrote a paper revising his view on what a modern day stage-gate system should look like and in this Cooper (2014) defines his new generation system as having three characteristics: Accelerated, Agile, Adaptive. This represents a significant shift in paradigm from waterfall to the acceptance of Agile as a step in the right direction, from a well-respected figure head.

Agile, is a “fail early” method that seeks to address risk earlier and to deliver the right innovative digital product. See Figure 3.

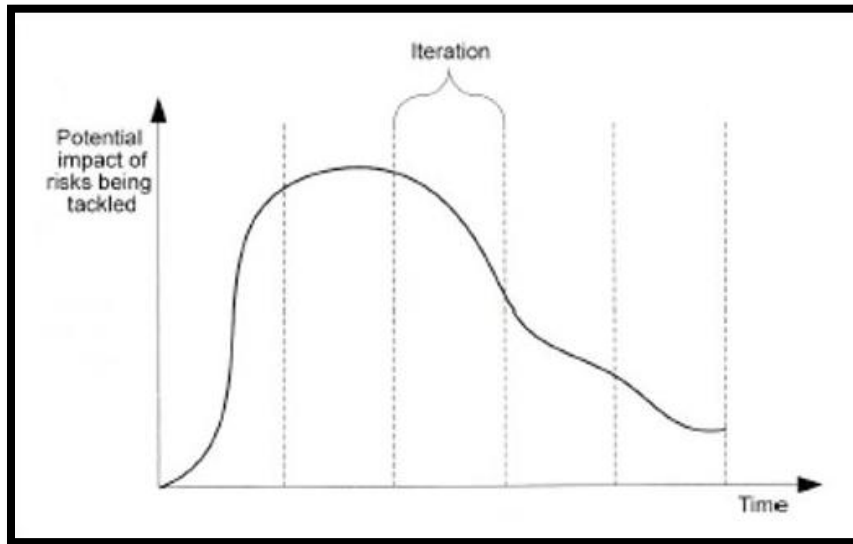


Figure 3: Risk profile of Iterative method (Larman, 2004, p. 39)

The Fail Early method of iteration is a key area of Agile and differs from the Waterfall model in that requirements and specification are not planned fully at the beginning but are refined and made more certain as time goes by. In other words, one would learn from the journey over settling on a list of pre-defined assumptions. In Agile this is termed an adaptive planning approach.

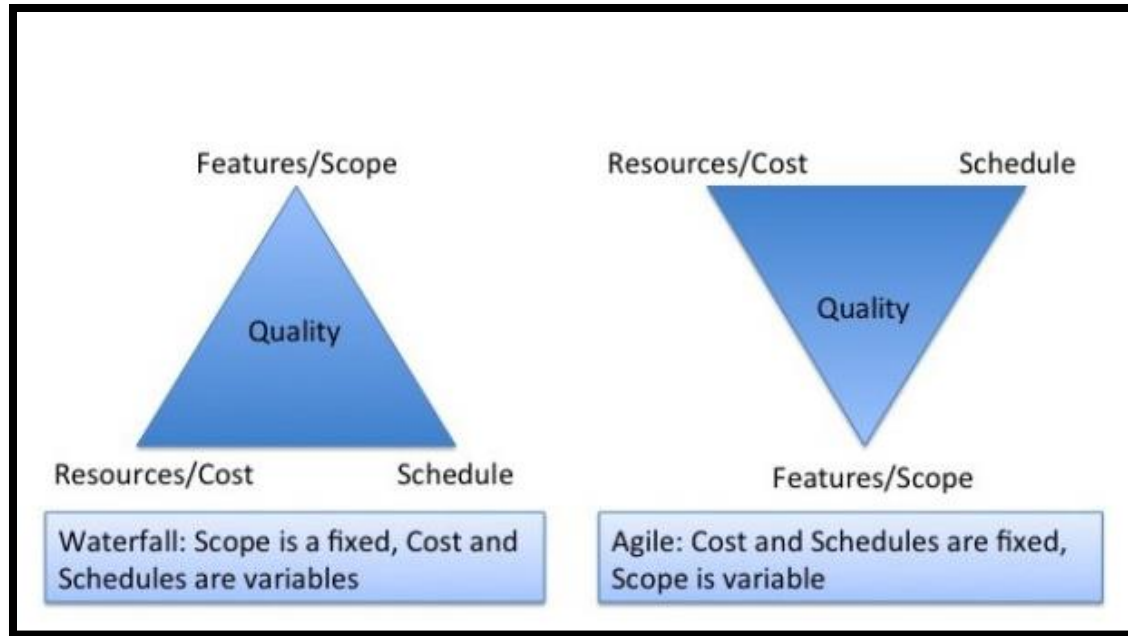


Figure 4: Iron Triangle and the Flipped Agile Triangle (Fewell, 2012)

In figure 4 the first triangle represents the traditional project management Waterfall model and the second, the Agile iterative model. Fail late versus fail early. What this means is “Agile finds the minimum solution possible to achieve a business goal” (Fewell, 2012, p. 23). Agile utilizes a Fail Early mechanism (Larman, 2004) to iterate towards the right innovative product, essentially starting with a minimal usable subset to test product value, then iterating and gaining feedback from customers (Highsmith, 2009) at frequent intervals ranging anything from 1 week to 6 weeks (Agile Alliance).

2.3 Agile Explored

The Agile Manifesto consists of four main values and beliefs (see figure 5) and 12 underlying principles (see figure 6). The Agile Manifesto along with its beliefs, values and principles form a “target culture for the successful delivery of software” (Denning, 2012).

The Agile Manifesto (see figure 6) comprises four value statements that depict values and beliefs held. There is a strong bias toward human interaction as represented to the bolded text to the left of the value statement. The right hand side of the value statement represents perceived bureaucracy which reaffirms the status quo. “Where there is value in the items on the right, we value the items on the left more”. In practice, these scenarios make firms ask very difficult questions about their everyday workings instead of prescribing one value over the other. Both sets of values are important but firms must decide, according to their context, which is more suitable and whether an Agile way of working suits them best.



Figure 5: The Manifesto for Agile Software Development

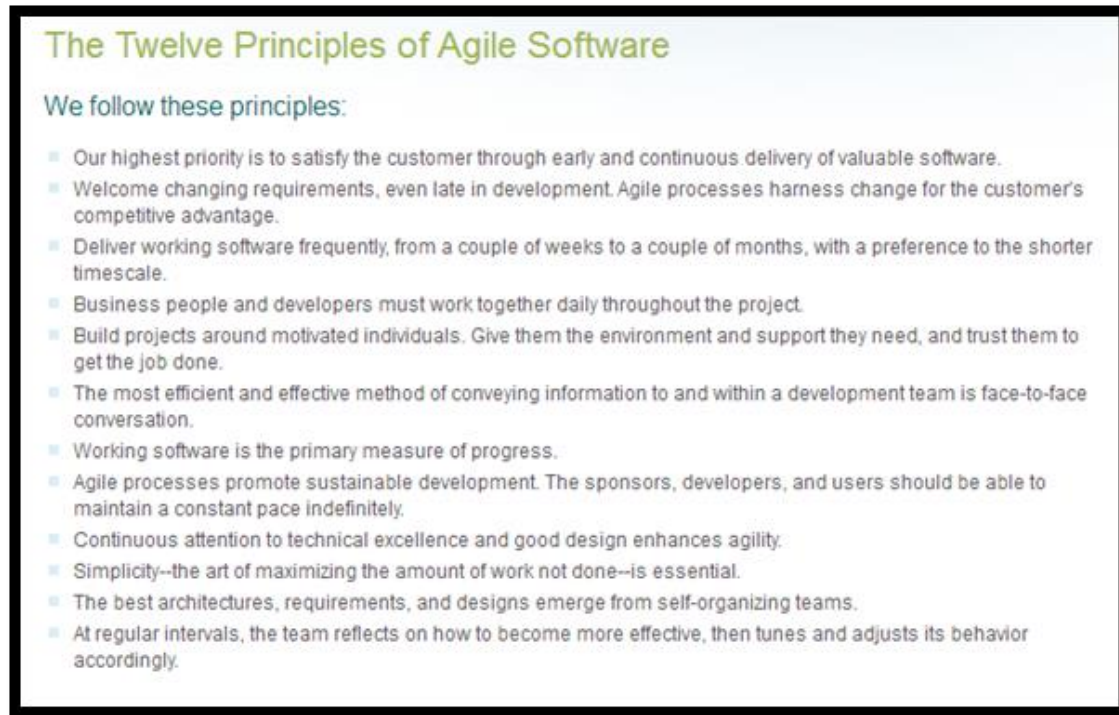


Figure 6: The twelve Principles of Agile Software (http://thecomplexityspace.com/wp-content/uploads/2014/06/agile_broussard_sized.jpg)

Agility according to Highsmith, (2009, p. 68) is the ability to both create and respond to change. Of these 12 principles, Highsmith (2009) make references to 2 principles that have direct bearing on a firm's ability to adapt- these he calls "principles of adaptation":

-Welcome changing requirements, even late in development. Agile processes harness change for the customer's competitive advantage.

-At regular intervals, the team reflects on how to become more effective, then tunes and adjusts its behavior accordingly.

The State of Agile 2013 shows that the top three reasons for adopting Agile are; to consistently accelerate time to market (23%), more easily manage changing priorities (16%), and to better align IT and business objectives (15%).

According to Cooke, (2010), Agile practices and techniques are better suited to situations with unknown factors (changing customer requirements) but are also ideal for highly predictable and replicable work. Agile is used in a variety of contexts ranging from the start-up to established firms. Whilst Agile used to be the advantage of smaller firms a growing trend amongst larger firms is to “innovate like start-ups” by responding quickly to change in order to deliver value to customers faster.

Agile can mean different things to different firms, so on the one hand we see firms that fully adopt one specific Agile methodology, and on the other hand we see firms that pick and mix certain features of existing Agile methodologies, as well as, add their own (See Appendix I- Table 5)

The methodologies associated with Agile include; Extreme Programming (1996), Crystal Methodologies (1996), SCRUM (1995), Adaptive Software Development (1997), Feature-Driven Development (1997) and Dynamic Systems Development Methodology(1995) (Fowler & Highsmith, 2001).

2.4 Agile and Innovation

Innovation is the successful delivery of creative ideas (Amabile, 1996). Research shows that as many as 40% of new products fail to deliver anywhere near the promised objectives (Castellion & Markham, 2013)

A factor that is part of Agile is **the** distinction between efficiency and effectiveness. For example, a project can be carried out efficiently but still produce the wrong product, whereas if it were carried out effectively, it would consider whether the right product or scope was being addressed.

Also, a business, especially a start-up, working on a NPD project does not always have information about the market. This is where Agile can assist the NPD team by providing an approach that shifts from ‘voice of the customer’ to ‘action of the customer’, and in so doing to actually having a product that meets their needs.

Other reasons that Agile is being used include (Walaa Atef, 2009)

- Breaks complex projects down into simpler mini-projects
- Accommodates change easily
- Improves ROI through frequent and regular delivery of value to the business
- Increased business involvement and satisfaction
- Increased visibility (progress, obstacles, risks, etc)
- Lower development risk, higher quality, less defects
- Shorter cycles produce working software and incremental product quickly
- Progress measured by running tested software
- Early and regular process improvement driven by frequent inspection

Looking at the barriers to adopting Agile, in the study of entrepreneurship, literature points towards cultural differences between the way American and British firms view start-ups (Lewis, et al., 2010, p36).

“Americans view failure as a badge of honour from which the opportunity to learn presents itself”.

America	28%
Britain	38%
Japan	44%
Italy	48%
Germany	49%
Spain	52%
France	53%

Table 2: The proportion of adults fearing that their creation of a new business could end in failure

The percentages in Table 2 were used to make the observation linking entrepreneurs’ fear of failure as a symptom of a much wider reaching societal problem. In other words, people are not given the chance to experience failure in a positive light. Literature shows that some firms find it hard to grasp the value of working with “incomplete information”, and experimenting, failing, learning, adapting. The mind set of

Agile is a shift away from a plan-based Waterfall approach, which some do not entertain. For instance, 30% of respondents stated ‘lack of upfront planning’ as a concern about adopting Agile (8th Annual State Of Agile Survey, 2013, p. 6). This may refer to the wider reaching societal problem as alluded above by Lewis (2010). However, for those that implement Agile, it is important to note the mantra “fail fast and fail often”. For this, the mind-set relating to failure should neither be shied away from nor pursued recklessly, and always viewed as part of the learning process (Flinders, 2012).

A firm’s culture is also considered to be a barrier to the adoption of Agile (“8th Annual State Of Agile Survey,” 2013). The State of Agile survey found the top three barriers to Agile include concerns such as a firm’s culture at odds with agile values (15%), external pressure to follow waterfall processes (13%), a broader communication problem (10%).

Another barrier to the successful adoption of Agile approaches in an organization is the historical misapplication of these approaches as techniques not principles. To quote Cooke, (2010, p. 340). “It is not enough for the people who participate in Agile work to understand the mechanisms of these activities. They also need to understand the intent, in order for them to most effectively utilize these approaches”. To quote Highsmith (2009, p368) *“Ultimately, what people do, how they behave, is what creates great products. Without concrete practices, principles are sterile; but without principles, practices have no life, no character, and no heart”*.

Koen, Bertels, & Kleinschmidt, (2014) carried out a large scale research that discovered the importance of organizational processes versus organizational activities. Koen's study showed that organizational activities were twice as important to organizational processes. Whilst Koen notes that the study’s findings are nothing new, they do act as robust evidence regarding the importance of culture, leadership, vision, resources.

2.5 Summary

This chapter has provided a review of the literature surrounding the Agile Manifesto, Agile Principles and their role in NPD processes. Agile was created in 2001 when 17 people met up to discuss how they might work together to improve the NPD process in the software industry. As the business environment changed and global competition became common some businesses started using Agile for other NPD processes such as Software Development. Agile's popularity can be attributed to Manifesto principles, beliefs and values that describe a target culture (Denning, 2011) for delivering value quickly to end users. Ma (2009) notes that there is more to innovation than teaching the nuts and bolts of taking an idea and shepherding a business through the NPD process – e.g. from idea-to-launch. Socrates insisted that the greatest teachers were not those who had the most information, but those who created the "space of learning". In other words, it's not what we know but our willingness to explore possibilities and embrace failure as learning that can lead to innovation. In the same way, Agiles "fail early" mentality and principles of adaptation share many cultural similarities.

CHAPTER 3: METHODOLOGY

3.1 Research Strategy

The purpose of the qualitative data analysis is examination and interpretation to understand the underlying meaning and pattern of relationship (Rubin & Babbie, 2007) . It includes systematic analysis of themes, pattern and categories of the data (Easterby-Smith, Thorpe, & Jackson, 2012).

New product development (NPD) processes are complex and require investigation into several different factors, which can be best done qualitatively (Denzin & Lincoln, 2000). Qualitative research allows the researcher to study their subjects in their natural settings and conduct a systematic enquiry into their beliefs, actions and processes. According Bryman & Bell, (2007) the flexibility of interviewing in qualitative research is especially suitable for gaining deeper knowledge on the topic.

3.2 Questionnaire Development

The development of the questions to ask was based on the literature review and identification of gaps in other research. Additional questions reflected those asked by other researchers to form a base line by which to compare answers. This was because the research was interested in finding out if there were changes in the processes and uses of the NPD processes in the intervening years.

3.3 Selection of Businesses to Interview

The criteria necessary to be selected for involvement in this study required a business to be based in London, UK and be involved in new product development using ‘Agile’ principles and or philosophies. LinkedIn.com was used to contact the MD or CEO of the business concerned and included an overview of the project, provided the name of the researcher, contact details for the department and school within the University, and assured anonymity regarding information supplied. Businesses agreeing to take part would be given pseudonyms to hide their identity.

3.4 Data Analysis

The data analysis adopted by this study is based on the principles of thematic analysis. As Maykut & Morehouse, (1994) point out: *"words are the way that most people come to understand their situations; we create our world with words; we explain ourselves with words; we defend and hide ourselves with words"*. Thus, in qualitative data analysis and presentation: *"the task of the researcher is to find patterns within those words and to present those patterns for others to inspect while at the same time staying as close to the construction of the world as the participants originally experienced it"* (p18).

3.5 Thematic Analysis

While qualitative research is systematic in its approach to data collection and analysis, framed by a focus of inquiry, open-ended questioning allows study participants to articulate their perceptions and experiences freely and spontaneously. In analyzing data generated in this format, responses are not grouped according to pre-defined categories, rather salient categories of meaning and relationships between categories are derived from the data itself through a process of inductive reasoning. The thematic analysis approach offers the means whereby by the researcher may access and analyse these articulated perspectives so that they may be integrated in a model that seeks to explain the social processes under study. The resulting data will be transcribed manually then coded using NVIVO 10 (Computer Aided Qualitative Data Analysis Software system). This is to improve transparency and understanding of the researcher's interpretations.

Braun & Clarke (2006), guides this Thematic Analysis in 3 phases:

Phase 1:

Open coding described as broad participant led deconstruction of the data from its original chronology into an initial set of non-hierarchical descriptive codes. See Appendix III.

Phase 2:

Categorization of codes, and reconstruction of data to form a framework conducive to advance research question. 12 Agile Manifesto principles were broken into a closed book of subthemes as per the article “Agile Manifesto Principles”- (Fowler & Highsmith, 2001). Open coding will also lead to emerging themes to reflect both open and closed coding. See Appendix IV.

Phase 3:

Developing themes, involve collapsing the 12 principles into 4 broader themes, to facilitate write up and discussion. See Chapter 5 for results.

3.6 Limitations

Semi-Structured interviews: The observer driven nature of semi-structured questions always carries a risk that subjectivity can direct rather than guide interviewee’s responses (Shlain, 1999).

The sample size and variety of team members were purposely limited due to time constraints of this MSc dissertation. Whilst the data collected was rich, further studies could consider a larger sample size with focus on mature Agile Teams for more depth.

The data analysis followed the broad principles and philosophical underpinnings from the guidelines for conducting a thematic analysis issued by Braun & Clarke, 2006. However, these are guidelines and not rules and the stages involving categorization of codes and defining and naming themes were used by introducing Agile Manifesto Principles instead of categories and themes as the researcher felt that the open codes were made to fit more clearly into this framework than a more inductive approach might allow for. In all other respects, the analysis conducted could be accurately described as thematic as per phase 3 (Chapter 5).

CHAPTER 4: FINDINGS

Thirteen interviews conducted across eight firms. Three of these firms, consisted of strategic and operational team members. In total, eight strategic and five operational interviews were transcribed – See Table 3.

Participant ID	Firms	Job Type	Job Role
Participant 1	Online Newspaper	Strategic	Head of Development
Participant 2		Operational	Senior Software Developer
Participant 3	E-commerce	Strategic	Head of Sales
Participant 4		Strategic	Product Owner
Participant 5		Operational	Software Developer
Participant 6		Operational	QA
Participant 7	Creative Agency	Strategic	Technical Director of IT
Participant 8	Government Digital Service	Strategic	Head of Agile
Participant 9	E-commerce 2	Strategic	Product Owner
Participant 10	R&D	Strategic	Product Owner
Participant 11	Software Development	Operational	Software Developer
Participant 12	Consultancy and Entrepreneur	Strategic	Director
Participant 13	Creative Agency	Operational	Software Developer

Table 3: Participant ID and Descriptors

Table 4 shows a rank of Agile principles to show the most dominant principles as referred to based on interviews transcribed and coded.

Principles	Interviews	Units of Meaning Coded
Principle 07- Working Software	12	69
Principle 01- Satisfy the customer	12	61
Principle 12- Inspect and Adapt	13	59
Principle 10- Keep it simple	9	38
Principle 03- Frequent Delivery	10	32
Principle 05- Support and Trust	9	30
Principle 08- Sustainable Pace	6	23
Principle 02- Embrace Change	7	21
Principle 06- Face to Face Conversation	8	19
Principle 09-Technical Excellence	4	9
Principle 04- Cross functional collaboration	3	6
Principle 11- Self-Organisation	2	2

Table 4: Rank of Agile principles based on number of units of meaning coded

4.1 Principle 1 - Our highest priority is to satisfy the customer through early and continuous delivery of valuable software.

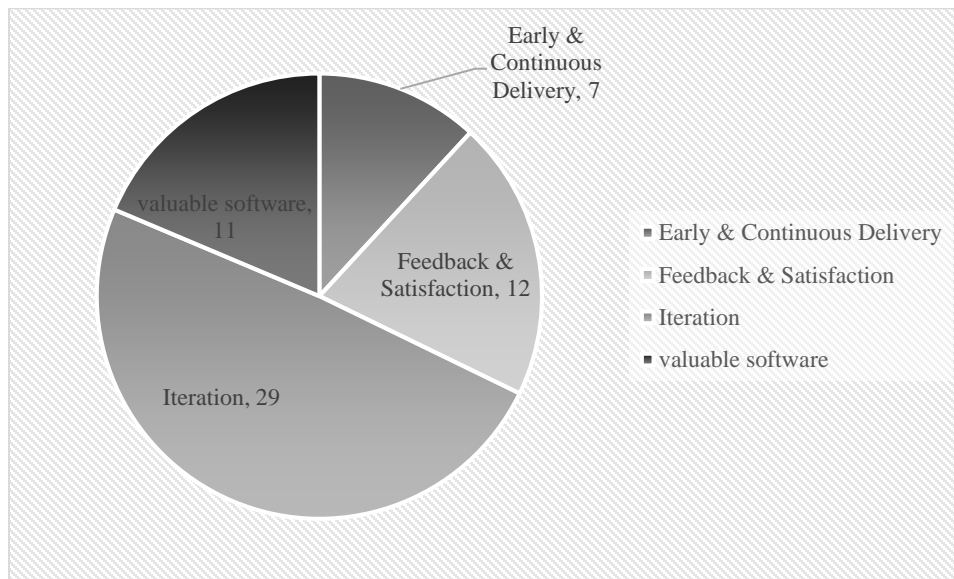


Figure 7: Thematic breakdown of Principle 1

Feedback & Satisfaction:

According to participant 11, developing new products for a new market requires:

“...how well the features solve customer pain the better the product-market fit, the higher the customer satisfaction.”

Early and continuous delivery:

Participant 1 explains the benefit of early delivery:

“you have got to set the assumption of how things are going to play out and the sooner you can put something in the real world and test whether that assumption is right or wrong —the more often you can be working on the right things.”

Participant 8, describes early delivery as opportunity to learn quickly:

“initially it was about showing that we could do something quickly and we wanted to get things in the hands of users as quickly as possible so that we could learn from it, which is a little contrary to the way that some of the other government IT projects work.”

Iteration:

Participant 7 states Agile iterative approach suits them better for Creative projects:

“Thanks to Agile, the project went through many iterations and learnings and this helped us create the right product for the client”

Participant 5 refers to Scrum’s role in the context of ever changing environments:

“Scrum was devised for ever changing environments and with nearly every Sprint the specification changes a bit. I’ve never been on a project where the product resembled the initial specification.”

Participant 12 highlights an additional consideration in the form of “what” to get feedback on.

“I identify what the biggest risks are and prioritize within the area of sprints...you should make sure the hardest risks are dealt with first.”

Continuous delivery:

Participant 1, on continuous delivery:

“Because every time you learn something you should be able to take that feedback and then make a better decision and that’s whether you get those amazing fast loops and making those big things.”

4.2 Principle 2 - Welcome changing requirements, even late in development.

Agile processes harness change for the customer's competitive advantage.

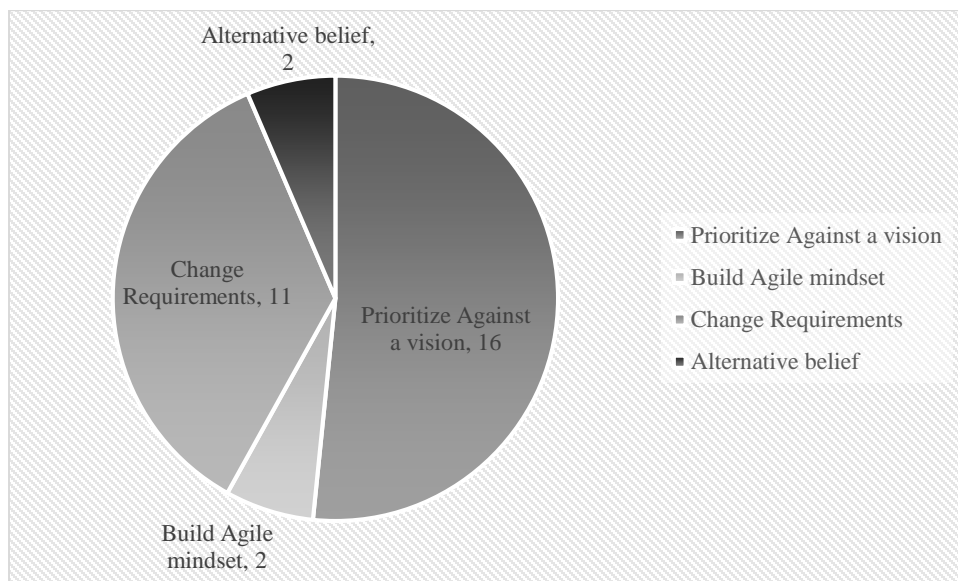


Figure 8: Thematic breakdown of Principle 2

Prioritize against vision:

Participant 8 reaffirms this view:

“...responding to change is important, but it’s also important for us that we respond to the needs of our users, that we try things out with them, and make changes based on what we find rather than on what someone assumes they will find.”

Build Agile Mind-set:

Participant 1 refers to Scrum as a stepping stone towards the Agile mind set:

“...everyone’s got to start somewhere. Scrum is an unbelievably useful set of things that you can literally download print out and get on with...hopefully you’ll get to a point where they’re more receptive to be able to work in a kind of an iterative fashion.”

Changing Requirements:

Participant 1 on Scum planning meetings:

“...if you do scrum and you do that by the book, you have planning meetings, typically every couple of weeks, where you estimate how long your tasks are going to take and how much work you’re going to be able to do over the next couple of weeks, and we didn’t really find it very useful. Estimation in general just doesn’t add anything for us.”

Participant 2 corroborates this view:

“...Generally, for us, estimating how long something takes is pointless- partly because we’re always wrong.

Alternative Belief:

Participant 1 on the move from Agile to “Lean Thinking” approach:

“...as I move towards lean thinking, I thought all of it was a waste, sitting in a room for a day every week, talking about a bunch of stuff that nobody went off and did.”

Alternative Belief:

Participant 5 describes the tension between embracing all changes late in development and maintaining a good standard. In reference to one such late request for change the developer recounted:

“...Why didn’t we think this from the first place!?”

“...Sometimes things evolve, things change. To make this the best product you have to adapt.”

4.3 Principle 3 - Deliver working software frequently with a preference for the shorter timescale

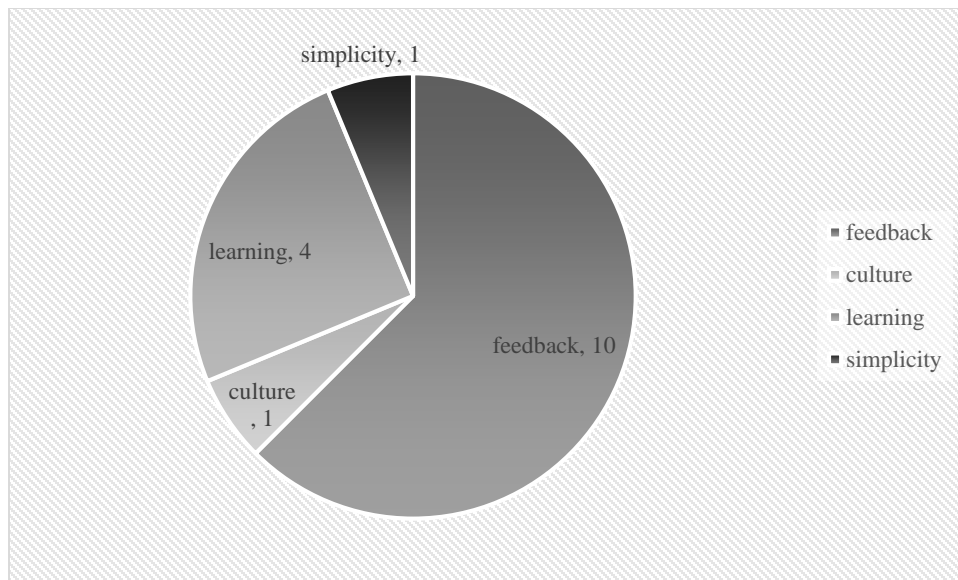


Figure 9: Thematic breakdown of Principle 3

Feedback:

Participant 4 talks about the importance of gauging the functionality and user experience of the product:

“...I think one of the most powerful things about testing after launch is because you test not just your eye on how it looks but you test functionality as well and the functionality with the looks is a very powerful combination because before its live all you can test is probably just how it looks unless obviously it gets environmental then you see the functionality as well so we make a decision for this product to actually collect feedback once we launch.”

At E-commerce firm, I notice the walls are covered in posters. The following best describes principle 3:



Learning:

Participant 1 talks about the benefits of obtaining feedback from working software:

“You got to start somewhere right? It’s like building software. The only thing you figure out how to do it is by doing it and learning it messing the half and then you know, figure something else out.”

“...The key benefit is being able to learn faster. So it’s all about learning because you’ve got a set of assumptions and most of those assumptions are wrong in this modern world...you have got to set the assumption of how things are going to play out and the sooner that you can put something in the real world and test whether that assumption is right or wrong - the more often you can be working on the right things.”

Culture:

At one point Participant 1 on corporate culture.

“...probably my closest set of things would be based around the kind of Lean start-up methodology with regards to build, measure, learn, iterate or that’s the kind of – that

I would say, if it was something to be written down that's what I want written down.

And I did put it on a wall once but nobody looked at it."

Simplicity:

Participant 1 refers to the importance of keeping things simple in order to get working software out frequently for feedback.

There's a lot of things like that helps. Ensuring feedback cycles helps eliminate waste and you keep things simple, because if you want to really release something tomorrow you have to ensure it is something simple in order to do it."

4.4 Principle 4 - Business people and developers work together daily throughout the project

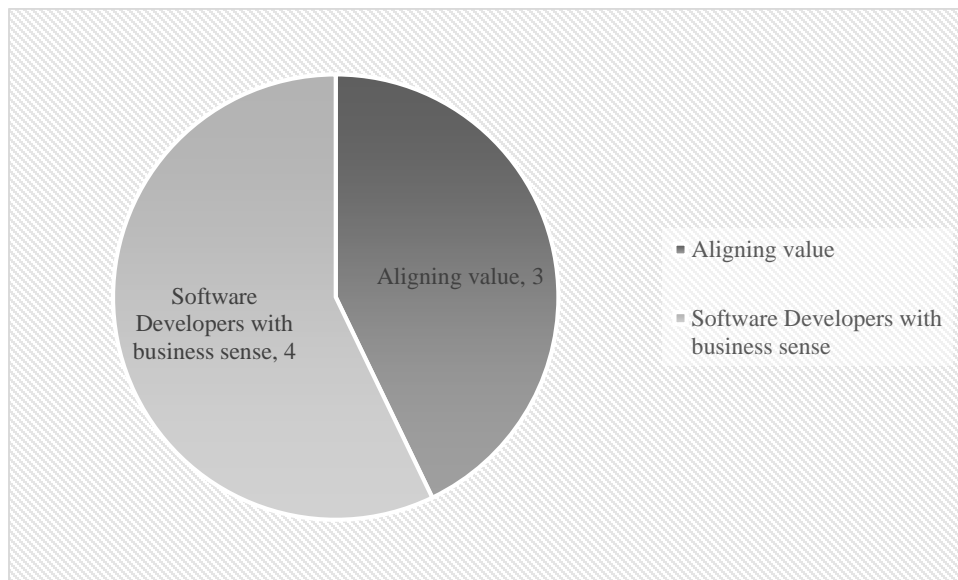


Figure 10: Thematic breakdown of Principle 4

Aligning Value:

“So typically we would put together a team of cross functional members. We would then make a list of features we want to add to our product, we call this the product backlog, then we start setting our sprints. We identify the minimum set of features to build in our first iteration this requires inputs from finance and marketing.”

Participant 7 on the need for vision:

“...the whole team acknowledges that we’re not quite sure what’s going to happen in the forefront. Even though we use this backlog from which we base our sprints, specifications change very often. One thing we do on the very first meet is define along with the client what success means to them.”

Software Developers with business sense:

Participant 9 refers to bridging the gap between business people and developers:

“...Imagine if there is a group of developers working in Silo (alone) away from the business. What ideas are these developers going to come up with and what ideas are the developers who are involved in the business going to come up with? So, you teach all developers what the business is about, what's the business model, how we make money, what are the issues. So, those developers who are more involved in the business and those in the Silo can come up with better ideas.”

Participant 1 states there are occasions where developers talk directly to the customer (end-user) as this cuts out the middleman in the form of business correspondent making things more efficient.

Photo taken whilst on site at E-Commerce 1. The firm has many posters on the wall one of which stood out as compelling for the purposes of illustrating the point at hand:



Figure 11: Photo taken at 'E-Commerce Firm'- An Engineer is a Creator

Participant 8 gave sent a link to their own interpretation of Design principles (See Appendix

4.5 Principle 5-Build projects around motivated individuals, give them the environment and support they need and trust them to get the job done.

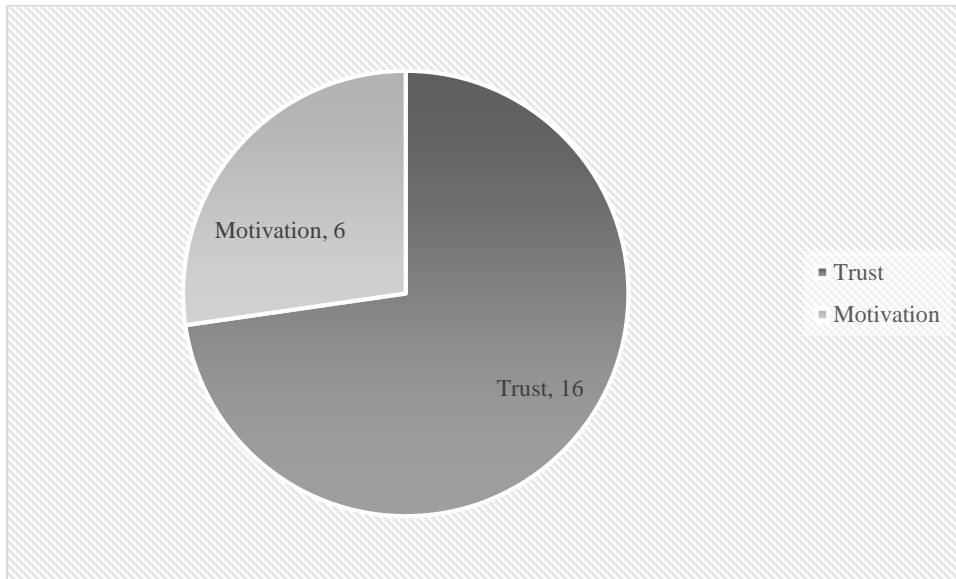


Figure 12: Thematic Analysis of Principle 5

Trust

Participant 1 talks about culture as a barrier to Agile adoption:

“They (the business) kept on saying they wanted to be Agile but when they got to do it, they kept on going back to their existing mind set and they didn’t want to change that because it was this whole kind of you know, I want a budget, I want to know exactly what’s not going to be built and you kind of say, “I don’t know what’s going to be built, however I can give you a window.”

Participant 12 talks about getting an innovative Agile project off the ground whilst overcoming traditional mind-sets toward annual budgeting:

“Traditional annual budgeting concerns a fixed price that is agreed and we deliver against that. That sticks in opposition to Agile where you don’t know exactly how many sprints are going to be done. So I will, talk with an Agile group, estimate from that fixed price and so the larger organization sees this fixed price contract but then I will manage the Agile process separately.

Motivation through environment and support

Participant 3 on relationship with culture initiative and increased revenue:

“...the culture was introduced these past 3 years and revenue has really rocketed. The amazing thing is that this only happened since focusing on the company culture.”

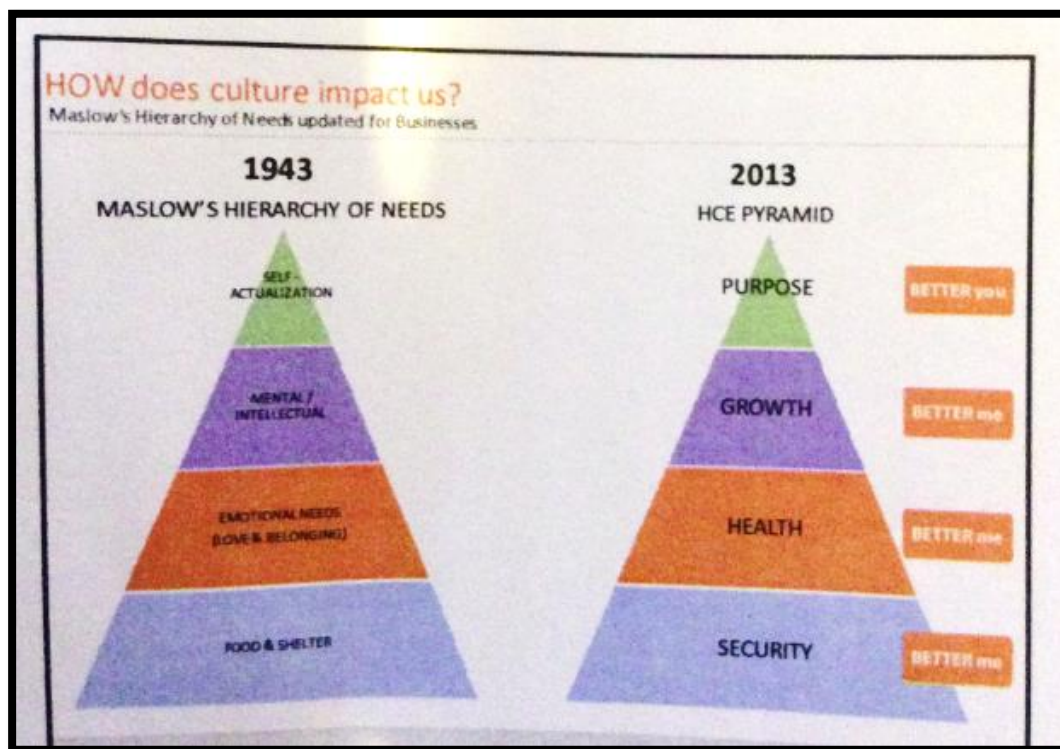


Figure 13: E-Commerce firm's version of Maslow's hierarchy of needs.

When asked about similarities between Agile and corporate culture, Participant 5 points to the following poster:



“The culture is one of improving yourself constantly and constantly growing. Likewise if your product isn’t growing then what’s the point? We have no water you’re not growing, you’re dying? So, culture promotes growth and that’s absolutely integral to what we do, and then improving yourself at the same time.”

Participant 3 talks about the importance of asking the question “why” as per the firm’s key mentor:

“...Simon Sinek is a key mentor of ours ... you can know how you’re going to do something; you know what you’re doing. But if you don’t know why you’re doing something, you’ll never have that true sense of purpose, that sense of motivation that really keeps you centred, and so in our company “Why” is to do a list of things that allow others to do the great things that they are meant to do. And how we do that is we use business as a platform to build people of higher character.”

Participant 3 shows me some induction material used to illustrate the firm’s “why”:

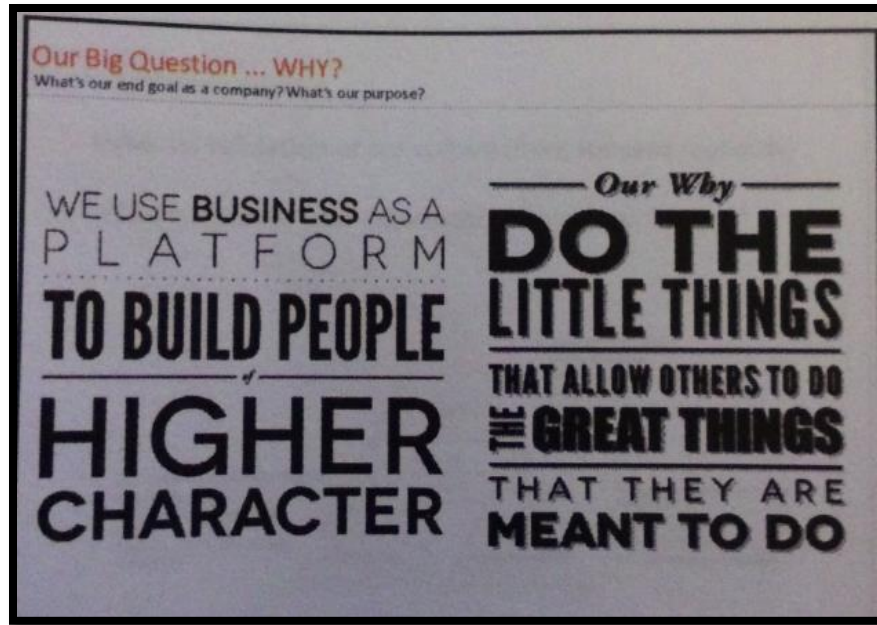


Figure 14: E-Commerce Firm's "Why?"

4.6 Principle 6 - The most efficient and effective method of conveying information within a development team is face-to-face conversation.

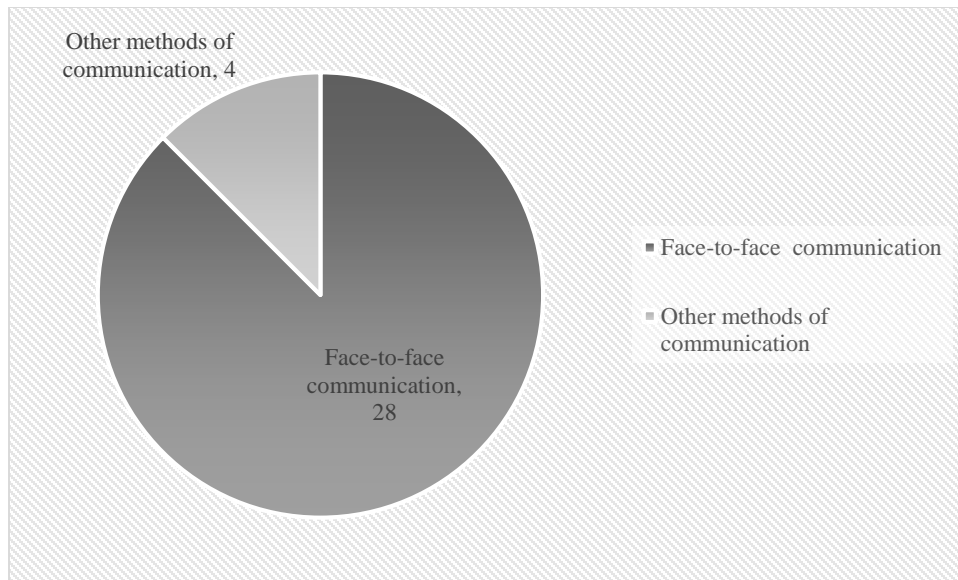


Figure 15: Thematic breakdown of Principle 6

Face-to-face communication

The face to face nature suited some personalities more so than others according to Participant 13:

“...In theory face to face is a great concept but from experience, Software developers can be quite shy. A daily stand-up in front of 10 people can cause such people to cease up. This is the worst because they don’t disclose impediments and this can impact the project negatively.”

Other methods of communication

Participant 7 outlined issues with what he called a “one man team”:

“...the three of them (marketing, coder, designer) we’re not really communicating and when they were they were communicating in terms of telling each other, look look I’ve done that, that’s amazing but there was no real glue between the three of them. So their jobs were closed.”

Participant 1:

“...Usage of large displays with Kanban interface allows information to radiate.”

Participant 10:

“...Desks are positioned very close and the relationship is very family oriented”

Participant 8:

“...Other forms of communication exist such as using the walls to radiate information. This allows transparency and ownership.”



Figure 16: The Government Web Development firm utilizes walls to radiate information

4.7 Principle 7 - Working software is the primary measure of progress.

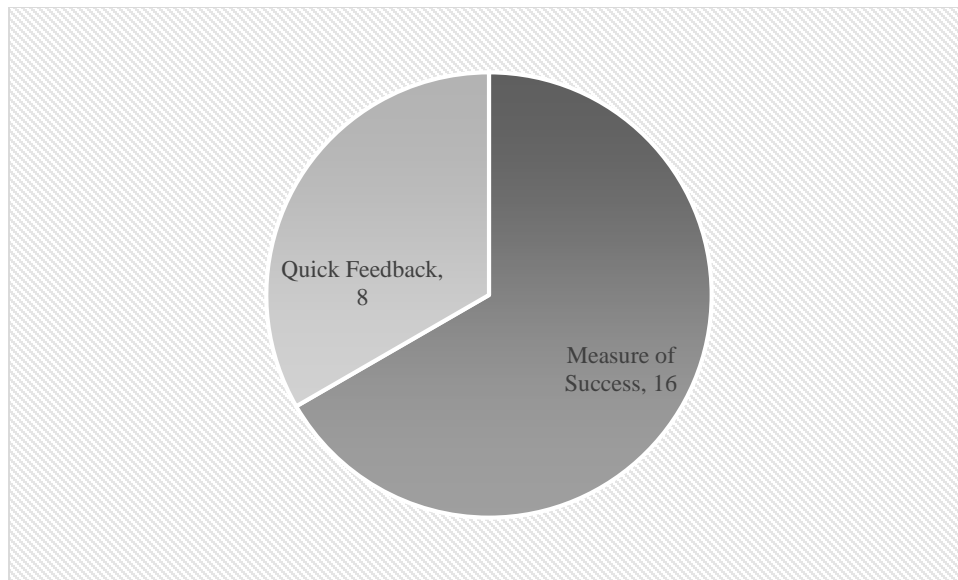


Figure 17: Thematic breakdown of principle 7

Measure of Success

While Participant 5:

“I think a lot of the time, especially with web development, you don’t really know how something’s going to look until it’s done... but the mock-up is very different than actually using something”.

Participant 4:

“I think one of the most powerful things about testing after launch is because you test not just your eye on how it looks but you test functionality as well and the functionality with the looks is a very powerful combination”.

Quick feedback

Participant 11:

“we found that with Agile, we could market test whatever we did quickly and use the feedback in our further development it saves a lot of time that we were earlier spending on guessing; and building stuff based on our assumptions coming from our experience but each client is different and his requirements are different”.

Participant 1:

“We don’t do planning meetings which sucks for one thing. We used to do them but not anymore. It don’t really add much value for us. We don’t plan. We don’t estimate how long works can take, really”.

4.8 Principle 8 - Agile processes promote sustainable development. The sponsors, developers and users should be able to maintain a constant pace indefinitely.

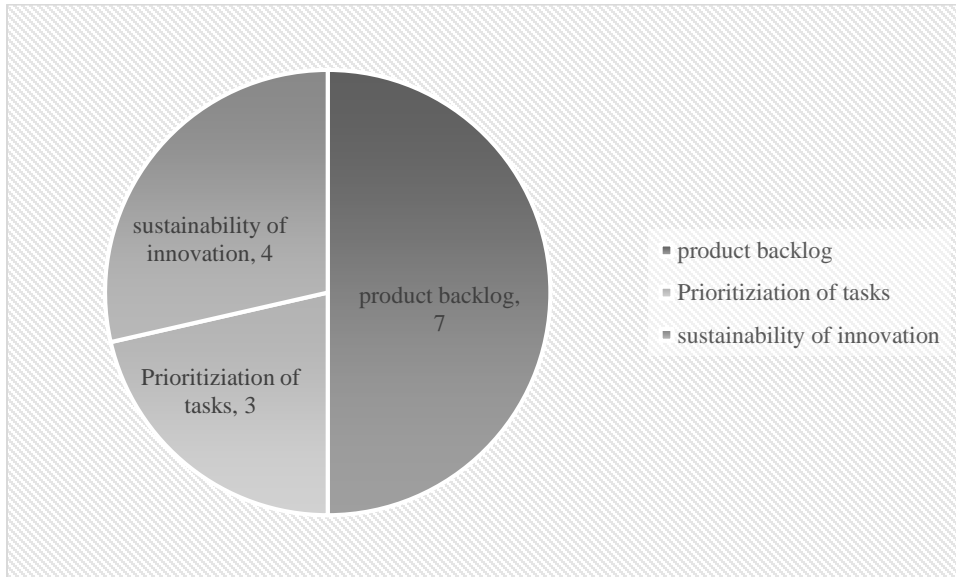


Figure 18: Thematic Breakdown of Principle 8

Product Backlog

Participants spoke about product backlog utilized as a way of executing upon a vision for sustainable pace:

Participant 11

“Product backlog contains all the features of the product. It is the master list of all the features. IT contains the vision of the product manager and all the Stakeholders it is like a wish list with all the items that would make this product GREAT!”

Participant 8 describes how its use made the delivery process effective as opposed to just efficient:

“...We use SCRUM practices to facilitate the effective delivery of products using things such as product backlog, burn down charts, prioritization, and sizing. We do

this through the analysis of velocity which allows us to determine the number of story points being actioned per sprint and this allows us to make estimations on the number of features to be accomplished in future sprints.”

Participant 1 talks about avoiding burnout through sustainable development:

“If you want to build quality, you need people to be at their best. They’re at their best when exercising, eating properly, sleeping well. And most of the breakthroughs don’t come at 3 o’clock in the morning when you’ve been drinking red bull all night.

Prioritization

Features were prioritized to ensure the greatest value was delivered per iteration, equated to a more focused effort rather than a free for all:

Participant 1(Developer)

“...we use burn down charts to track and measure progress we use tools that allow us to view burn down charts. The burn down chart helps us measure the team productivity which helps us make reasonable estimates of effort.”

Participant 2:

But it’s lots of smaller short term things in each of those points. It’s basically the minimum viable learning that you can get from it. What’s the minimum amount of stuff that we can do to get the greatest amount of learning, and reduce the most amount of unknowns that would come at the end of this project?

Participant 8

I guess back log should be clear, acceptance criteria should be clear and definition of done, definition of when things move along should be clear.

Sustainability of innovation

Agile for business as usual and Agile for innovation. Participant 9 talks about a split team setup utilizing scrumban for innovation and Kanban for business as usual.

“if you have just a Scrum team they are going to be interrupted very often, because imagine they are in the middle of a sprint and someone from legal team comes and says, “We have to change this term because otherwise we will be fined,” That’s why it’s better to have a Kanban team for the company as they deal normally with business as usual.”

4.9 Principle 9 - Continuous attention to technical excellence and good design enhances agility.

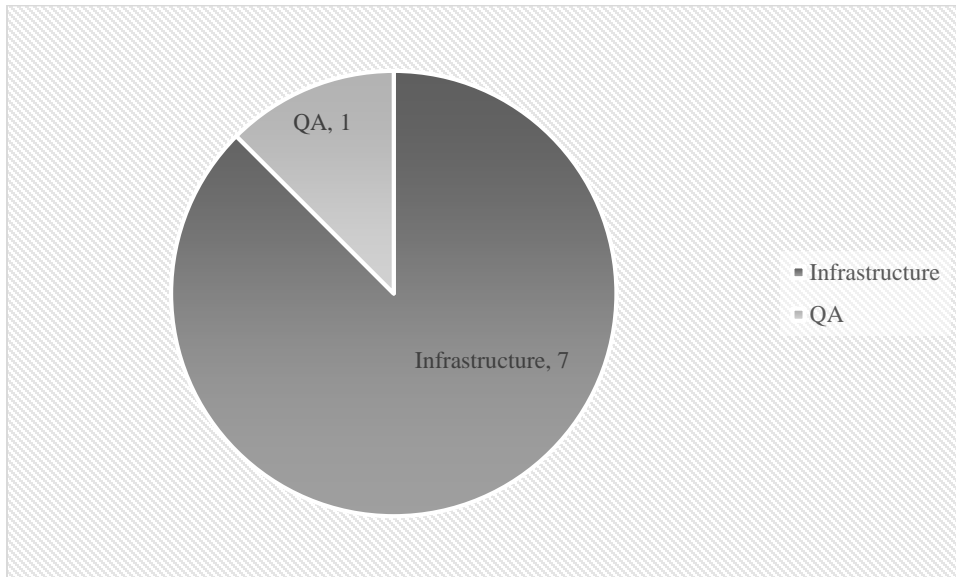


Figure 19: Thematic breakdown of Principle 9

Infrastructure

Participant 1 stated:

“Infrastructure ensures developers are able focus on the creativity. Infrastructure if done well will enable quality testing.”

Participant 2 likewise said:

“...swapping modules out enables agility to address fast pace of changing requirements and specifications.”

Participant 1 mentioned that they got rid of the last QA analyst as much of his task had been carried out by developers

4.10 Principle 10 – Simplicity, the art of maximizing the amount of work not done is essential.

Simplicity:

Participant 1:

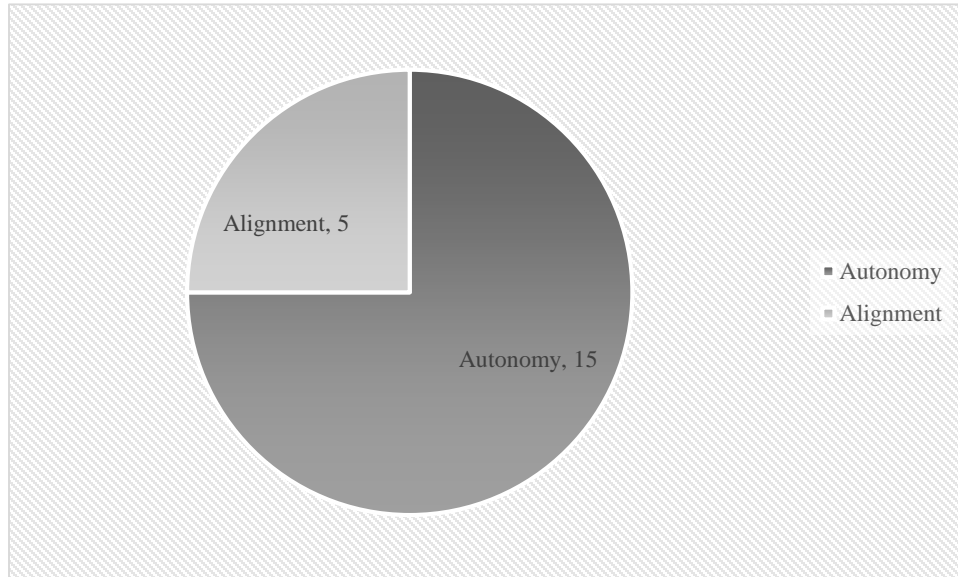
“It’s so easy for development to get excited and go 5,000 lines of bad code. Isn’t really valid or useful... feedbacks cycles help eliminate waste and how you keep things simple, because if you want to really release something tomorrow you have to feel something simple in order to do it and retrospective, yeah a hundred percent.”

MoSCoW (See glossary for definition)

Participant 2 on measuring for value by prioritizing least complex feature:

“...And what you can do, you can analyse by complexity; which is the idea that the least complex brings the most value. So you can print this ratio and find out which one you should look at or pick up first. “.

4.11 Principle 11 - The best architectures, requirements and designs emerge from self-organizing teams



Autonomy:

Participant 8:

“So I think that two things that go together are autonomy and alignment. So teams having autonomy about the way that they work, it’s very important that everybody is in line with similar goals”.

Similarly, Participant 1:

An overarching strategy is needed to avoid too many ideas being suggested.

Alignment:

Participant 12, when referring to instances where software and hardware are combined, refers to self-organizing as being trickier to manage due to mixed groups from different backgrounds. This is because they all speak different terminologies and have their own way of doing things.

“...to see the proof of that. It may be true in practice, I’m not always sure. Self-organizing teams are great whenever of the same background. If you’ve got a row full of developers, that will work quite well. Getting that mixed group of people to self-organize is much trickier.”

Impact of firm’s culture:

Autonomy for individual members of the team to organize themselves is the optimal Agile mind set. It’s not the type of thing that comes overnight. Participant 1 states:

Agile takes time to implement. It is a mind-set. People get disgruntled with Agile because it doesn’t deliver benefits straight away. They don’t realize it’s something that needs investing in.

4.12 Principle 12 - At regular intervals, the team reflects on how to become more effective, then tunes and adjusts its behaviour accordingly.

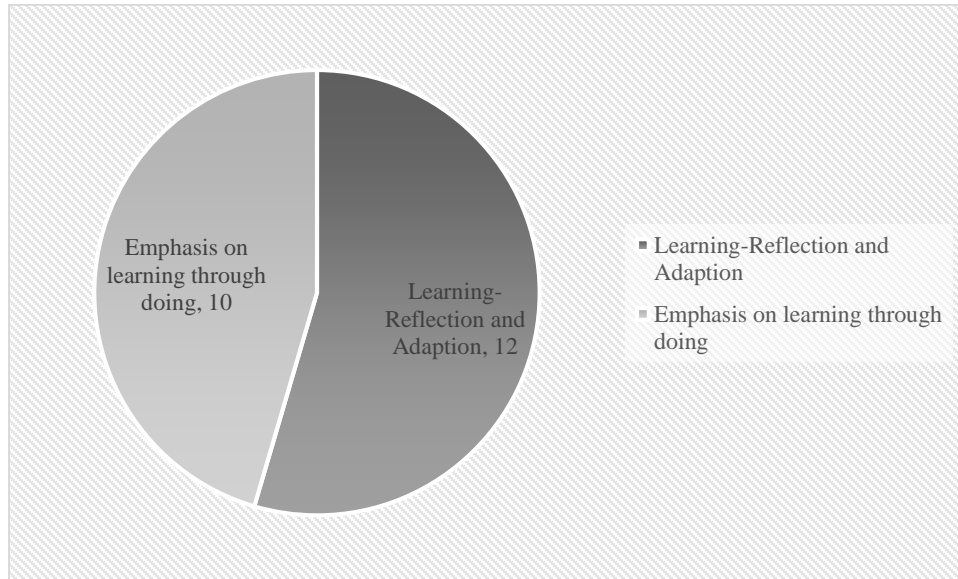


Figure 20: Thematic breakdown of Principle 12.

Learning through reflection and adaptation

Participant 1 emphasized learning more so than all the other respondents in terms of implementing Agile. The retrospective to his mind was the most important SCRUM practice to enable teams adapt to an agile mind set.

Emphasis on learning through doing. I.e. repetition builds good habits.

Participant 1:

Regular repetition of practices that lead to reflection and adaptation

Participant 3:

“Deliberately doing certain practices is a vital thing to remember...So we use culture as a practice ground to develop yourself. Things such as practicing public speaking

internally, receiving very critical feedback from the CEO, are all cultural things that help us grow as people and this manifests into business.

CHAPTER 5: DISCUSSION AND ANALYSIS:

The findings from the case study interviews have provided a rich vein of knowledge into how seven London UK based businesses have employed Agile Principles to develop innovative new products. The data collected has enabled common themes and patterns to emerge, which have highlighted specific Agile Principles that through their repetition alone would suggest they are key factors for successful NPD (See Chapter 4: Table 4). However, taking on board the psychology of Agile as proposed by the 17 ‘inventors’ Agile is more than the sum of its parts. To understand the relevance of Agile in the role of innovative NPD requires analysing each principle in relation to the other principles. To segregate out one principle and herald it as *the* one key factor is not appropriate in Agile.

Each Principle in Agile needs to be reviewed as it relates to the other Principles. To that end, this discussion analyses the individual characteristics of each principle in turn whilst also noting similarities, interactions and overlaps that exist between the Principles and make Agile whole.

Principle 1 exists to ensure that the needs of customers are satisfied. However, Agile does not demand upfront agreement on what ‘needs’ mean, Agile does not accept that the ‘needs’ of a product must be known. Needs require continuous building, testing, modifying, building, testing, modifying, etc., with the end-user until the product-market fit is correct; success through experimentation and change of an actual product. To fully benefit from the experience the manufacturer/developer must be willing to learn from the experience, so that the next time they can make a better informed decision, which in turn reduces risk. Agile Principle 1 becomes a learning tool. Learning is associated with testing of assumptions not just early on but also continuously. The earlier the iteration the earlier a firm can start piecing together the right innovative digital product. This reinforces the view held by Aaen (2013) that learning quickly and embracing risk rather than mitigating for it, is the difference between traditional project management and innovation management. This also corresponds to the “fail early” method as described by (Larman, 2004).

Principle 2 looks at embracing change, which Principle 1 was also concerned with. So Principle 2 is complementary to Principle 1. From the interviews a number of the participants reiterated the need to be willing to accept change even if this meant disruption to their ‘jobs’, but that change should not be for changes sake; change should occur only after thorough analysis based on fact, feedback, and skills of the developers. The final prize was still the satisfaction of the customer but waste too was also important; waste not only in time and money in the development of the actual product but also in the planning of the process. Here Agile begins to be seen as all persuasive, all consuming, a concept that cannot be just pulled out of a box every time a new product needs developing. However, Agile is not complex although it is significantly different. No doubt this ‘difference’ accounts for some of the difficulties businesses encounter in implementing Agile. While Agile utilizes such methods as iteration to gain feedback, daily scrum meetings, and retrospectives as methods to harness change, these are all subject to a firm’s culture. One participant remarked that it took eighteen months before the traditional command and control hierarchy would allow the Agile team to work in a true iterative agile fashion. That is, they imposed deadlines, budgets, and controlled scope. In the words of participant 1: *“they kept on saying they wanted to be Agile but when they really attempted to do it they kept on going back to their existing mind set”*. This reflects back to Govindarajan & Trimble, (2010) who noted that where cultures clash it is the old culture that has the upper-hand to begin with because the old ways are known and often perceived as less risky.

Principle 3 is concerned with delivering work frequently, about having a tangible piece of functionality from which the customer can interact with and decide whether the work carried out is valuable or needs to be revised. It is also about the frequency in which work is delivered as this increases the ability to learn. By producing work for testing frequently there is less risk that extensive work will have been completed, which if incorrect or in need of modification would prove a major task. Keeping modifications short and simple as one interviewee pointed out was a key benefit because it enabled more chances to learn, and the way in which software developers learn is by trying out assumptions and seeing if they work through

testing in the real world, from customer feedback. Learning is a critical part of Principle 3 which was also a factor that emerged when analysing Principle 1.

Principle 4 is about working together between otherwise non-communicative groups, such as developers and business management. These groups are unlikely to ‘talk’ the same language, and consequently barriers were expected to exist, but surprisingly in the interviews there was an acceptance of mutual responsibility and recognition of the need to work towards business goals and a common vision. Principle 2 by encouraging the creation of cross-functional teams where members have to learn to talk to each other to get work completed acts as a catalyst to embrace change.

Principle 5 looks at the motivational aspects of NPD and how the role of the individual can be encouraged. The old approaches to NPD (Hustad, 1977; Morris, 1990; Cooper, 1986) relied heavily on controlling the NPD process demanding clear and concise product definition at the earliest point in the process. The mind set was that of the group, individual flights of fancy were discouraged. With these approaches to NPD fixed budgets and ‘hurdle rate’ indicators for selecting the next new product were commonplace. Traditional yearly budgets that are calculated for the whole year upfront can diminish innovation by creating a lack of trust (Govindarajan & Trimble, 2010). Innovative Agile projects are at odds with the nature of fixed budget, time, and cost. Furthermore, most budgets are based on historical data which new product developments lack. Novel ideas can often be shut down as crazy and farfetched by a system that embraces the status quo at its very core, that is, annual budgeting requirements. Such traditional entrenched approaches cannot be overcome overnight. A point highlighted in the case studies, where businesses were accused of slipping back into ‘old ways’. Principle 5 shares similar ideals to Principle 2 – the need to embrace change.

Principle 6 concentrates on the need for face-to-face communication, which overlaps with Principle 4’s need to work together and break down barriers for the common good of the company. However, not all the interviewees agreed with the concept as some people are shy or introverted and do not ‘come over’ well in groups. However, Principle 8 offers support under Team dynamics.

Principle 7 is focused on the need to develop a working product as this is the primary measure of progress and has links with; Principle 1 – the need to satisfy the customer, deliver the product to the customer and provide a valuable product and Principle 3 the need to deliver frequent products. But Principle 7 accepts the need to recognize the financial aspects of NPD; businesses are in business for profit.

Principle 8 looks at the sustainability of NPD and emphasizes the need to continue to produce the product. In the interviews there was an emphasis on the actual team – the need to support the team to remain healthy and creative, because without the team there would be no product. This Principle overlaps with Principle 4 working as part of a team and Principle 5 about creating a motivated team.

Principle 9 reiterates the role of technology, as Litvic (1992) states that the obsolescence of technology can out pace product development (as cited Larsen & Lewis, 2007). Fast forward to the 21st century and technology advancement (Moore's Law) has placed and will continue to place increasing demands on firms to keep up (For a comprehensive breakdown of the effects of Moore's Law (Crosbie, 2009). Clark, & Wheelwright (1995) observes the scenario where firms compete with each other in fast paced competition to see who can develop more innovative products faster and faster (as cited by Glassman, 2010). A faster time-to-market also means that a company can start making profits sooner, thus appealing investors, and generating cash flow for everyday operations. Whoever has the better infrastructure can spend more time on creative endeavours.

Principle 10 is about simplicity. Responding to change as well as seeking change according to Participant 1, can be made all the easier if we focus on the essentials. The need for clarity was a common theme and so was the need for vision. In a market place where firms try to deliver faster and with better quality, it is essential for innovative digital products to have clarity and a vision. Simplicity was brought up by participant 1 as an essential element to enable the early and continuous delivery of working valuable software. This principle was also seen in other forms such as the minimum viable product when used to verify an innovative idea, and the minimum useable subset as used to pinpoint core features of an innovative digital product. Simplicity is clarity, and the result is quick delivery of value.

Principle 11 looks at the best architectures, requirements, and designs emerging from self-organizing teams. Data emphasized culture as an important aspect of self-organizing teams. A sense of ownership was mentioned by Participant10 as a result of having the option to pursue your own role in the team. Autonomy was a key theme as well as having a vision. In NPD, the effective delivery of innovative digital products has no roadmap from which to follow. However, in the real world teams are made up of individuals and each with a different personality. The best self-organizing team can therefore be slowed down by underperforming or under skilled team members. Effective delivery of innovative digital products can therefore be compromised by the wrong team member(s).

Principle 12 looks at reflection, the need to look back on actions taken to enable change for the better and to remember points that might otherwise have been forgotten. Better quality of feedback was associated with having valuable working software from which to reflect on. At the same time any adaptations would be based on this. The feedback is therefore based on fact rather than assumption. The internal culture of the firm, through its consistent rituals can be seen as the practice grounds from which employees grow. And this growth manifests into improved real world performance with customers. Principle 12 again reflects the ‘learning’ approach of Agile as encountered in Principle 1 and many of the others too. It is about self-improvement, process improvement, business improvement, and environmental improvement.

To summarize the thematic analysis it was found that twelve Agile Principles can be summarized by the four themes of the original manifesto as shown in Fig 5-Agile Manifesto (Pg.16)

However, it also became apparent that there were slight subtleties that also existed. For example the following themes are the result of collapsing codes from in phase 2 (Appendix IV) into 4 broad themes condensing and summarizing main findings – as per phase 3 of Braun & Clarke, (2006)

Themes	Description	Interviews	Units of Meaning Coded
Cross functional team interaction over individuals and interactions	Team consensus, transparency, and communication, cross functional collaboration. Holistic benefit, Vision and clarity guide teams.	13	91
Validated software over working software	Validated software refers to the continued testing of digital products after launch using data to make evidence based changes to features. Real time feedback gained from actual usage over assumption.	13	110
Vision over a plan	Starting with 'Why' allows delivery team members to work toward 'how' and 'what'. The concept is applied to all facets of organization life. A shared vision helps guide cross functional teams move toward a shared set of principles and values that can be manifested into improved innovative digital product delivery.	13	95
Creating change over responding to change	For those firms looking toward innovation as a means of competitive advantage. A shift from exploitation of markets (responding to change) to exploration of markets (being the change).	13	135

CHAPTER 6: CONCLUSION AND FURTHER RESEARCH

6.1 Conclusion

This study into the role of Agile in the NPD process of innovative software development has reviewed how seven UK based firms have used Agile. The research was based on an in-depth analysis of research into traditional innovative product development processes over the last fifty years. The findings from the qualitative semi-structured interview survey has provided a rich vein of research that addresses the deficits in those researchers works that were found to be biased, of questionable validity, dubious analysis and ultimately offering inappropriate conclusions.

The research undertaken for this study enabled the firms themselves to express openly and candidly how they have used Agile, how it affects the individual members of staff, the customers and their businesses. These actions have given meaningful insights into Agile. Agile is not easy, it requires dedication, commitment, a willingness to change and acceptance of new practices. No wonder it meets with resistance from the old school of NPD and approaches to justifying the development of innovative products. But for those interested in developing products that meet the fickle, potentially ever-changing needs of customers in the 21st Century new ways to bring products that meet those needs must be employed. Agile as its name suggests offers that capability.

Agile is a collection of Principles, but it is more than this. Individually, the Principles can add to the development of innovative products, collectively they can revolutionize innovative product creation and still meet the needs of the customer. And continue to meet those needs.

This study offers those interested in better understanding Agile an insight into its use in eight firms from the perspectives of those who work with Agile and who believe in it.

6.2 Further Research

The research reported in this study relied on interviews, people providing their own accounts, experiences and opinions on Agile. It could be argued that to gain a true understanding of Agile in practice requires the use of a longitudinal ethnographic study. Observing how the Agile process worked in real-time could reveal further insights into the benefits, costs, and critical success factors of Agile.

Agile grew out of the need to develop new ways to approach the changing environment of new product design and development, the need to continually create innovative products, particularly in the digital world of software. However, now product manufacturers are beginning to question if Agile could work for them? Could it? Consequently, research is needed that identifies manufacturing firms using Agile and carries out qualitative research to record how manufacturers apply the Agile concept to physical products. Would having a tactile product for testing amongst customers make reiterations of designs to improve market fit easier?

Then there are 'Services'. Services provide unique issues in NPD (or maybe the term should be NSD?), not least that services tend to be intangible – you cannot see them, you cannot feel them. Possibly not even hear them, smell them or taste them. So how would you test them? Measure their performance? Experiencing a service is probably how most people would describe their first interaction with a service, and maybe Agile is the tool to use to provide better services?

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APPENDIX I: MISC

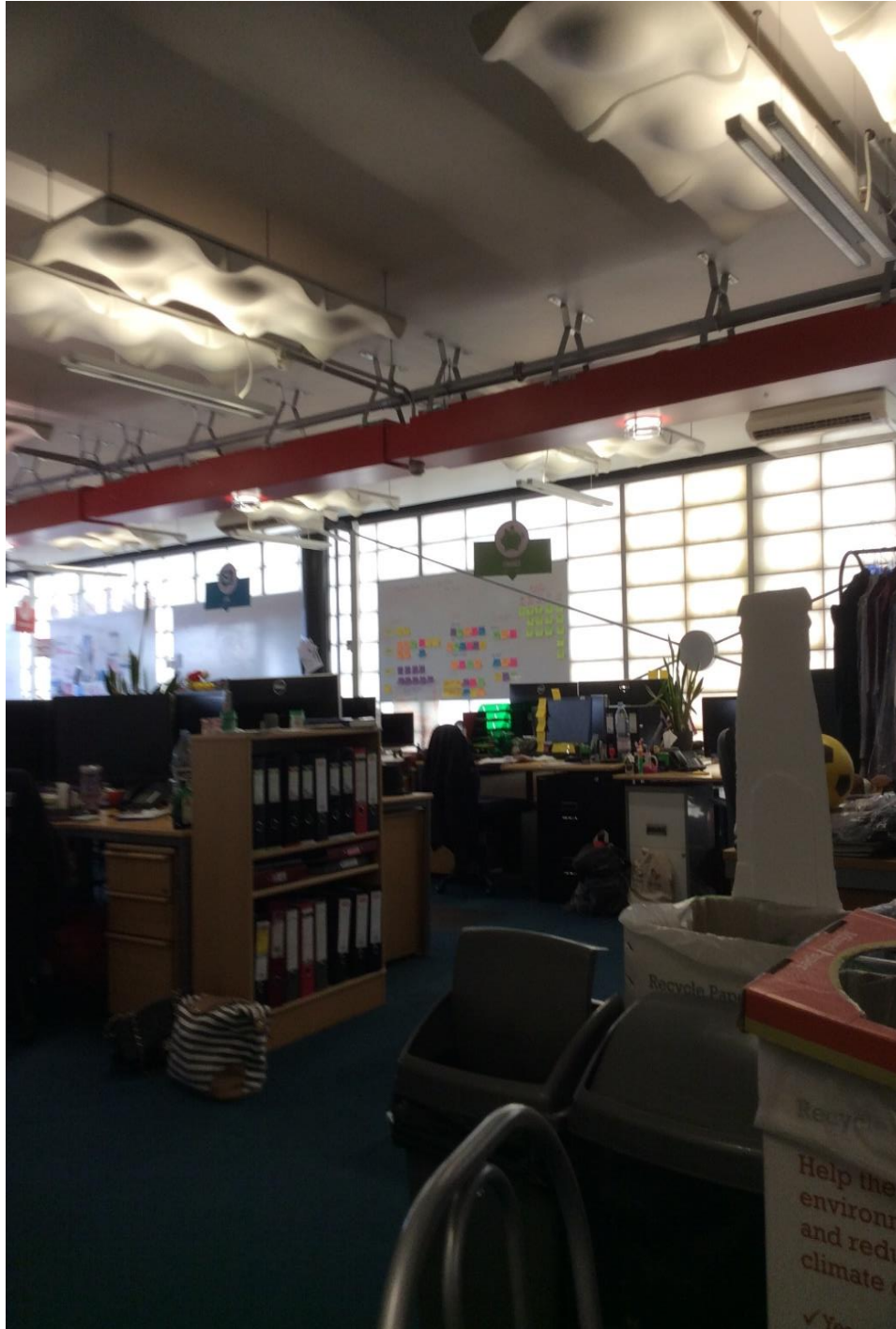


Figure 21: Product Backlog at E-Commerce firm 1

Software Development (government digital service)

10 design principles	7 digital principles.
1Start with needs* 2Do less 3Design with data – requirements gathering with UX experts. Voice of user to actions of user. 4Do the hard work to make it simple 5Iterate. Then iterate again. 6Build for inclusion 7Understand context 8Build digital services, not websites 9Be consistent, not uniform 10Make things open: it makes things better	The 7 GDS digital principles Putting the public first, in delivering digital public services Digital by default Putting users first Learning from the journey Building a network of trust Moving barriers aside Creating an environment for technology leaders to flourish Don't do everything yourself (you can't)

Table 5: <https://www.gov.uk/design-principles>Figure 22: Agile wall at the GDS (<https://gds.blog.gov.uk/2012/12/19/the-agile-wall/>)

APPENDIX II: BREAKDOWN OF AGILE MANIFESTO PRINCIPLES

Breakdown of Agile Manifesto principles as per Fowler & Highsmith, (2001) – “Agile Manifesto”. Sub-Themes are derived from this article.

Agile Principles	Sub-Themes
1) Our highest priority is to satisfy the customer through early and continuous delivery of valuable software.	delivery, iteration, feedback, value
2) Welcome changing requirements, even late in development. Agile processes harness change for the customer's competitive advantage.	(Principles statement about adaptation- (Highsmith, 2009) embrace change, feedback is change, prioritization,
3) Deliver working software frequently, from a couple of weeks to a couple of months, with a preference for the shorter timescale.	reduce delivery cycle times, evaluate & learn from growing product,
4) Business people and developers work together daily throughout the project.	clear vision, business(customer) and developers frequent daily communication, joint responsibility,
5) Build projects around motivated individuals, give them the environment and support they need and trust them to get the job done.	trust, decision making by team (experts), motivation and intrinsic over extrinsic needs(Principle statement about individuals over organizations (Bilton & Cummings, 2014)
6) The most efficient and effective method of conveying information with and within a development team is face-to-face conversation.	Tacit understanding, writing inefficient medium, blend of documentation and conversation.
7) Working software is the primary measure of progress.	risk, iteration, fail early, requirements Principle Statement over operational effectiveness over strategic goals(Bilton & Cummings, 2014)
8) Agile processes promote sustainable development. The sponsors, developers and users should be able to maintain a constant pace indefinitely.	agility, healthy employees (alert and creative), working pace, velocity, burnt out workers are not agile
9) Continuous attention to technical excellence and good design enhances agility.	continuous evolution of design, clear vision
10) Simplicity—the art of maximizing the amount of work not done—is essential.	simplicity, clear purpose, keep it simple
11) The best architectures, requirements and designs emerge from self-organizing teams.	High frequency of interaction, few process rules.
12) At regular intervals, the team reflects on how to become more effective, then tunes and adjusts its behaviour accordingly.	(Principles statement about adaptation- (Highsmith, 2009) change is inevitable, refine and reflect important, continuous practice improvement,

APPENDIX III: PHASE 1: OPEN CODES

Open Codes	Interviews	Units of Meaning Coded
Satisfaction	10	14
prioritizing	5	6
valuable software	6	8
Early Delivery& Continuous Delivery	7	12
fail late-divergent views	3	3
fail early to reduce risk over time	4	8
-NPD	1	1
MVP & MVS	1	1
feedback on demo adds quality	2	3
frequency of meetings	2	2
impediments	1	1
post live period iteration	1	1
changing requirements	6	16
Validated response to change	1	1
planning no good	4	7
negotiation- qualitative aspect	1	1
harness change	3	5
scrum	3	5
Competitive Advantage	1	1
Late Change Adaptation Tension	1	1
feedback	13	32
feedback on demo adds quality	2	3
frequency of meetings	3	3
impediments	1	1
learning	5	14
collaboration	2	2
collaboration over contract	1	1
matrix structure	2	4
team collaboration	1	1
culture	9	30

collaborative team hires recruits	1	1
Cultural environment	2	5
Corporate Culture	2	2
self-help, help others, help community	1	5
foundation of corporate culture	1	1
importance of expertise	1	1
culture change and revenue	1	2
human capital	1	2
top down to bottom up	1	1
trust	6	7
communication	11	38
electronic conversation	1	1
business+ developer communications	1	1
developer to consumer	2	2
transparency	5	10
Chinese whispers with middlemen	1	1
contract negotiation	1	1
daily scrum	3	6
requirements	4	13
validated learning	4	8
experimenting	2	4
experimentation	2	2
testing ideas	1	1
working software	11	51
fail early	13	42
fail late	1	1
value	1	3
retrospective	2	2
sustainability	2	4
motivation	1	1
varying scope	1	2
vision	5	10
importance of overarching strategy	2	3
series of small projects	1	2

product backlog	3	7
time estimates	1	1
risk	1	1
sales	1	1
QA	2	2
0QA	2	7
unity between business, tech, consumer	1	1
simplicity	5	8
Kanban	2	2
Lean approach	4	4
decision making	1	1
iterating	5	11
post live period iteration	1	2
roi	2	3
self-organising teams	2	2
self-organising -divergent view	0	0
Culture-lean start-up	1	1
feedback	11	32
feedback on demo adds quality	2	3
frequency of meetings	2	2
impediments	1	1
learning	5	14
daily scrum cross functional communication	1	1
Lean approach	4	4
culture manifests into business	11	22
feedback and failure	2	3
principle of you perform how you train	1	1
rituals to reinforce behaviour	1	2
culture of entrepreneurship	1	1
attitude to failure	1	1
learning	5	14
culture of learning	1	1
retrospective	2	2
iterating	4	6

Appendix IV: PHASE 2: OPEN CODES MAPPED TO 12 PRINCIPLES

Principles + (Open and closed coding)	Interviews	Units of Meaning Coded
Principle 1- Satisfy the customer	9	49
-NPD	1	1
MVP & MVS	1	1
Satisfaction	9	47
Early Delivery& Continuous Delivery	6	36
Assumptions	2	3
fail early to reduce risk over time	3	29
learn	2	4
learning frequently	1	21
fail late-divergent views	3	3
prioritizing	5	6
valuable software	3	5
Principle 2- Embrace Change	7	22
changing requirements	6	16
Divergent beliefs	1	2
negotiation- qualitative aspect	1	1
Tension with sustainability	1	1
planning no good	3	6
Validated response to change	1	1
harness change	3	5
scrum	3	5
Principle 3- Frequent Delivery	11	41
Divergent	1	1
feedback	10	33
embracing failure mitigating risk	1	1
frequent learning	4	18
culture of learning	1	1
Divergent view	1	6
number of weeks between software delivery	3	3
working software	2	3
innovation	2	2
Principle 4- Cross functional collaboration	3	7
business and developer team	1	1
cross functional team	2	4

Principle 5- Support and Trust	9	34
culture	8	32
collaborative team hires recruits	1	1
Corporate Culture	2	2
Cultural environment	2	5
balanced egos	1	1
culture change and revenue	1	2
foundation of corporate culture	1	1
human capital	1	2
importance of expertise	1	1
self-help, help others, help community	1	5
top down to bottom up	1	1
trust	6	9
Divergent views	2	2
meritocracy-mv21- voted into power by	1	1
recruitment by team consensus	1	1
Principle 6- Face to Face Conversation	9	28
communication	9	28
business+ developer communications	1	1
Chinese whispers with middlemen	1	1
contract negotiation	1	1
daily scrum	3	6
Daily Scrum time saving rules	1	1
fast response	1	1
developer to consumer	2	2
electronic conversation	1	1
transparency	5	10
impediments announced	2	3
team consensus	1	1
Principle 7- Working Software	8	39
experimenting	1	2
experimentation	1	1
testing ideas	1	1
requirements	3	11
validated learning	3	6
map	2	2
working software	8	25
fail early	8	21

adaptation-pivot	0	0
Addressing complexity	0	0
feedback	8	17
feedback on demo adds quality	2	2
frequency of meetings	1	1
impediments	1	1
learning	3	9
culture of learning	0	0
retrospective	0	0
learn	1	1
negotiation story points	0	0
prioritising	1	1
fail late	0	0
Waterfall	2	2
value	1	3
Principle 8- Sustainable Pace	6	23
product backlog	3	7
risk	1	1
sales	1	1
time estimates	1	1
retrospective	2	2
sustainability	2	4
motivation	1	1
varying scope	1	2
vision	5	10
importance of overarching strategy	2	3
series of small projects	1	2
Principle 9-Technical Excellence	4	9
OQA	2	7
unity between business, tech, consumer	1	1
QA	2	2
Principle 10- Keep it simple	9	22
iterating	5	11
post live period iteration	1	2
roi	2	3
simplicity	5	8
decision making	1	1
Kanban	2	2

Lean approach	4	4
Principle 11- Self-Organisation	2	2
self-organising -divergent view	0	0
self-organising teams	2	2
Principle 12- Inspect and Adapt	10	45

APPENDIX V: SEMI-STRUCTURED INTERVIEW QUESTIONS

Thank you very much for allocating time for this interview. Let me give you a quick introduction. This interview is for a dissertation on Agile methodologies, with main focus of identifying principles and practices that help your firm deliver new products/services. The interviews can be made anonymous and if there are questions that you do not want to answer, please indicate by saying pass

Introduction questions

What is your name?

What is your job title?

Do have any qualifications that you feel are relevant to agile?

How would you classify your firm? What type of company is your firm?

How many people are working in the company?

How many people are working in your team?

How many years has your company used agile?

How many years' experience do you have with Agile?

What were the key aspects behind the decision to move to an agile methodology?

What are the key delivery aims of using agile in your firm? (Value to customer?)

Value to customer early as possible...track what we deliver is right for customer. Launch and track

OPEN ENDED QUESTIONS

1) Can you explain your corporate culture if any?

2) Do you use any methodologies? (Ex. waterfall or hybrids,) Why did your firm choose to go with these methodologies and what aspects of these methodologies help you achieve the goals mentioned?

3) How does Agile influence Innovation at your firm? Experimentation? Learning?

4) Could you list out any agile methodologies that you utilize throughout a project? -With emphasis on why...How do these practices help you realize business value/goals?

5) How do you ensure the innovative product you build is the right one for the consumer?

6) Do you agile project management (declaration of interdependence) or agile manifesto?

7) Is there anything else you'd like to add in terms of the importance of agile to successfully delivering the right innovative digital products? e.g.

Success factors essential from taking an idea to launch? Deliver innovative digital products?