Obstacles and Opportunities in Implementing Large-Scale Agile Project Management: Re-positioning Activity Theory as an analytical tool.

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I hereby declare that the work presented in this thesis has not been submitted for any other degree or professional qualification and that it is the result of my own independent work.

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Abstract

A key challenge facing organisations adopting large-scale Agile delivery methods is that of quickly and effectively learning new ways of working. This thesis posits that fundamental historical, cultural and behavioural aspects will affect the transition, learning and development of new working practices. Activity Theory (AT), a Practice Theory based approach, was selected as an organisational learning approach to examine these elements and was applied to a small Initial Study. The application process and results obtained, revealed issues relating to the validity and consistency of the research approach and the contextualisation of results. This led to the re-examination of Activity Theory and Agile literature resulting in the creation of a consolidated Activity Theory framework (CATF) consisting of several discrete components.

Characteristics and features of an activity were closely defined, and six generic Agile activities identified to structure the examination of organisational practices. A set of evaluation criteria consisting of collaborative activity, contradictions and congruences were established. A Structured Question Set was created and applied to an Agile implementation case study within a large public sector organisation. Data collection consisted of practice observation and thirty-three interviews and analysis was undertaken using qualitative data analysis software.

The contributions of this thesis are that the Practice Theory based approach provides original insight in surfacing the socially constructed, learning and development obstacles when adopting large-scale Agile delivery methods. Using the CATF to identify learning and development issues related to practice, provides useful perspectives that reinforce other approaches and promotes discussion beyond anecdotal and list based viewpoints. In focussing on the obstacles to learning and development of large-scale Agile practices, the CATF provides a structured and layered perspective analogous to a 'meta' maturity model without prescribing practices or procedures. The contribution of the CATF is as a diagnostic and analytical tool that is granular, scalable and progressive.

Publications associated with this research

Chita, P. (2018). Agile software development-adoption and maturity: An activity theory perspective. *International conference on Agile Software Development*. Springer. Cham.

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Table of Contents

List of Figures

List of Tables

Glossary

Action	Middle part of the hierarchical elements of an activity
Artifact	One of the nodes of the activity triangle
AT	Activity Theory
B&C	Building and Coding – one of six generic Agile activities
CATF	Consolidated Activity Theory framework
CHAT	Cultural Historical Activity Theory
CMMI	Capability Maturity Model integration
Community	One of the six nodes of the activity triangle
CoP(s)	Community of Practice
Division of Labour	One of the six nodes of the activity triangle
DSDM	Dynamic Systems Development Method – an Agile delivery method
D/STP	Digital/Service Transformation Programme – the change programme with the case study
G&S	Governance and Support – one of the six generic Agile activities
HCI	Human Computer Interaction – discipline studying human computer interaction
ICT	Information and Communication Technology
IS/IT	Information Systems/Information Technology
Object	One of the six nodes of the activity triangle
OO	Object Oriented – based around objects rather than functions or logic
Operation	Sub-conscious element of an activity
PDCA	Plan Do Check Act – Deming cycle (Deming, 1993)
RM	Requirements Management – one of the six generic Agile activities
RPM	Rethinking Project Management network
Rules/Norms	One of the six nodes of the activity triangle
SAFe	Scaled Agile Framework – an Agile method for large organisations

SBU	Strategic Business Unit
Scrum	An Agile delivery method
SECI	Socialisation – Externalisation – Combination – Internalisation (Nonaka & Takeuchi, 1995)
Subject	One of the six nodes on the activity triangle
T&Q	Testing and Quality – one of the six generic Agile activities
XP	eXtreme Programming: An Agile delivery method
ZPD	Zone of Proximal Development (Vygotsky, 1978)

Chapter 1: Introduction

1.1 Background and aims

Understanding the difficulties and issues associated with Information Systems/Information Technology (IS/IT) functions transitioning to Agile delivery methods has been problematic (Boehm & Turner, 2005), particularly at the large-scale, with many varied perspectives (Maier et. al., 2012), organisational settings and approaches (Fontana et al., 2014). Much of the literature regarding Agile approaches identifies success factors and challenges at different levels that impact on the transition to and development of Agile practices and particularly large-scale Agile methods (Dikert et al., 2016; Edison et al., 2021; Abrar et al., 2020).

Traditionally, organisations have turned to assessment frameworks or maturity models for guidance in adopting new approaches or improving their current practices. Maturity models such as the Capability Maturity Model integration (CMMi) are specified precisely to facilitate assessments of compliance so that organisations can reach identified goals (Meyer, 2014). However, within an Agile delivery methods context, the concept of a maturity model with well-defined processes (Paulk, 1999) contrasts with the general perception of Agile advocates who view the two as incompatible (Meyer, 2014). This has given rise to a substantial number of Agile maturity models (Leppanen, 2013). This rise in the number of Agile maturity models has been critiqued by Gren et al. (2015) who question the idea of separate maturity models for Agile methods and indeed the whole notion of maturity. There is a growing appreciation of the factors involved in Agile maturity that go beyond sets of practices to consider some form of cultural assessment that might also be included as part of the assessment process (Gren et al., 2015). The identification of a wide range of cultural, organisational and people factors is regarded as key elements of the transition to Agile approaches (Nerur et al, 2005).

Given the inter-related and complex nature of the environment faced by organisations undertaking Agile approaches, this study uses Engeström's Activity Theory (1987), which is a Practice Theory based framework, as an analytical tool. Activity Theory provides a framework to examine many aspects of work activity. It especially highlights contradictions, frictions, and tensions that arise when new initiatives are developed. Activity Theory (AT) is well suited to the examination of cultural and behaviour issues

which arise when IS/IT functions transition to and adopt Agile approaches (Floricel et al., 2014). Other studies (Dennehy & Conboy, 2017) have also highlighted the need to consider environmental, behavioural, and cultural dimensions when studying software development. The literature does not however provide detailed accounts of the different social and environmental causal factors and tensions that underlie these challenges or of the behavioural, historical, and learning elements that influence, impede, or facilitate them.

Key to the successful implementation of Agile methods has been the role of training and continuous learning (Chan et al., 2009; Heidenberg et al., 2010; Misra et al., 2009) especially as a means of overcoming resistance to change. Several authors stress the important role of an organisation's ability to nurture learning, teamwork, personal empowerment, and self-organisation (Nerur & Balijepally, 2007; Sheffield & Lemetayer, 2013). Maier et al., (2012) identify an 'Emphasis on Learning' as one of the four elements that are typical of a mature organisation.

Within organisations, learning opportunities are a function of their work practices (both historical and current), interactions and collaborative activities as well as of the organisational and social elements and infrastructure that impact on these aspects Gherardi (2009). It is these specific aspects where this study is focussed, using Activity Theory to evaluate the cultural and behavioural problems that hinder the organisational processes of learning and adopting large-scale Agile delivery methods. The use of Activity Theory within a situated practice context can help understand where knowledge is socially constructed and how it is both actively and passively constructed (Gherardi, 2009).

The application of Activity Theory can be somewhat problematic because there is no standardised approach to its deployment and implementation (Barab et al., 2002; Blanton et al., 2001; Mwanza, 2001; Nardi, 1996). In addition, Kaptelinin et al. (1999) described the basic principles as too abstract and provide an additional helpful 'Activity Checklist'. To facilitate analysis, this study develops a consolidated Activity Theory framework (CATF) as a diagnostic tool to examine the cultural and behavioural impediments to organisational learning when large-scale Agile delivery methods are adopted. The analysis is extended further to provide an indication of an organisation's Agile capability. To this extent the CATF may be regarded as a form of assessment

framework or maturity model, but the focus remains on the obstacles and issues related to the learning and development of Agile practices rather than the practices themselves. Consequently, the developed CATF may be regarded as a 'meta' maturity model which forms a structured and progressive (in the sense of gradual or staged development) approach to examining these issues.

The CATF consists of a combination of elements that are uniquely assembled to provide a detailed granular insight and understanding of the significant cultural, social, and behavioural aspects of an organisation's adoption and use of large-scale Agile methods. The elements include the definitions of generic Agile activities, the identification of different levels of contradictions and congruences, the recognition of collaborative activity that forms the basis of resolving difficulties and issues, and the production of a Standard Question Set that enables the consistent and reliable application of the tool.

The CATF is used to examine an IS/IT function based large-scale Agile implementation within a large public sector organisation based in Scotland. The specific focus is on Engeström's concept of expansive learning whereby organisational learning progresses by the resolution of contradictions and frictions (Engeström, 1987). Consequently, the learning, development and successful take-up of large-scale Agile methods are regarded as occurring through the resolution of multiple contradictions that the organisation will progress through. Understanding the Activity Theory based sequence of identification, consideration, and subsequent resolution of contradictions within an expansive learning cycle is regarded as a useful approach that facilitates original insights into the obstacles and impediments to adopting large-scale Agile delivery methods.

1.2 Research method and research questions

Preliminary research (Chapter 3) provided useful direction and context via an Initial Study consisting of observation and interview within the IS/IT function of an educational institute in Scotland. This Initial Study drew attention to various difficulties with the use of Activity Theory for research and the resulting data set, such as the lack of in-depth data, difficulties in determining relevant issues and in applying a consistent approach. This led to a re-appraisal of the research method, the use of the Activity Theory framework and the data set, resulting in the development of the consolidated Activity Theory framework (CATF) (Chapter 4) and the decision to focus on one significant case study organisation in the main study rather than several smaller cases. The experience of conducting the Initial Study and the results obtained led to a change in thinking and the aspiration for a more guided, repeatable, structured, and comprehensive analytical approach.

To this end, the consolidated Activity Theory framework (CATF) incorporates additional elements to provide greater granularity of data and a consistent approach. This was achieved by re-examining Activity Theory principles and adopting a changed hierarchical structure (Cash et al., 2015); sub-dividing artifacts into three levels (Bertelsen, 2000); including the collaborative activity elements of co-operation and co-construction (Engeström et al., 1997); incorporating the concept of contradiction congruences and stabilisations (Allen et al, 2013); identifying expansive learning actions within Engeström et al.'s (2012) seven sub-divisions of the expansive learning cycle; and developing a generic question set (Mwanza, 2000; Quek & Shah, 2004; Jonassen & Rohrer-Murphy, 1999; Martins & Daltrini, 1999). In addition, the Agile maturity model literature was examined and six generic activities within the Agile delivery domain were defined. Within these activities, tasks and artifacts were also identified. The results from the Initial Study acted as a catalyst for the re-appraisal of methodology. Once this re-appraisal had been started, a variety of elements were incorporated into the CATF because they were potentially useful in providing further insights and awareness into organisations transitioning to or developing increased Agile capability.

The CATF was then applied to a large transformation programme (Digital/Service Transformation Programme) within the case study organisation (Health Care Org.) that operates in the healthcare sector. This transformation programme lasted two years,

involved a core group of approximately one hundred employees, and used the large-scale Agile method SAFe (Scaled Agile Framework, Leffingwell, 2007). The flexible and adaptable SAFe methodology represented a substantial change from the previous traditional, governance focussed, big design up-front, waterfall, and linear approach that predominated within the organisation. Data was collected by close observation of a sample of meetings and product demonstrations during the life of the programme, and by conducting thirty three interviews after the programme had terminated. The configuration and development of the CATF enabled the study to address three research questions.

RQ1: What insights and understanding can a Practice Theory based organisational learning approach provide when adopting a large-scale Agile method?

RQ2: How can a consolidated Activity Theory framework (CATF) provide a contextual and relational understanding of the cultural and behavioural obstacles when adopting large-scale Agile delivery methods?

RQ3: To what extent can a consolidated Activity Theory framework (CATF) contribute towards the assessment of obstacles to learning involved in developing an organisation's large-scale Agile capability?

The first of these research questions examines the value that the Practice Theory approach (Nicolini, 2013) to organisational learning, as captured in the CATF, can provide when an organisation adopts a large-scale Agile method. Adopting and developing new work practices requires attendant changes in organisational culture, social and behavioural practices (Gren et al., 2015). It is the difficulties and obstacles in achieving these required changes that can be highlighted and illuminated by a Practice Theory based approach (Floricel et al., 2014).

The second research question examines how the CATF can provide a contextual and relational understanding of the cultural, behavioural and learning aspects of adopting large-scale Agile delivery methods as discussed by various authors (Misra et al., 2010; Edison et al., 2021; Dikert et al., 2016). It is suggested that different elements of the CATF can also provide insight to many of the management and organisational, technological, people and process elements that other authors (Nerur et al, 2005; Gandomani et al., 2015, Kalenda et al., 2018) outline. The identification of contradictions

and congruences afforded by the CATF aligns with Vijayasarathy & Turk's (2012) consideration of the dialectical interplay between enabling and detracting factors influencing the successful adoption of Agile practices.

The third research question examines whether the CATF can be a useful analytical tool in assessing the obstacles to learning involved in developing an organisation's large-scale Agile capability. This is addressed in terms of providing a structured, progressive indicator of the nature and type of learning and development issues that organisations face in adopting large-scale Agile methods. This partially responds to Gren et al.'s (2015) statement that decision-makers within organisations would benefit from measuring agility before, during and after the transition to an Agile method. Although the CATF does not measure agility or prescribe Agile practices, it does seek to identify important organisational learning and development impediments and hindrances for organisations intending to develop a large-scale Agile delivery capability. From a learning perspective, the CATF can help to focus attention on the important influence of the environmental mix such as culture, procedures, roles, peers, policies, and artifacts.

1.3 Research findings and contribution

The main findings of this study are, firstly, that the Practice Theory approach, as captured by the CATF, brings new insights revealing where work and efforts take place, and highlights areas of agency and creativity. This confirms the view that Activity Theory provides multi-faceted insights and understanding at a detailed level, surfacing ingrained cultural and social insights that impact the learning and development of practices (Bakhurst, 2009). The CATF is also able to illuminate the important cultural, organisational and management aspects of organisations transitioning to Agile delivery methods. This study found many areas of overlap that support other perspectives on transitioning to large-scale Agile methods (Kalenda et al., 2018; Edison et al., 2021). Finally, the CATF provides a structured and layered measure of agility analogous to a 'meta' maturity model, that identifies important learning and development elements that practitioners should consider. The CATF provides a useful lens for examining these elements when implementing, adapting, or 'improving' large-scale Agile delivery practices.

1.4 Thesis structure

In addition to this introductory chapter, the thesis consists of a further seven chapters that describe the research undertaken. The structure is as follows.

Chapter 2 provides a literature review of the domains within which this study is situated. The chapter examines project management and Agile delivery approaches. It discusses organisational learning focussing on Activity Theory, then examines the intersection of organisational learning, large-scale Agile delivery methods and Activity Theory.

Chapter 3 addresses the Initial Study conducted to explore organisational learning issues present in the Agile delivery domain. The Initial Study prompted a return to the literature in order to re-consider how Activity Theory could be applied within the context of the research area.

Chapter 4 discusses the development of the consolidated Activity Theory framework (CATF) deployed in the main Case Study. The CATF represents a combination of perspectives from the Activity Theory literature as well as the definition of generic Agile delivery activities. This chapter explains the different elements included and the rationale and underpinning of the constructed framework.

Chapter 5 sets out the research philosophy and methods used in undertaking the study. The main case study, Health Care Org. is introduced, and the data collection approach is outlined.

Chapter 6 details the findings from the application of the CATF to the Digital/Service Transformation Programme (D/STP) within Health Care Org. This chapter is structured according to different elements of the CATF.

Chapter 7 discusses the findings from Chapter 6 and is structured according to the three research questions.

Chapter 8 provides a summary of the research findings and a conclusion to the study, stating the main contribution of the work as well as recommendations for further research.

Chapter 2: Literature Review

2.1 Introduction

This chapter reviews literature relevant to the research, starting with considerations of project management and organisational learning. The aim is to evaluate the literature relating to learning challenges and issues that arise when organisations change the way they deliver projects. The review progresses to focus on one element of each of these domains namely Agile delivery methods and Activity Theory. The review then examines their intersection where Activity Theory is discussed as a potential tool to analyse the organisational learning aspects of large-scale Agile delivery methods.

The first section (2.2) discusses the main shifts in project management that have led to a broader conceptualisation of project management as a complex, social and behavioural phenomenon. This is accompanied by a changed project management delivery perspective which puts less emphasis on rigid planned approaches and up-front design to more Agile, iterative, collaborative approaches that demand significant changes in culture and behaviour.

Section 2.3 examines organisational learning approaches from experiential learning to Communities of Practice (CoPs). Section 2.4 then discusses Activity Theory as an appropriate approach to the examination of the organisational learning difficulties and issues when implementing Agile delivery methods.

Section 2.5 examines the application of organisational learning approaches first in a broader project management context as well as within the Information Systems domain. The section considers the application of different organisational learning approaches to the Agile delivery environment. This is then refined to consider the application of Activity Theory to the Agile delivery context. The final section (2.6) connects these diverse elements to arrive at the research themes and the research questions that this study addresses.

2.2 From project management to Agile delivery approaches

2.2.1 Introduction

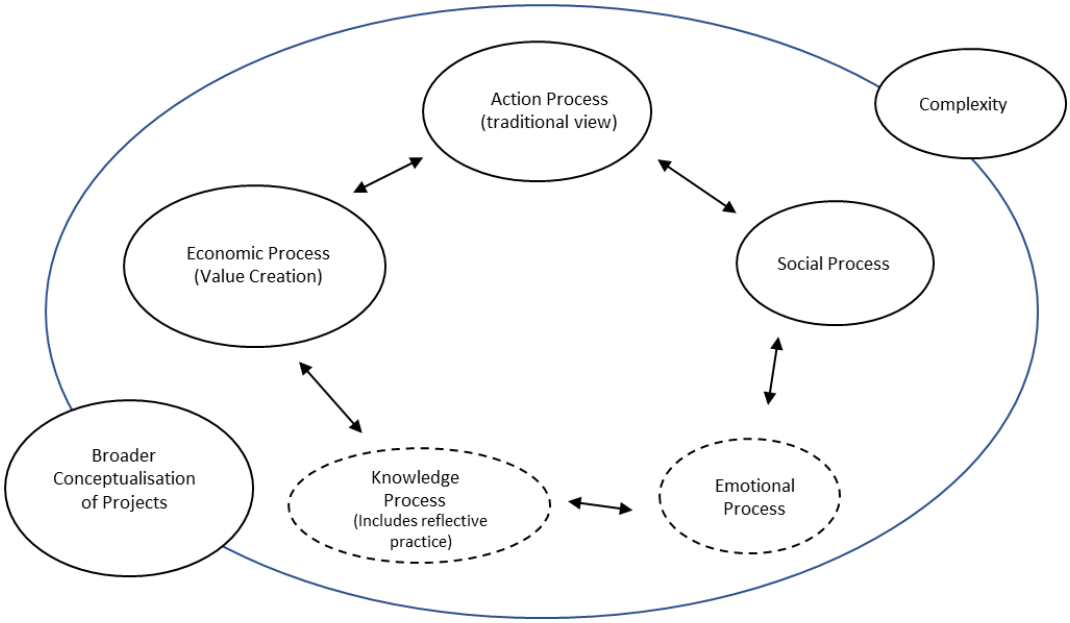
This section provides an overview of the main issues affecting project management and the parallel rise in Agile delivery methods with their promise of more successful project delivery outcomes. This has resulted in organisations transitioning away from traditional plan-driven linear approaches to the more flexible and iterative approaches characteristic of Agile approaches. This section identifies the nature and magnitude of the challenges that organisations face as they transition from traditional project management approaches to Agile methods.

2.2.2 Rethinking Project Management

Crawford et al. (2006) addressed the major challenges of project management arising from an ESPRC funded 'Rethinking Project Management' network (RPM) series of events (Winter et al., 2006). A major emphasis centred on project managers becoming reflective practitioners who can learn, operate, and adapt in complex project environments. The RPM network challenged the conventional view of the project management discipline as being linear, deterministic and execution and task focused with an emphasis on planning and control (Crawford et al., 2006). The RPM network suggested there was a strong need for new thinking that would help practitioners to move beyond the traditional technical and controlled approach. Since the publication of these seminal contributions (Cicmil et al, 2006; Winter et al., 2006; Maylor, 2006; Morris et al., 2006; Crawford et al., 2006) there has been little research activity in the project management domain that does not make some reference to them (Thomas & Mengel, 2008; Sauer & Horner, 2009; Morris et al., 2012).

Subsequent contributions also criticised the lack of relevance of the old linear paradigm and raised concerns about the discipline's ability to meet business needs (Thomas & Mengel, 2008; Morris et al., 2012) as well as the perception that all projects are effectively the same with insufficient consideration of the human aspects of project management (Thomas & Mengel, 2008). The RPM network (Winter et al., 2006) identified five directions where further research activity was needed. Sauer & Reich (2009) in a later study proposed an expansion of these directions to include two additional elements (indicated in Figure 2.1 below by dashed ovals).

Figure 2.1: Extension of the RPM network direction (Sauer & Reich, 2009)



Sauer & Reich (2009) identify knowledge and learning as a valid extension of the RPM Network directions for research. They place this extension on a par with viewing projects as social processes because knowledge is regarded as an important part of project management processes, with the effective management of knowledge being one of the key predictors of IT project performance. When Sauer & Reich (2009, p.189) state that "In view of the fact that 'people development', 'learning orientation', and 'creativity and innovation' all relate to knowledge and learning" they view projects as knowledge processes. They affirm that "by focusing on knowledge and learning processes in projects, we can understand how to cope better with uncertain and dynamic environments" (Sauer & Reich, 2009, p.190).

2.2.3 Agile delivery approaches

The shift in emphasis within the broader project management literature was accompanied by the growth in interest in the Agile approach to the delivery of software and IS/IT projects (Boehm, 2002).

The drivers for Agile approaches have been the promise of faster development times, lower defect rates, increased customer satisfaction and a solution to rapidly changing requirements caused by dynamic business environments (Boehm & Turner, 2005).

In contrast to linear, planned project management approaches exemplified by extensive 'command and control' elements, Agile approaches are characterised by evolutionary

and iterative approaches (Cockburn, 2002). The rise of Agile methods has been heralded by many claims of improved performance and capability (Sutherland, 2015), with increasing deployment in all sectors of the economy including the public sector (Nuottila et al., 2016). A recent study involving a large data set across multiple industries has shown that in terms of the delivery of change and project success (efficiency and stakeholder satisfaction) the use of Agile methods had improved project success especially within the high technology, professional services and health care sectors (Serrador & Pinto, 2015).

Given the benefits of Agile approaches as well as greater flexibility and responsiveness to changing environments (Almeida, 2017) the approaches have been well publicised by practitioners, especially those within the software development industry (Boehm, 2002; Highsmith, 2009). Agile approaches are now widely adopted and there have now been many studies that have examined transitional success factors as well as those elements that have hindered progress (Gregory et al, 2015; Carew & Glynn, 2017 citing Dikert et al, 2016).

In examining Agile implementation challenges, Gregory et al. (2015) found that the top three challenges that face practitioners and businesses were (1) Claims and limitations of Agile capabilities; (2) Integration within an organisational context; (3) Organisational culture clashes. These challenges are evolving as Agile methods mature (Gregory et al., 2015). They take place within the context of increasing dissatisfaction with traditional project delivery methods (Stephen et al., 2011) which have themselves been undergoing significant re-appraisal and analysis including examining the scope of project management as well as the role of the project manager.

The term ‘Agile approach’ has been widely used as an umbrella term to include specific Agile methodologies such as Extreme Programming (XP), DSDM Atern, Lean, Kanban etc. that may all be grouped under the Agile heading. In 2001, the Agile Manifesto identified the core values that all the different Agile methods shared.

Individuals and interaction over processes and tools
Working together over comprehensive documentation
Customer collaboration over contract negotiation
Responding to change over following a plan

> "That is while there is value in the items on the right, we value the items on the left more".
>
> (Agile Alliance, 2019)

According to Gren et al. (2015), this manifesto and the emphasis on the items on the left fundamentally describes a culture change required of organisations intending to adopt an Agile approach. The departure from the processes, tools and document focus of traditional project management is further highlighted by Cockburn & Highsmith (2001) who state that, within Agile approaches the focus is on individual competence as a critical factor. In their view, if an individual is not good enough then no process (right hand side of the manifesto) will rectify this.

The term 'Agile' also encompasses methods such as Scrum, although this focuses on project management rather than being a software development Agile framework (Carew & Glynn, 2017 citing Dyba & Dingsoyr, 2008). The term 'Agile approach' is also "theoretically and conceptually amorphous" regards it's meaning and form (Carew & Glynn, 2017, p.277 citing Conboy 2009 and Iivari & Iivari, 2011). This research uses the term 'Agile approach' to generically refer to any Agile methodology and the term 'Agile process' to refer to the conceptual elements that make-up an Agile methodology. The term 'Agile practice' is used to refer to the in situ deployment of the elements of an Agile methodology.

Agile methodologies have been developed by technical practitioners (Sutherland, 2015; Leffingwell, 2007) to address problems that arose within the software development function attempting to keep pace with rapidly changing business environments (Drechsler & Ahlemann, 2015). The Agile PM Handbook v2 (DSDM Consortium, 2014, p.198) defines Agile Project Management as

> **"***A style of working where requirements and solutions evolve through collaboration between self-organising, cross-functional teams. Agile promotes adaptive planning, evolutionary development and delivery, a time-boxed iterative approach and encourages rapid and flexible response to change"*

Cobb (2011) presents the notion of a spectrum of agility ranging from traditional waterfall approaches at one end to Scrum and XP at the other. Cobb makes the point that in the middle there will be mechanisms to blend different levels of agility to meet business requirements (Cobb, 2011). Agile approaches have now moved beyond the realms of the software development and IS/IT domain and are increasingly common in non-IT areas (Serrador & Pinto, 2015) and are seen as solutions to organisational requirements to deliver in a disciplined manner with speed and agility (Randall, 2014; Dreschler & Ahlemann, 2015). It is unlikely that there will be a return to non-Agile approaches (Larman, 2004), and so there will be an increasing demand for Agile project management and Agile delivery approaches from both software development and IS/IT functions (Stephen et al., 2014) and in non-IT sectors (Conforto et al.,2014).

2.2.4 Implementing and transitioning to Agile delivery approaches

There are many studies that identify complications that occur when implementing Agile approaches (Gregory et al., 2016; Dikert et al., 2016). Theses complications include abandoning the Agile approach when problems start to occur, and only adopting a select few of the Agile practices without understanding their full benefits prior to implementation (Yu & Petter,2014). There is no single study that definitively indicates how best to adopt Agile methods and the many difficulties that organisations will incur when transitioning to an Agile approach (Rohunen et al, 2010; Dikert et al., 2016).

There are broader organisational issues that occur with implementing Agile project management such as a need for a change in management style and a need for much more collaboration between project members (Nerur et al.,2005). Gren et al. (2015) examined the prospects of quantitative measures of agility and found that the Agile approach occurs on a range of levels within organisations and that the term ‘Agile process’ is relatively undefined, and that researchers may well be developing their own conception of what Agile processes are.

These authors also view Agile processes as consisting of more than just hands-on practices. They state that their research could well have considered cultural assessments instead of solely considering the degree of use of Agile practices (Gren et al., 2015). They further suggest that social psychological measurements are more appropriate for organisations wishing to measure their level of agility (Gren et al., 2015). This view is of

interest because it points to a broader consideration of Agile practices. A key challenge would be to identify a suitable framework for analysis of these aspects.

The process of transitioning to Agile methods has been subject to many studies both qualitative and quantitative. Many of the issues relate to the behavioural, mindset and attitude elements that are required of individuals adopting Agile methods. The following are typical of these types of studies.

Conboy et al. (2011), focus specifically on the people challenges when adopting Agile methods. Based on a focus group analysis in combination with 17 case studies they identify nine 'people' challenges that occur when moving to Agile methods. Gandomani et al. (2013) broaden this perspective by identifying four broad categories of obstacles for organisations that seek to move to Agile methods. These include organisational and people-related elements in addition to the usual process and technology and tools related that are normally identified.

Misra et al. (2009) undertake a large survey focused on success factors rather than 'challenges' in adopting Agile software development. These success factors are 'customer satisfaction and collaboration and commitment'; 'decision time, corporate culture and control'; 'personal characteristics, societal culture, learning and training'. 'Learning and training' factor is of note because it was assessed by the authors by examining the 'willingness to continuously learn from one another and train the team members through mentoring and professionally guided discussions' (Misra et al, 2009). Of immediate relevance to this study is an emphasis on continuous learning by participating individuals.

After reviewing the literature, Chan & Thong (2009) developed a conceptual framework from a knowledge management perspective that identifies key elements for the acceptance of Agile practices. The main elements are summarised as 'Ability', consisting of experience and training; 'Motivation', stemming from senior management support and organisational culture; 'Agile method characteristics', perceived usefulness and compatibility; 'Opportunity', such as teamwork and shared understanding.

In terms of the process of customising an Agile method, a study by Rauf & Al Ghafees (2015) showed that most organisations do not follow any Agile method completely. They adopt a mixture of Agile practices and traditional approaches. Similarly, case study analysis of Agile implementations (Rose, 2015) shows that some organisations embrace

Agile principles without the wholesale abandonment of established traditional approaches. The research noted that there was also some symbolic re-labelling of some traditional elements using Agile terminology. Rose (2015) also found that this was detrimental to moving forward with Agile approaches because labelling acts as a departure point for organisational transformations, and noted that "the path to innovation is not navigable when labels do not accurately reflect either the status quo or the transformed state" (Rose, 2015, p.85).

Chan et al. (2009), Misra et al. (2009), and Heidenberg et al. (2010) all recognised training and continuous learning as an important success factor in adopting Agile approaches with regard to overcoming resistance to change. Agile approaches and methods support the ability to innovate and use the opportunity afforded by change (Heidenberg et al., 2010 citing Nerur & Balijepally, 2007). Consequently, Agile practices such as frequent retrospectives will generate new solutions rather than simply adapting to a new situation (Nerur & Balijepally, 2007).

Other authors stress the importance of organisations abilities to nurture learning, teamwork, personal empowerment and self-organisation (Nerur & Balijepally, 2007; Sheffield & Lemetayer, 2013). These are key elements that underpin all Agile methodologies. In particular, they appear frequently in other literature that identifies the crucial aspects of Agile method adoption. Ganesh & Thangasamy (2012) in their case study analysis highlight another requirement, namely responding to the changing needs of the software development team being key to successful transitioning to Agile methods. These authors regard this as more important than following a preconceived plan of Agile adoption practices.

Gandomani & Nafchi (2015) propose a simple and flexible Agile adoption and transition framework which they contrast with other frameworks. They claim these other frameworks are too complex and inflexible, and require significant organisational overhead. Their proposed framework operates in an iterative, continuous, and value-based approach in line with Agile approaches and is applicable to all organisations (Gandomani & Nafchi, 2015). These authors conclude that Agile adoption practice can follow Deming's PDCA (Plan Do Check Act) Cycle (Deming, 1993).

2.2.5 Implementing large-scale Agile

Agile methods were designed with a single team in mind (Kalenda et al. 2018) and their success and potential benefits has led them to be scaled up and considered for larger projects in big organisations (Boehm & Turner, 2005). Defining exactly what large-scale Agile is has led to the consideration of a diverse range of elements including size of development teams, stakeholders, complexity of integration, budgets, and project duration (Dikert et al., 2016). Consequently there is no firm agreement as to what constitutes large-scale Agile in the literature (Rolland et al., 2016). Dikert et al., (2016) provide a focussed and quantifiable definition of large-scale Agile as involving more than 50 developers or at least six teams working on a common product or project in the same organisation (Edison et al., 2021) and this research adopts the same definition.

There is little available direction on how to scale Agile methods such as Scrum or XP and whether the scaling process should involve specific practices or techniques (Edison et al., 2021). Instead there are a number of scaled up Agile methods that are used for larger Agile projects involving multiple delivery teams such as SAFe, LeSS and DAD (Edison et. al., 2021; Kalenda et al., 2018). These methods cater for the broader needs of large-scale agile delivery such as alignment and cohesion across many delivery teams as well as the interdependencies across organisational functions such as finance and HR (Edison et al.,2021). In addition other factors such as the trend towards distributed delivery teams and global agile practices have led to the emergence of these large-scale Agile methods (Vallon et al., 2018; Sinha et al., 2020).

Despite the increased pressures for the use of large-scale Agile methods, Rolland et al (2016), citing Booch (2015), caution that the use of agile methods in large development projects remains a significant challenge. The process of large-scale Agile implementation is not trivial and entails key managerial challenges and consequences for the whole organisation (Fuchs & Hess, 2018). Kalenda et al., (2018) state that scaling up Agile methods for larger projects involves the continuous transfer/transformation of knowledge involving a substantial emphasis on communication needs. Each large-scale Agile method has its own focus and emphasis on guiding principles with LeSS having ten principles, DaD has seven and Scrum at Scale having five core values and SAFe having four. Safe's core values are Alignment, Built-in Quality, Transparency and Programme Execution (Edison et al., 2021). The SAFe method which is the method adopted by the

main case study in this research, is built on Agile values, principles and methods and requires full support from leaders to embrace agility across the organisation (Edison et al., 2021).

The deployment of large scale Agile methods within organisations present a number of key challenges. Dikert et al., (2016) citing Dyba & Dingsoyr (2008), note that the difficulty of introducing Agile methods increases with organisation size and that Agile methods may not be a good fit for large undertakings. Citing Lindvall et al., (2004), Dikert et al,. (2016) state that the increased dependencies between projects and teams within large organisations increases the need for formal documentation and this reduces agility. In addition, large-scale Agile approaches require development teams to interface with organisational functions which are non-Agile in nature such as HR and senior management (Dikert et al., 2016).

There have been a variety of studies, some involving systematic literature reviews (SLR), that have identified the various challenges involved in implementing large-scale Agile methods. Edison et al (2021) identified 31 separate challenges grouped into nine categories. These categories included Inter-Team Coordination, Organisational Structure, Requirements Engineering, Change Management and Customer Collaboration. Earlier Dikert et al., (2016) had identified 35 specific challenges of implementing large-scale Agile, which were also grouped into nine categories of which the most frequently mentioned were Difficulty in Implementing Agile; Integrating non-development functions; Change Resistance, and Requirements Engineering challenges.

Almeida et al (2019) point to a study by Dingsoyr et al (2018) that managed to group these diverse challenges into just three main dimensions Customer Collaboration; Knowledge Sharing and Improvement, and Inter-Team Co-ordination. Ebert & Paasivaara (2017) distilled the different elements further and summarised the most difficult challenge as that of the mind-set. Changing the practices will not make a company Agile if the underlying culture and thinking don't change.

Conversely the identification of the success factors, things that "must go right" (Edison et al., 2021), involved in the implementation of large-scale Agile methods have also received attention with Dikert et al. (2016) identifying 29 success factors grouped into eleven categories. The main categories that have been significant are Choosing and Customising the agile approach; Management Support; Mindset and Alignment; and

Training and Coaching. Importantly Dikert et al.'s (2016) systematic literature review identified that management were seen to be the key role in the transition to large-scale Agile as they had the authority to remove impediments. Kalenda et al., (2018) study found that training personnel, informing and engaging people within the agile development process and involving actors to help push the process further were key success factors.

Edison et al., (2021) identify 27 specific success factors grouped under the broad headings of Management and Organisational (4); Process (14); People (7); and Technology (2). Other authors have confirmed the significance of specific success factors within these broad categories. Dikert et al., (2016) identify intensive communication as an important factor within the specific Transparency success factors under the Process category. Kalenda et al., (2018) report that the most common reported success factor was the increase levels of knowledge and expertise which would be sited in the External Coaching specific success factor within the People category. Dikert et al (2016) identify the importance of change leaders and management in the specific success factor of Strong Leadership and Commitment to Agile within the Management and Organisational category.

2.2.6 Organisational and managerial perspectives of large-scale Agile methods

From an organisational and managerial perspective, the challenges of migrating to large-scale Agile methods are greatly affected by culture (Ebert & Paasivaara, 2017) that exerts considerable influence on decision-making processes, problem-solving strategies, innovative practices and social negotiations (Nerur et al., 2005). Neither culture nor mind-sets can easily be changed and facilitating this shift will require the "right blend of autonomy and cooperation" (Nerur et al., 2005, p.76).

Nerur et al. (2005) provide a broad organisational and managerial perspective with regard to the problem of implementing Agile approaches. They acknowledge that changing software development processes is a complex task with organisation wide implications and is therefore not to be undertaken lightly. They identify a key issue of Agile approaches contrasting with traditional linear, plan-driven approaches with Agile's emphasis on creativity rather than process. This major difference prompts the authors

to identify the following key issues that organisations need to consider and which are also likely to apply to large-scale Agile methods.

2.2.6.1 Management and organisational issues

Values norms and assumptions are reflected within organisational routines. Culture exerts influence on behaviour and actions as well as on decision-making processes, problem-solving strategies, innovative practices, information filtering, social negotiations, relationships, planning and control mechanisms, and organisational structures. None of these are easily changed, making the move to Agile approaches much more difficult especially when moving from a command and control approach to a much more facilitative and collaborative approach. Often the biggest challenge is to get the project manager to relinquish control and authority and move to a more directive and facilitative perspective (Nerur et al., 2005). This resonates with Heidenberg et al.'s (2011) later study regarding overcoming resistance from project managers. Furthermore, much of Agile methods knowledge is tacit, i.e., not documented, making organisations heavily dependent upon Agile teams. This could well be unacceptable to some organisations (Nerur et al., 2005).

2.2.6.2 People

Agile approaches need cooperative, collaborative social processes between communities of members. The Agile approach of pluralist decision-making by diverse development teams can lead to difficulty in making decisions (Nerur et al., 2005). The Agile practices of shared learning, reflective workshops and collaborative decisions may be difficult for some, and the Agile practice of advocating employing "above average people" creates a culture of elitism as well as difficulties in finding staff (Nerur et al., 2005, p.76).

2.2.6.3 Process

Agile approaches can be problematic for those organisations attempting to achieve higher levels of maturity for instance moving up the Capability Maturity Model Integrated (CMMi) levels. Shifting from processes to focus on peoples' capabilities and competences can be lengthy and expensive and not easy to do within current structures. (Nerur et al., 2005).

2.2.6.4 Technological Issues

Organisations from a centralized mainframe historical context may have difficulties in moving to object oriented (OO) approaches typically employed by Agile delivery approaches (Nerur et al., 2005).

2.2.7 Conclusion

The literature has indicated a need for increased emphasis on social, cultural, and behavioural aspects that are considered to be fundamental aspects of project delivery. These elements need to be considered when organisations shift from one delivery mode to another because this transition has substantial organisational learning and development challenges including a need to focus on continuous learning and organisational culture and values involving a dialectical approach. The next section looks at the different organisational learning schools of thought that impinge on these development challenges.

2.3 Organisational Learning

2.3.1 Introduction

The previous section introduced the project management domain and how moves to more Agile approaches places different demands in terms of organisational learning and development. The question then arises as to how best to understand these demands, including consideration of appropriate academic disciplines and contexts. This section presents the organisational learning domain which forms the theoretical academic context and background for this study. The section starts by introducing theories of learning and approaches that have had a significant impact on the domain. It introduces and explains many of the concepts and terminology that the selected approach to this research builds upon.

2.3.2 Learning theories – a spectrum

There have been many learning theories that have attempted to address various aspects of learning. Some of the earliest work was done by behaviourists such as Watson (1930) and Skinner (1953) based on the notion that people repeat behaviours that are rewarded and avoid behaviours that are punished (Cheetham & Chivers, 2001). These learning influences are external to the learner, with the 'teacher' attempting to drive the behaviour of the learner who is regarded as passive. That is, the learner simply responds to the instruction from the 'teacher'. A major issue with this approach is that it does not cater for the learner's thoughts, values, emotions, and motives because only the conditioned response can be observed.

An alternative view expressed by cognitivists does not see learning as conditioned by responses to stimuli. Instead, learning is seen as a combination of intentions, perceptions, beliefs, motives, and understanding (Piaget, 1926). The emphasis is very much on the use of the mind and mental processes and examines how individuals gain insight and understanding when interacting with their environments.

It is possible to identify a spectrum of learning perspectives from the early, strictly external stimulus theories leading from Behaviourist to Cognitivist to Constructivist and then to Humanist perspectives. In this spectrum, the focus shifts from external stimuli towards the individual learning processes (Illeris, 2009).

From a constructivist perspective such as that of Piaget (1926), a learner is not a blank slate but has some prior knowledge that shapes their learning. Each learner constructs their own meaning from various interactions. The learner's previous experiences will drive the meanings that they will take from learning exercises, and what an exercise means will vary from individual to individual. Consequently, learning is not regarded as the repetition of a task in a rote form as a behaviourist might believe (Bates, 2016).

Constructivists view development as a movement through a predictable sequence of frames of reference (schemas or mental models of experience) that culminates in the ability of learners to engage in transformative processes of critical self-reflection and through discourse (Mezirow, 2009). Technically the constructivists approach includes mentoring, coaching, action learning and Communities of Practice.

The humanist approach is entirely student-centred. This approach is based on the self-actualization notions of Abraham Maslow (1908 - 1970) and Carl Rogers (1902 - 1987). The humanist view is that learning only occurs in particular environments where the learner feels safe and secure. Following Maslow's approach, it is only when certain needs are met that learners can progress towards a deeper understanding. Humanists view the teacher's role as similar to that of counsellors and mentors, rather than being conveyors or bringers of knowledge.

Social learning theory evolved from behaviourism, and includes ideas from cognitivists (Illeris, 2007). This approach is based on the work of Bandura (1986). It examines how social influences can enhance learning by influencing an individual's thoughts, feelings, and action through cognitive, vicarious experiences and through self-reflective processes. Through social learning (especially observational learning), learners can develop a tacit form of knowledge that can significantly improve their performance although this knowledge remains difficult to articulate (Bates, 2016). Bandura believes that individuals' behaviours are influenced by both their social world and their personal characteristics, and that individuals' behaviours reciprocally influence their social world. A key aspect of Bandura's work is that he draws attention to the social context of learning (Bandura, 1986).

2.3.3 Reflection and learning

Chris Argyris produced some of the earliest work in organisational learning (Burnes et al., 2003) and is often regarded as the founder of this field. In a seminal article in the Harvard Business Review entitled *Teaching Smart People how to Learn*, Argyris (1991) suggested that organisations increasingly require their employees to learn and yet these very employees do not know how to learn, especially the ones that previously have excelled in education. Argyris stated that learning is not just problem-solving (which he calls single-loop learning) but that proper learning (which he calls double-loop learning) only occurs when employees reflect critically on their own behaviour and views, and a subsequent change in knowledge state occurs.

Argyris asserted that highly skilled employees are very good at single loop learning because they have spent years studying within such a loop. He argues that such people rarely learn further because when something goes wrong, they adopt defensive reasoning and look externally for the causes. This defensive reasoning can block learning taking place because it encourages people to keep private their reasoning, assumptions, and influences shaping their decisions. Encouraging open inquiry of these elements is often seen as intimidating and negative (Argyris, 1991).

The concept of reflective practice was developed by Donald Schon (1983) in his key work *The Reflective Practitioner: How Professionals Think in Action.* This challenged the dominance of technical aspects of professional development and viewed reflective practice as a key tool for professional development. His ideas of reflection in action and reflection on action have been influential in curriculum development within professional education.

Boud et al. (1996) regard reflection as a vital element in any form of learning. The authors refer to Dewey (1933) who states that reflection is prompted by 'an inner discomfort' which Dewey (1933) indicates is "a state of doubt, hesitation, perplexity, mental difficulty, in which [reflective] thinking originates, and … an act of searching, hunting, inquiring to find material that will resolve the doubt, settle and dispose of the perplexity". This 'inner conflict' is a source of contradiction that can be considered within the cultural and historical context of Activity Theory (discussed later in this chapter).

2.3.4 Experiential Learning

Jarvis (2009) points to the incompleteness of the behaviourist and cognitive approaches in understanding human learning. He advocates experientialism as providing greater understanding due to its positioning of the learning process within social contexts. Kolb (1984) argues that for learners to be effective they have to progress through the characteristics relating to his four stages of the experiential learning cycle, and that learning is the process whereby knowledge is completed through the transformation of experience.

Kolb (1984) suggests that learners need to keep moving around this cycle, starting by experiencing something (concrete experience) which will then be reviewed (reflective observation). From this some conclusions are drawn (abstract conceptualisations), after which the learner plans what to do in the future (active experimentation). According to Kolb, learning is a function of the interaction of the behaviour of the individual with their environment, and learners develop a preference for learning in a certain way.

There are however critiques of Kolb's 'experiential learning cycle': some such as Jarvis (2009) maintain that it is too simple to portray the complexities of the social process of human learning as a cycle, that within the learning cycle there is no reflection on past experience, and that the focus is on the here and now. In addition, experience is affected by social factors which need to be viewed beyond the individual's perspective. Vince (1998) also suggests that there are underlying unconscious processes that need to be considered with regards to barriers to learning and defence mechanisms. These elements can also be explored using the Activity Theory analytical framework.

2.3.5 Transformative learning

According to Illeris (2007), transformative learning occurs in special circumstances and is far-reaching. He points to other authors who have described it using different terms: 'significant learning' (Rogers, 1951); 'expansive learning' (Engeström, 1987); 'transitional learning' (Alheit, 1994) and 'transformative learning' (Mezirow, 1991). This type of learning occurs as a consequence of a special crisis situation where it has been necessary to change the learner's previously strongly held schemas and patterns in order to make progress. Illeris (2009) notes that this form of learning requires a great deal of energy and can be wide-ranging and profound.

The first advocate of the 'transformative learning' term was Mezirow (1991) who theorised that a learner's experience alters their present paradigm and therefore alters their knowledge and perceptions. Mezirow's approach relates to when individuals experience a disorientation or unease with current practice that through various stages leads to a change in their previous belief systems (schemas) by engaging in critical reflection of their own experiences. This leads to a transformation in their perspective. According to Mezirow (1991) there are four main components of the transformational process.

1. Experience - we have an experience.
2. Critical Reflection - the processing of experience
    a. Content - think or act on the experience.
    b. Process - process what we are going to do with that experience.
    c. Premise - allows us to compare and contrast new experience with our previous beliefs and mindset.
3. Reflective discourse - open and objective analysis of the experience.
4. Action - taking action which may be immediate or delayed.

Mezirow' s (1991) transformative learning theory has much in common with previously discussed concepts including Engeström's more social and community-based 'expansive learning' theory (Engeström, 1987) which forms the basis of the Activity Theory framework that this research has adopted.

2.3.6 Learning within an organisational environment

Technically all aspects of a learning organisation or organisational learning are work-based learning (WBL) because WBL equates to that learning which is situated within the work-based contexts. The organisational learning field has attracted scholars (Newell & Galliers, 2006; Easterby-Smyth et al., 1999; March, 1999; Gherardi, 2001) from many different disciplines. Some researchers incorporate different approaches such as linguistics, storytelling, and narratives. It has been argued that if meaning and learning are constructed through dialogue and communication between people then a closer analysis of the actual words and communicative practices would be very valuable (Easterby-Smith et al., 1999).

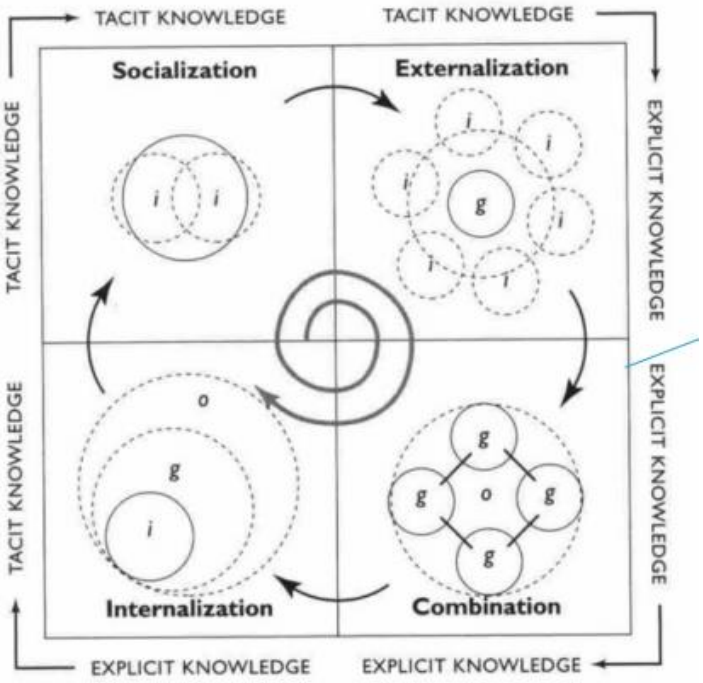
In addition, consultants such as Peter Senge became interested in this area and have popularised the use of the term 'learning organisation'. Senge was the first to advocate organisational learning as a means of competitive advantage. His book '*The Fifth Discipline*' (1990) sparked a dramatic rise in business organisations pursuing organisational learning (Burnes et al., 2003).

Organisational learning has also been driven to the fore by the increased pace of change and globalisation requiring organisations to develop their abilities to learn and adapt. Consultants such as Senge (1990) have focused on 'practical interventions' within organisations to help them become 'learning organisations'. Some such interventions are based on best practice whilst others are based on theories of learning or psychology. These factors are very relevant to this study. Of particular interest is Easterby-Smith et al.'s (1999) conclusion that in fast moving industries such as IT, the need for a high level of learning is crucial. They highlight the importance of organisational culture in shaping the behaviour of individuals and organisations.

According to Gherardi (2009) the 'Learning Organisation' topic's place was taken by the Knowledge Management domain after the 1990's. Thereafter the debate centred around those who wished to address the management of knowledge and those who still addressed organisational learning. The concept of the 'management' of knowledge is key here because organisations sought to maximize their human assets. Central to this debate is the concept of tacit knowledge and explicit knowledge as first discussed by Polyani, (1967). The creation and transfer of knowledge from one state to the other and from one individual to another (learning) is difficult to understand because knowledge creation is, as learning theorists have discussed, not a simple matter of pouring information into people's heads.

Nonaka & Takeuchi (1995) proposed the SECI framework as an indication of the knowledge transfer process as is outlined below in Figure 2.2. The framework is cyclical, starting with the Socialisation stage where tacit knowledge is passed from one individual to another through practice, imitation, observation and guidance. The framework moves onto Externalisation in which tacit knowledge is made explicit through codification in documentation, manuals and procedures. Once externalised the knowledge is Combined (summarised and aggregated) with other knowledge to make more explicit knowledge. Knowledge may then be adopted by an individual in the next stage of Internalisation where it modifies the individuals' existing tacit knowledge. The cycle then repeats.

Figure 2.2: SECI model (Nonaka & Takeuchi, 1995)



Whilst popular within the learning organisation domain, this model has its critics including Engeström (2009). In a general critique of organisational learning theories as being weak in identifying the specific processes and actions that constitute the learning process, Engeström also identifies weaknesses in the SECI model. His criticism is that the knowledge creation processes is "unproblematically given from above" or from senior management (Engeström, 2009, p.58). He further states that the elements to be learned are portrayed as "outside local processes" where the first step (Socialisation) is smooth and conflict-free. Nonaka & Takeuchi (1995) had labelled the Socialisation phase as 'sympathised knowledge' but Engeström argues that learning is not stable, defined or even understood ahead of time. Engeström states that often there is no competent teacher available and that activities are being learned as they are being created (Engeström, 2009, p. 58).

2.3.7 Communities of Practice (CoPs) and innovation, learning and development

In his introduction to Lave & Wenger's (1991) seminal book '*Situated Learning: Legitimate Peripheral Participation*', William F. Hanks states that their discussion moves the learning debate from an acquisitive process to one of participation in a social context with access to knowledgeable individuals. Hanks (Lave & Wenger, 1991) also states that "Learning is a process that takes place in a participation framework" and that learning is mediated by the different perspectives of the co-participants. It is these participants (community) that are learning, and this learning is distributed amongst them. Lave & Wenger stress that learning is integrated within everyday social practice and that it is inseparable from the "lived-in world" (Lave & Wenger, 1991, p.35). Consequently, it can be a complex phenomenon that is part of social structures, involving relations of power in terms of access to and participation in practice.

'Legitimate peripheral participation' (LPP) is Lave and Wenger's term for the mode of engagement of the learner who is participating to a limited degree and responsibility in the actual practice of an expert. The expert has responsibility for the ultimate outcome. The learner must acquire skills by engaging in the process and participates to a limited degree in the practice. As this happens the learner's identity changes from outsider to insider (Legitimate Peripheral Participation). Although it is anticipated that the apprentice is the one who might be transformed the most by participation in the process, the wider perspective is that the experts themselves will also learn during the process. This means that the learned skill itself might change (Lave & Wenger, 1991).

Lave & Wenger (1991) clarify that a specific master-apprentice relationship is not necessary. It is the 'legitimate' access to participation with experts that is the key. The actual teaching is not observable, but learning occurs through the work-practice of the community where the curriculum is often structured by experts who may decide when a novice is ready to handle a more difficult task. Evidence suggests that the existence of other novices simultaneously increases the spread of knowledge and learning.

In addition to the participation aspects, Lave & Wenger (1991) recognise the role of language regarded as not just a descriptive aspect of reflection on action or participation but as an actor in itself. Language is regarded as a part of participation originating from social and cultural contexts (i.e., technical jargon) and is configured along with the work aspects itself. Lave & Wenger (1991) state that the process of learning to speak as a full

member of a community of practice is part of the process of learning. They refer to a study indicating that learning how to operate within a school is a major part of what the institution teaches.

Lave & Wenger (1991) explain that understanding the technology, tools and artifacts used within any community of practice are a way of connecting with the practice's history and of participating with the practice more directly. So, knowledge within a community and dealing with practices can be coded within artifacts that can be quite revealing about the practice of that community. For example, in a software project management domain it may be useful to examine elements of the work practice such as the use of the JIRA software tracking tool or even an Agile project management tool such as a burn-down chart to more fully understand software development practice.

In summary 'situated learning' becomes legitimate peripheral participation through communities of practice. All of this takes place within a social world. The transformation of novices to experts in a development cycle is integral to the practice itself. The place of knowledge is within a community of practice and the development cycle of that community is where learning must occur. As people learn they move along the community's reproduction cycle and this is a major distinguishing feature of a community of practice.

From an organisational learning perspective, Wenger (2000) states that successful organisations will design themselves as social learning systems. Wenger & Snyder (2000), in their pitch to place the Communities of Practice approach in an organisational context, identify several beneficial elements of CoPs to organisational learning. These complement existing organisational structures, promote knowledge sharing learning and change and facilitate the sharing of experiences and knowledge in free-flowing creative approaches. They also thrive within and beyond large organisational boundaries. Wenger & Snyder (2000) provide Table 2.1 below to identify the distinguishing features between communities of practice and other organisational structures.

Table 2.1: Communities of Practice and Organisational Structures Comparison. (Wenger & Snyder, 2000)

	What's the purpose?	Who belongs?	What holds it together?	How long does it last?
Community of practice	To develop member's capabilities; to build and exchange knowledge	Members who select themselves.	Passion, commitment, and identification with the group's expertise.	As long as there is interest in maintaining the group.
A formal work group	To deliver a product or a service	Everyone who reports to the group's manager.	Job requirements and common goals	Until the next reorganisation
Project team	To accomplish a specific task.	Employees assigned by senior management.	The project's milestones and goals	Until the project has been completed.
Informal network	To collect and pass on business information.	Friends and business acquaintances.	Mutual needs.	As long as people have a reason to connect.

Brown & Duguid (1991) agree with Lave & Wenger's (1991) perspective that working and learning are linked, and that innovation depends on both working together where knowledge lies within the context where it has meaning. In a precursor to some of the concepts of Practice Theory (Schatzki, 2001), Brown & Duguid (1991) stated that learning is built up of the materials to hand and the process of engaging within a community. Learners adopt the community's viewpoints and learn to speak its language. Learners acquire the culture of the community and learn how to behave as a member of the community. Consequently, workplace learning can be understood in terms of communities and becoming a practitioner rather than simply learning about a practice.

Similar to Wenger & Snyder's (2000) work, Brown & Duguid (1991) did not see these communities as part of the organisation's formal structure. Instead, they are likely to be more fluid and to cross organisational boundaries, perhaps incorporating people from outside the organisation. The authors say that Communities of Practice are also continually evolving as they "bridge the gap between their organisation's static canonical view and the challenge of changing practice" Brown & Duguid (1991, p.50).

2.3.8 Practice Theory

Gherardi (2001) proposes a slightly different approach of 'learning-in-organisations' which is essentially constructivist. In this conceptualisation, people construct their own understanding and knowledge of the world through experiences and reflecting on them. Anything new that is experienced must be reconciled with past experiences, so individuals actively create their own knowledge. Gherardi (2001) makes the following points.

- Learning occurs through practice (a domain of knowing and doing) where a network is socially woven around a domain of knowledge. The knowledge, the subject (person), the object (what is being done -such as software development) are produced together within a situated practice.
- The locus of knowledge and learning is situated in practice (which connects knowing with doing). This is distinct from Communities of Practice (see section 2.3.7 above) which emphasise the collaboration and social and situated aspects of learning (Lave & Wenger, 1991).

Practice-based approaches view practice as the connection between thought and action and being in the world. The tacit knowledge that is embedded in practices and is learned by doing them is knowledge that comprises habit, habitus and habitualization (Gherardi, 2009). These are defined as:

- Habit - a settled or regular tendency or practice that is hard to give up.
- Habitus - deeply ingrained habits, skills, and dispositions that we have.
- Habitualization - society is constructed by use and those before us and it is followed by habit.

For a practice to be recognisable as such it needs to be stabilised and institutionalised. That is, practices perform a role of uncertainty reduction when their execution is anchored in the material world consisting of objects, tools and technologies that guides people's actions. This is also true of the less material or physical tools such as norms, values, and customs.

Gherardi (2009) states that even the term 'knowledge' (as applied to the learning process) is problematic because it implies that knowledge is an object. She points out

that replacing this with 'knowing' is more indicative of an activity and a process that take place over time. According to Gherardi (2009), this re-positioning opened the way for Schatzki et al.'s (2001) book from which most practice theorists take their departure point. Schatzki et al. (2001) postulated that knowledge should be defined as an activity, as a collective, as distributed doing and as an activity situated in time and space which effectively means taking part in work practices.

The tacit knowledge (Polyani, 1967; Nonaka & Takeuchi, 1995 - see section 2.3.6 above) that researchers have tried to make explicit remains within bodies that use sensory knowledge to formulate aesthetic judgments that sustain organisational processes. According to Gherardi (2009), working practices remain the central point where tacit knowledge is constructed and transmitted to others.

However, we need to understand the dynamic of this knowing-in-practice to avoid the notion of tacit knowledge as only waiting to be made explicit. It is through these practices where learning, working and innovating take place, so practical activities become a collective 'bricolage' (an improvised construction using whatever materials are available to hand) and willing participants mobilise resources, use instruments and employ a contingent and goal directed rationality (Gherardi, 2009).

Therefore, knowledge is not only an activity based in practice, but is also distributed between humans and non-humans. Objects, tools, and artifacts embody knowledge, anchor practice and are also extensions of human memory. Gherardi (2009) suggests that it is work practices where tacit knowledge is constructed, held, and transmitted so the emphasis is on doing because that is how tacit knowledge is acquired. This is very much the key concept within Practice Theory, instead of the collaborative activities that are addressed by the Communities of Practice (CoPs) approach. Gherardi (2009) reverses the Communities of Practice term to a 'Practice of Communities' to emphasise the point.

Gherardi (2001) points to the use of Activity Theory (Engeström, 1987) within a situated practice context as an approach that could help understand where knowledge is socially constructed, and how it is constructed both actively and passively. Practice Theory states that work practices are where learning, working and innovating take place, and that such practices are a construct of the available elements of activities, resources, tools and artifacts and objectives (Gherardi, 2009).

2.3.9 Conclusion

Socio-cultural organisational learning approaches including Communities of Practice and Practice Theory have been evaluated for their relevance and suitability for application to the types of cultural and social changes that may be engendered when organisations change their project delivery approaches. The Practice Theory approach in particular holds promise in terms of providing an understanding of the complex elements involved in learning that includes cultural norms and habits, activities, and artifacts. The next section takes up this focus examining the use of Activity Theory as an approach that can aid understanding and provide context for these different elements as well the occurrence of friction, conflicts and types of issues which are likely to occur as organisation transition to and adopt large-scale Agile methods.

2.4 Activity Theory (AT)

2.4.1 Introduction

This section provides an overview of Activity Theory, building the case for its application to the organisational learning aspects of large-scale Agile methods. Previously, section 2.2 made the case for the consideration of social, cultural and behavioural elements when organisations seek to implement Agile methods. In particular, it focussed on continuous learning as well as the identification of a dialectical approach that incorporated analysis of hindering and beneficial factors.

Section 2.3 considered the learning and development theories that could provide a context for understanding such elements and identified. Here, Practice Theory was identified as an appropriate approach due to its flexibility and breadth as well as its situated practice focus that could aid understanding of the complexity of the transition to Agile approaches. This section focuses on Activity Theory as a form of Practice Theory that has dialectical origins and has a broad, multi-faceted approach. This could help in understanding how learning and knowledge are socially constructed and developed, as well as with the identification of hindrances and obstacles such as friction, conflicts and contradiction that may impede an organisation's transition to using Agile methods.

2.4.2 Origins and Development of Activity Theory

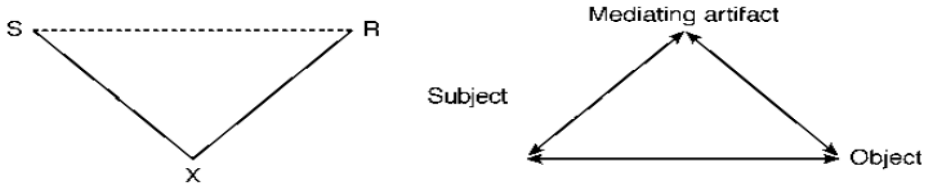
Activity Theory (AT) was first suggested by Lev Vygotsky in the early 1920s and 1930s. However, it only became available to English language academics through translation in Vygotsky (1978) and (1997). During this period, the Russian school of developmental psychology examined the social character of learning. Vygotsky (1978) argued that learning takes place by learners interacting with their environments and that development takes place by learning. This moved the focus of learning and development outside the mind. To learn, individuals must be presented with tasks that are just out of the reach of present abilities. Vygotsky terms this the 'Zone of Proximal Development (ZPD)'. This describes a situation where individuals attempting to complete a task (e.g. swimming or riding a bike) need the help of others ('scaffolding'). Eventually individuals will be able to complete these tasks on their own. They will then have shifted out of their ZPD and will have learned.

The subject matter of what teachers teach should fall into the student's ZPD: every individual will have a different ZPD level.

Vygotsky (1978) emphasised the powerful role of culture and community in learning. His ZPD concept had a significant contribution from elements such as collaboration, practice, and facilitation. In addition, Vygotsky's focus of analysis was the individual (subject) who transforms an object using a mediating tool which itself is culturally and historically constructed. This notion of 'mediation' was key (Vygotsky, 1997). In addition, there was the notion that objects (mediating artifacts or tools) are themselves not 'raw materials' but are instilled with the values and norms of that society within which they are constructed.

This introduction of cultural mediation between the stimulus (S) and response (R) elements of the theories of the early behaviourists is an important point (Engeström, 2001) resulting in a modification that gives rise to the triangular diagram in Figure 2.3 showing the insertion of a cultural artifact (X) between a subject and an object. This artifact then mediates actions and behaviours. Engeström (2001) notes the difference of this perspective from those of cognitivists such as Piaget, who had regarded objects as value-free raw materials rather than being imbued with cultural and social qualities.

Figure 2.3: Model of mediated Action (Engeström, 2001)



(A) Vygotsky's model of mediated act **(B) A common reformulation**

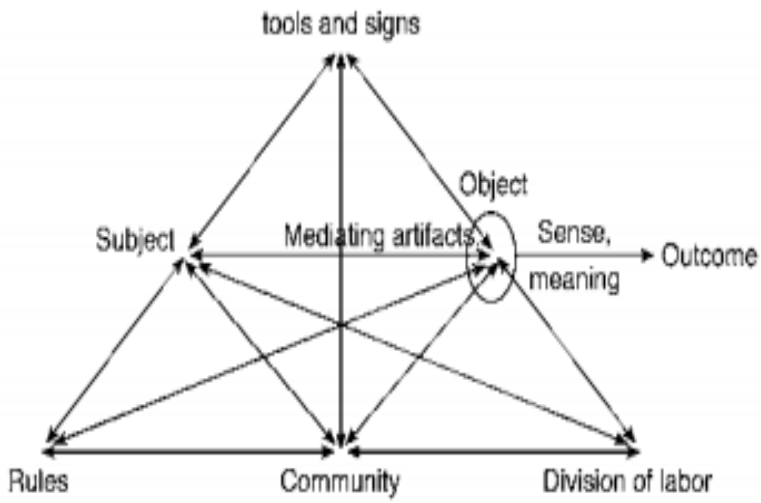
Vygotsky's culturally mediated actions which focussed on individuals is regarded as the first generation of Activity Theory (Spinuzzi, 2020). This was later extended by Leont'ev (1981) who introduced the additional focus on collective activity. Leont'ev focused on the role of contexts and actions as part of a set of larger activities (e.g. hunting) and this became the second generation of Activity Theory (Spinuzzi, 2020). This development included the division of labour, collective activity, and differentiation of an individual's actions. The emphasis shifted from the sole actions of an individual to the complex interactions between individuals and the groups to which they belong (Leont'ev, 1981).

Engeström (1987) introduced the notions of Community which could be an organisation (or a department or a project team) and an Outcome which is the intention or goal of the activity (Object). It is this added layer (Rules, Community & Division of Labour – see Figure 2.5 below) that provides the contextual nature of activity. Engeström (1987) further developed conceptual tools to help understand the connections and interrelations between activity systems, dialogue, and different perspectives where at least two interacting systems are examined, and the analysis extends outwards in all directions. This extension into organisations as cultural-historical activity theory (CHAT) is regarded as the third generation of Activity Theory (Spinuzzi, 2020). Engeström (1987) identifies five fundamental elements of his version of Activity Theory as an attempt into assemble it into a coherent framework which Peim (2009) calls the 'Engeströmization' of Activity Theory.

1. The activity system is the prime unit of analysis.
2. Multi-voicedness of activity systems
3. Historicity
4. Tensions and Contradictions
5. The possibility of expansive transformations.

Engeström (1987) extended these elements to arrive at the now familiar complex triangular diagram in Figure 2.4 below.

Figure 2.4: Activity Theory (Engeström, 1987)



Here we can see the focus includes the individual's mediated relationship with the object as well as collective and collaborative aspects including social and cultural elements. According to Engeström, this activity system accounts for the factors that determine individual behaviour and development. Key to this study is Engeström's assertion that learning new practices comes from identifying and understanding contradictions and conflicts within a system (Engeström, 2001).

Each of the nodes of the activity system is outlined below with some hypothetical illustrative examples from a software delivery environment.

Object:	This is where activity is directed towards a purpose e.g. to deliver a software application.
Outcome:	A change in the Object delivered by the Subject undertaking the Activity e.g. improved software.
Subject:	This relates to both an individual or a group involved in the activity that delivers the Outcome. For example, the subject could be a programmer or a project team.
Tools and Signs:	These are the tools and artifacts that mediate and influence the behaviour of the Subject within the Activity and impact the Object. Examples include a development tools and programming languages.

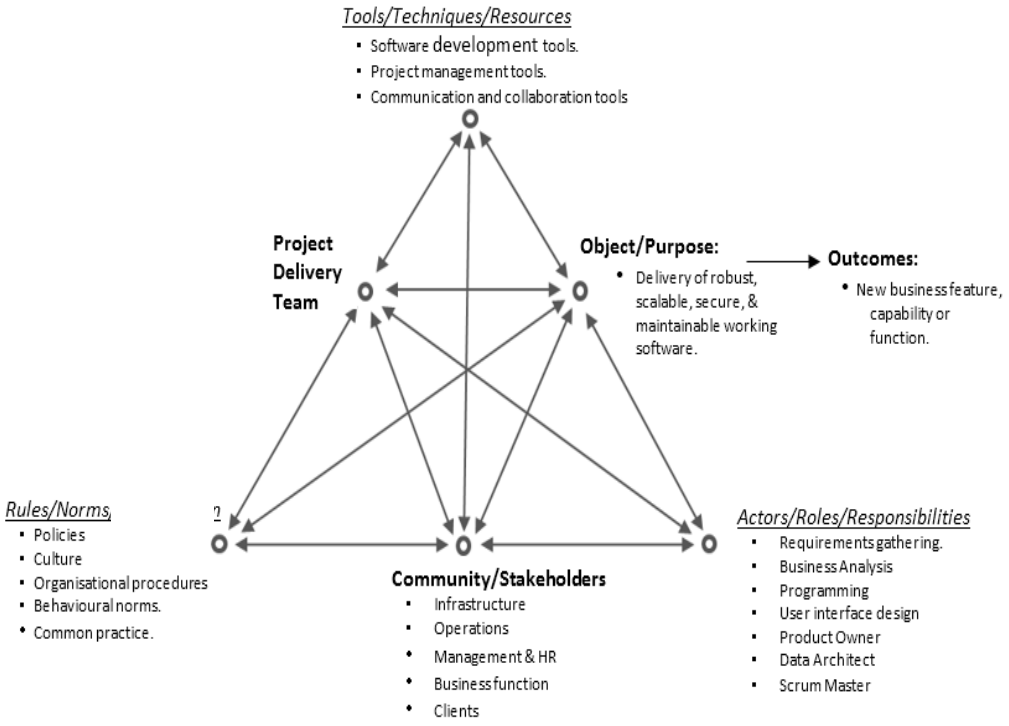
Community: This places the activity within the social and cultural context of the subject. In this case it could be an organisation, department or technical function.

Rules: Within the community of the subject there are likely to be rules and norms that impact on the way the activity is executed. These rules could be organisational policies or industry procedures.

Division of Labour: This represents the different responsibilities and job roles that might exist. Examples include project manager, programmer, business analysts and customers roles.

These elements are further explained in Figure 2.5 below which has been adapted to represents a project delivery activity.

Figure 2.5: Example project delivery activity (after Engeström, 2000)



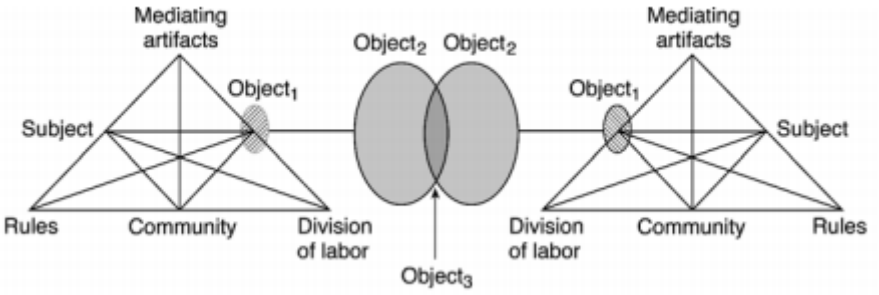
The focus of attention is the line through the middle of the triangle from the Project Delivery Team node to the Object/Purpose node that represents the focus or purpose of the activity/work. In addition, activities both mediate and are mediated (affected/influenced) by the node representing Tools/Techniques/Resources that are used as part of the activity as well as by the Community/Stakeholders context node within which the activity takes place. For example, the software development activity is mediated by the tools used such as Kanban boards or conformance with a planned work

package specification. Similarly, the software development activity is mediated by the community & social group context such as whether clients are closely involved within the development activity.

This perspective has a further dimension where the relationship between the Project Delivery Team node and the Community/Stakeholders node is mediated by the node representing Rules/Norms. Similarly, the relationship between the Community/Stakeholders node and the Object/Purpose is mediated by the Actor/Roles/Responsibilities node that reflects how work & responsibilities are divided and allocated.

This theory was developed further to include multiple perspectives and networks of interacting activity systems. Figure 2.6 shows the interaction of two neighbouring activities such as the activity system of a programmer in an IT department interacting with the activity system of a client customer in another organisational function (Engeström, 2001)

Figure 2.6: Activity System Interactions. (Engeström, 2001)



Engeström (1987) states that within these activities, learning will take place following the resolution of internal contradictions. For example, the introduction of a new technology, work practice or system can impact a collaborative activity and initiate a new process of learning by giving rise to new questions, tensions and contradictions. These lead to expansive learning where the object and the motive of the activity are re-conceptualized to embrace a radically wider horizon of possibilities than previously envisaged. Engeström (1987) call this process ‘expansive learning’. Contradictions will also take place between activities as teams and organisations adapt and learn new practices and processes.

Engeström (1987) points to a problem with traditional approaches to learning which pre-suppose that the knowledge or skill to be learnt is itself well known, well-defined and stable. Engeström (2001) states that learning in modern organisations does not correlate with this view and that people are continually learning something that is new, undefined and not stable.

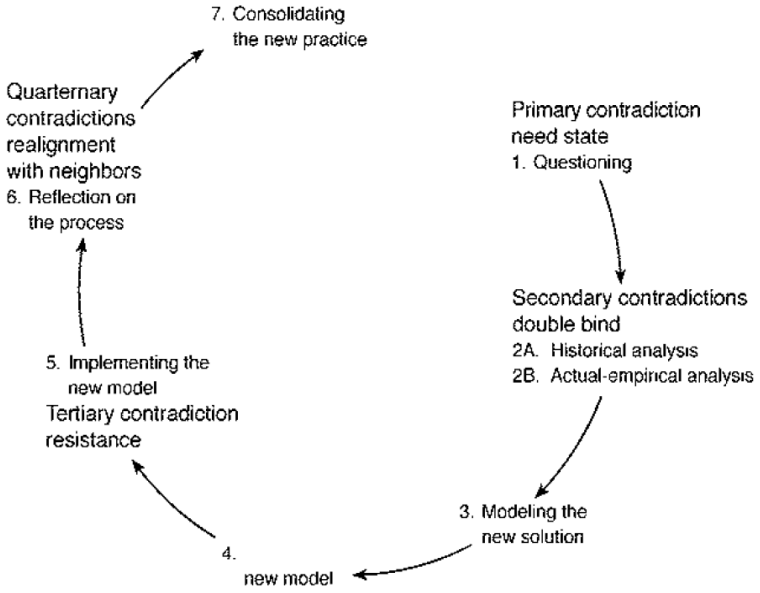
> *"In important transformations of our personal lives and organisational practices we must learn new forms of activity which are not yet there. They are literally learned as they are created. There is no competent teacher. Standard learning theories have little to offer if one wants to understand these processes"*
>
> (Engeström, 2001, p.138)

For example, with reference to the Communities of Practice (CoPs) learning approach, Engeström (2009) states that the motivation comes from participation in culturally valued collaborative practices where something useful is produced. This works well for novices in a field transitioning to valued experts in stable practices, but Engeström argues that the motivations for risky expansive learning associated with major transformation is not well explained by mere participation and the gradual acquisition of mastery (Engeström, 2009).

It is suggested that the transition to Agile approaches represents a similar major transformation involving risky expansive learning where individuals and organisations are faced with highly variable approaches and perspectives that are not easily described or evaluated (Boehm & Turner, 2005). Unlike traditional approaches where the emphasis is on clearly specified processes and practices (Fontana et al., 2014), the Agile emphasis on human and cultural elements 'is not yet there' in Engeström's (2001) terms.

Engeström (2000) states that learning new practices comes from identifying and understanding contradictions and conflicts within existing activities and follows an expansive learning cycle as shown in Figure 2.7 below.

Figure 2.7: Strategic learning actions and contradictions in expansive learning cycle (Engeström, 2001)



The following explains this further where the titles in bold refer to the seven points of the expansive learning cycle as displayed in Figure 2.7.

1. **Questioning:** This is the important trigger point in expansive learning where there is a conflicting contradiction/tension that leads to the questioning of existing standard practice. A *Primary Contradiction* will emerge from within a node of the activity triangle (Figures 2.4 and 2.5).
2. ***Secondary Contradictions***: This step leads to deeper analysis and more detailed questioning of the historical and cultural aspects. This is likely to emerge between two or more nodes within the activity triangle.
3. **Modeling:** This is where a new solution (activity/practice) is modelled.
4. **New Model**: This is where the new model (activity/practice) is validated.
5. **Implementation model**: This is likely to give rise to a new set of contradictions between the old and the new activity. *Tertiary Contradictions* will emerge between an evolved activity and a previous instance.
6. **Reflection on the process and alignment** with neighbouring activities. *Quaternary Contradictions* emerge between a new re-organised activity and its neighbouring activities.
7. **Consolidating new Practice**: The activity/practice previously unknown is now consolidated and becomes the norm.

Within Engeström's third generation of Activity Theory, learning is now understood as a collective process of creating and acquiring something that is not yet there and that expansive learning proceeds from questioning existing practice to analysing it, to modelling, examining and implementing new solutions (Engeström & Sannino, 2021).

Barab et al. (2002) explain that tensions entering the activity are the driving forces behind the contradictions and disturbances which lead to the activity changing and developing. These contradictions are best understood as tensions amongst the different elements of the activity system. Through understanding the interplay within these dualities, researchers can better understand and support development and innovation and learning within the activity system. Barab et al. (2004) state that contradictions within an activity are potential opportunities for intervention and improvement. The authors see contradictions as providing elements of an expanding activity system and can be viewed as a 'gap-analysis' exercise.

Kaptelinin & Nardi (2006) view activities are almost always in the process of working through contradictions and that these contradictions are the sources of development. Identifying contradictions within activities has formed the basis of several studies within the IS domain and they have mostly focused on Quaternary contradictions between different activities (Hasan et al., 2017 citing Kuutti & Virkkunen, 1995). This focus may well relate to the typical relationship between the two activities of software development and user/client business activity. Hasan et al. (2017) state that within the Human Computer Interaction (HCI) domain, the focus has been on Secondary contradictions involving the subject and tools/techniques nodes. With regards the occurrence of Tertiary contradictions, Mursu et al. (2007) provide a description of contradictions within the IS function which they state is between the object and motive of the 'dominant form of the central activity' and the object and motive of a 'culturally more advanced form of the central activity'. The authors state that these Tertiary contradictions occur when work practices are re-organised and the old mode of operation is rebelling against the newer one (Mursu et al., 2007). This is of interest to this study as it is asserted that the 'culturally more advanced form' may represent a more large-scale Agile form of the software development practice. This would involve a significant change to the practice as discussed earlier in sections 2.2.4 and 2.2.5.

From the above it is apparent that Activity Theory provides a broad analytical framework offering multiple perspectives for analysis that may be useful in examining the interactions and interrelationships of elements within a large-scale Agile delivery environment.

2.4.3 Benefits of, and rationale for using, Activity Theory

Kuutti (1995) points to the value of Activity Theory (AT) as a theoretical framework for analysing human practices as developmental processes (including learning). Engeström's original book on Expansive Learning (1987) represents one of several theories that challenged existing notions of human activity and learning as being independent and isolated from the cultural contexts within which they take place. Engeström's development of Activity Theory suggests that learning activities can only be understood within their culturally and historically situated contexts (Engeström, 2015). Bedny & Karwowski (2004, p.138) define an Activity as

> *"A goal directed system where cognition, behaviour and motivation are integrated and organised by the mechanism of self-regulation toward achieving a conscious goal. Activity determines the specificity of interaction of conscious subjects with external world."*

Bedny & Karwowski (2004) see activity as socially formed, object-oriented and artifact-mediated. They contrast this with behaviourism which sees behaviour as isolated in terms of stimulus and response mechanisms that ignore socio-historical dimensions. According to Bedny & Karwowski (2004), Activity Theory (AT) is based on the psychology framework developed by Vygotsky (1978) which itself was inspired by a Marxist 'social cultural' perspective that views mental development occurring as a process of acquiring culture that shapes human cognition. This founding concept of AT was subsequently developed by other authors who view the mind as developing from object-practical activity that is historically contextualized (Leont'ev, 1978; Engeström, 1987).

Kaptelinin et al. (1999) states that AT is not a predictive theory but a descriptive one. Turner (2016, p.26) further elaborates, suggesting that AT is not a theory in terms of conventional thinking as being falsifiable or predictive in nature. Instead, AT is a "conceptual framework and vocabulary for describing human purposive behaviour - or activity".

Many authors have evaluated AT's value in a variety of contexts. Kaptelinin et al. (1999) see AT as a mechanism for helping researchers and designers to ask meaningful questions. Barab et al., (2002) used AT to study the introduction of a technology rich academic course. They found that the use of AT allowed a means of characterizing the complexities of the situation and understanding the dualities that existed. This led to an analysis of the activity system tensions. By using AT, these authors were able to understand activity system outcomes that were inconsistent with organisationally espoused objectives.

Bakhurst (2009) outlined a typical scenario that draws researchers to AT. He characterised this as a need to examine a phenomenon that is not readily investigated using traditional social science techniques due to its occurrence within a complex system and the richness of the human elements involved.

AT meets the research requirement for a qualitative theoretical framework to "reveal the structure of the phenomenon and enable the researcher to generate and interpret data" (Bakhurst, 2009, p.206). In their conclusion following a detailed account of the constituent elements of an activity, Bedny & Karwowski (2004) concluded that there are multiple benefits from adopting the AT approach to research, including enabling consideration of concepts such as culture, goals, motivation, and social interaction. The different cultural aspects involved in Agile delivery approaches are often cited as a reason for difficulties in implementing Agile methods. Hence AT represents an appropriate analytical tool within this context.

Within the Human Computer Interaction (HCI) domain, Riechart et al. (2016) states that existing theory might be limited in terms of studying computers in social, organisational, and political contexts due to such theory's inability to analyse user's goals, plans and values. For these reasons, these authors identified AT as capable of providing the necessary qualitative analytical framework to analyse their case study of an administration process. Also within the HCI domain, Mwanza (2000) pointed to the usefulness of AT's consideration of the social, cultural, and psychological aspects of the user within an activity context.

2.4.4 Issues relating to the application of Activity Theory

Barab et al. (2004a) examined the use of AT for identifying the characteristics of participation. They make the following points regards the use of Activity Theory as an investigatory tool.

- There are no generally prescribed methodologies for applying and using AT concepts and principles.
- In order to understand how to use Activity Theory, they suggest accessing work by other authors (Barab et al., 2002; Blanton et al., 2001).
- The application of AT commits the researcher to research methodologies such as case studies, ethnography, and design experiment. This means committing to an extended holistic view that allows for multiple perspectives.
- AT as described by Vygotsky, Leont'ev and Engeström is to be used descriptively. This means that it is intended to help with the understanding of learning and work in a socio-culturally rich context. There is no claim that is a prescription for change.

Barab et al. (2004b) provide an example of an R&D project applying AT which looked at designing and building an on-line forum. The authors point to the helpful identification of contradictions that arose as a community engaged in a new practice that challenges current culture. Connected to this study's use of AT to examine the organisational learning aspects of large-scale Agile delivery approaches, Barab et al.'s (2004b) examination of the use of Communities of Practice (CoP), state that where the CoP is designed to support learning itself then it becomes a tool that mediates the interaction between a subject and an object within an activity system. This introduces some complexity into the application of Activity Theory: one might have anticipated that the CoP would be placed at the bottom of Engeström's triangle (at the Community node – as discussed earlier), it could also occur at other points of Engeström's (1987) triangle such as a mediating tool.

> *"In terms of Engeström's triangle, this treatment elevates the notion of community from simply occupying the bottom of the triangle to an entity whose reach is distributed across multiple components as it functions as a tool, object, outcome, and, at one unit of analysis, even subject."*
>
> Barab et al. (2004b,p.206)

A similar aspect is described by Benson et al. (2008) who used AT to conduct a comparative study of on-line education programs and the use of a computer-based course management systems (CMS) such as Moodle and Blackboard. In their analysis, these researchers abandoned their original intention to analyse these CMS as the object activities when they realised that the subjects did not view CMS as objects. Instead, they discovered that the CMS were actually a key element of most of the activity system impacting on all three of the mediators of human activity. They concluded that without using AT (at a micro-level), the detailed elements of a system implementation could be missed, and so proposed solutions may well be inappropriate or even subverted (Benson et al., 2008).

2.4.5 Critiques & dilemmas in operationalising activity theory

The above examples of AT use serve to illustrate the highly variable and dynamic approaches possible. This is further illustrated where there is consideration of some of the dilemmas in using AT as well as highlighting some differing views. Barab et al. (2004a, p.) explain that by examining the primary components of Engeström's version of AT an analysis can be structured "without the burden of too overt a prescription".

They have one proviso: before the analysis can begin the researcher has to select a unit of analysis for investigation. It is only once the researcher has made the decision as to what level of analysis to adopt that they can 'mine' the collected data to "determine the content they view as constituting a particular component of the triangle with the goal of developing a triangular characterizing of the activity" (Barab et al., 2004a, p.207).

In the introductory chapter to the second edition of his original 1987 text, Engeström (2015) discusses experiences as well as challenges to the theory of expansive learning. He refutes Bakhurst's (2009, p.206) critique that AT does not provide much explanation because it could be applied to "having dinner or walking the dog". Engeström counters that this is incorrect because these are not collective activities but instead are "short-lived individual or group actions or cluster of actions". Activities are achieved by means of actions and actions only make sense when they are viewed within the context of the activities within which they are performed (Engeström, 2015).

Engeström (2015) also refutes Bakhurst's (2009) argument that the triangular model is static, stating that it is merely a unit of analysis that can help to analyse dynamic

relations and change within activities. Both Piem (2009) and Engeström (2015) agree that an issue with AT is difficulty in reconciling local level aspects (subjects, actions and situations) with larger macro-level aspects (activity systems, organisations and historical contexts).

Engeström and Sannino (2010) also repeat that expansive learning does not accrue due to a designed intent or policy but instead is an historically evolving reality. They reiterate occurrence of contradictions within activity systems. Finally, they suggest that it would be sensible to have policies that can make expansive learning less 'problematic' but what such policies would look like is not discussed in their contribution.

AT is often used in conjunction with other analytical tools. Bedny & Karwowski (2004) state that this is a benefit of AT in that it empowers the efficient utilisation of other methods of analysis. Barab et al. (2004c) ground their study of an online community forum in terms of both AT and Socio-Technical Interaction Networks (STIN). They emphasise the respective contributions of both approaches, contending that taken together, AT and STIN provide a richer view of design activity and community (Barab et al., 2004c). Wenger (1998, p.230) indicates that both CoPs and AT have similarities where they address,

- Tensions and contradictions that exist between the collective community and the individual.
- Notions of identification (individual) and negotiability (community).
- That these elements exist in a duality that stimulates both harmony and tension.

Both Wenger (2000) and Engeström (1987) see such tension as opportunities for learning and development for the individual and for the community (Barab et al., 2004a). Riechart et al. (2016) stress the value of AT in its consideration of people (subjects and community) in their analysis. The authors concluded their study by stating that the use of AT supplement the use of other theoretical approaches such Actor Network Theory (ANT) and also Principle Agent Theory. Finally, Engeström (2001) himself points to yet possible further developments in the third generation of activity theory and refers to several studies including those that discuss the interface between AT and Latour's Actor Network Theory.

2.4.6 Conclusion

It is clear from multiple sources that AT has many benefits in its use as a broad analytical framework offering multiple perspectives that would be useful when examining the wide variety of issues that are raised within organisations undergoing change. AT affords a unifying perspective that encompasses a variety of elements including the identification of goals and motivations, the use of tools and artifacts, the influence of organisational practices, rules and procedures as well as providing an understanding of the dualities that lead to tensions and frictions that characterise organisational change.

AT is not a prescriptive approach but rather a descriptive one that can operate at multiple levels. It provides a rich vocabulary and context to aid in understanding human behaviour within complex organisational phenomena. The ability to capture such complexity and richness of understanding is absent from other traditional social science approaches, and is ideally suited to the analysis of an organisation's transitions to Agile approaches. Turner (2016, p.34) concludes AT is "complex, demanding and occasionally obscure, but is remarkably comprehensive and coherent".

The next section takes up the analysis by looking at the application of practice- based approaches (of which AT is one) to ~~the~~ project management and the adoption of Agile methods.

2.5 Organisational learning, activity theory and Agile delivery

2.5.1 Introduction

This section focuses on the intersection of the previous sections, examining the use of Practice Theory based perspectives within the project management and Agile delivery domain. Within this junction, three themes are examined – projects and learning, AT and Information Systems (IS) development, and learning within Agile delivery environments. These three themes provide the context within which this research takes place.

2.5.2 Learning within project structures

Ayas & Zeniuk (2001) and Scarborough et al., (2004) use the term 'project-based learning' inclusively to encompass both the creation and acquisition of knowledge within projects as well as the subsequent transfer of that knowledge to other projects and to other parts of the organisation. According to Ayas & Zeniuk (2001) there are many articles within the literature (usually originating in the organisational learning domain) that espouse the value of a project structure as a vehicle for developing inquiry skills to understand assumptions and to assess the consequences of actions as well as providing the context for double-loop learning. Ayas & Zeniuk (2001) list several favourable characteristics of a project structure for learning including a sense of purpose, CoPs that cross project boundaries, a learning and supportive infrastructure typically associated with small groups and systemic and collective reflection. However, a different picture emerges from the project management domain where authors conclude that the temporary nature of projects, along with time pressures, centralization and deferrals, impede project members from learning within and from projects. (Keegan & Turner, 2001).

Bakker et al. (2011) refer to learning within projects as the 'project paradox', considering that on one hand the multi-disciplinary and transient nature of projects would be suitable for the creation of knowledge while on the other hand the temporary nature of projects would inhibit knowledge 'sedimentation' due to project dissolution and participant dispersion. Their study showed that the host organisation's recognition of the value of the knowledge created by the project was important, and that no single

factor in the knowledge transfer process itself was sufficient on its own (Bakker et.al, 2011).

Traditional project objectives (delivery of typical iron triangle project parameters of cost, time and scope) and views do not necessarily consider learning in the workplace as an explicitly stated or desirable aspect of projects. Sense (2007) considered projects from multiple perspectives, importantly including a socially constructed view of learning, to determine how projects could be suitable mechanisms for learning. Social constructivists encourage examination of learning in projects through the experiences and interactions of project participants where individuals develop their own learning activities in interactions with their project environments (Sense, 2007). Sense (2007) argued that project management practitioners can assemble a "situated learning environment within their projects through communally analysing, critically reflecting upon and developing actions relating to five sociological elements in a project milieu". Sense (2007) drew these elements from the work of Wenger (1998) providing a framework to guide project-situated learning activity that includes Knowledge Management (KM) and Learning Relationships.

Sense (2011) agrees with Ayas & Zeniuk's (2001) list of characteristics as to why projects are powerful learning environments also referring to the existence of multiple interactions and reflections where, for instances formal and informal meetings create multiple opportunities for participants to share knowledge through personal exchanges and narratives, and to reflect on solutions to project problems. Sense (2011) suggests these sometimes intense meetings may provide workers with opportunities for inquiry, interpretation and reflection to assist with understanding their experiences and learning.

The importance of experiential learning in a project manager's development was stressed by Turner, Keegan & Crawford (2002). Berggren & Soderlund (2008, p.289) recommended an adaptation of experiential learning because "knowledge is produced in the context of application". As part of the RPM network. Crawford et al. (2006) also specifically stated the need for practice to become more integrated with learning, and that a less theoretical focus was needed with more emphasis on practical applications and experiences. They emphasised that learning and development are more effective when integrated within work and professional activity. These authors point to specific

types of learning mechanisms that may be utilised in the project management domain including work-based training, coaching, master classes, reflective practice, action learning, special interest groups (SIGs), simulation, and double-loop learning. Crawford et al. (2006, p.727) make the significant point that,

> *"Learning should be viewed as a social process in which the individual is able to integrate their learning (i.e., possessed knowledge) with the development of the organisation and its practices given that individual development is a component of organisational development."*

Hallgren & Soderholm (2012) are keen advocates of the 'Projects as Practice' approach, and are interested in the everyday work of project management and its contexts hitherto these have not received much attention. Projects as practice moves away from previous project management analysis which had focused on two main streams (Hallgren & Soderholm, 2012).

a. Structural (traditional) focusing on best practice and the development of tools and models and an analysis of leadership styles, routines and organisational forms.
b. A human-oriented process (this emerged from Scandinavia in the 1990s) with the emphasis on description, change, social processes and business development and comes closest to understanding human behaviour.

Hallgren & Soderholm (2012) suggest that both streams had taken for granted the practice aspect and so the role of people and their actions in accomplishing projects has not been properly analysed and understood. The Projects as Practice approach looks at the sum of actors and actions involved in projects and the construction of their environments. It analyses how people relate to their tools and how they embed the tools within particular contexts.

Hallgren & Soderholm (2012) summarise that project work is seldom about technical tools but that it is more about constant small changes in activities that keep naturally unstable projects stable. It is the analysis and understanding of these activities that are likely to deliver useful insights.

Hallgren & Soderholm's (2012) contribution represents a rationale for the application of the practice based approach to the project management domain. It forms a chapter in a book by Morris, Pinto & Soderlund *The Oxford Handbook of Project Management,*

2012. The book's editors are amongst the most authoritative commentators within the academic project management domain; consequently, the article's inclusion suggests a willingness to consider different approaches at an important and influential level. In addition, although their discussion of the practice approach addresses general project management practice, the principles and objectives are equally applicable to the Agile project management domain. In particular, the Practice Theory approach has led to the consideration of learning through application, an examination of everyday practice and participation, and consideration of the influence of material artifacts and tools.

2.5.3 Activity Theory applied to information systems development

AT was first introduced to the IS community by Bodker (1990) (Grace, 2012), and was used to study the interaction between the activities of developers and the activities of users (Crawford & Hasan, 2006). De Souza and Redmiles (2003a) have used AT to study collaboration between software developers. They found that their analysis had led to a finer degree of activity detail with regards to the software development process.

Crawford & Hasan (2006) were clear that AT is an appropriate tool for analysis within the IS domain and suggest situations where Activity Theory provides a suitable research framework. These situations relate to complex, dynamic, knowledge-intensive work that takes place within groups or communities which are supported by socio-technical systems.

Grace (2012) pointed to work by Kaptelinin & Nardi (2006), Korpela et al (2002) and Kuutti (1995) stating that AT has the potential to go beyond traditional cognitive approaches in understanding how human activity is mediated by both technological and non-technological artifacts. Karanasios et al (2014) confirm the benefits of utilizing an approach such as Activity Theory that does not privilege the social over the technical offering a socio-technical approach.

Overall, AT has been adopted by many involved in the IS domain (see the Computer Supported Cooperative Work (CSCW) 2002 – special edition) as an analytical tool that offers several advantages. Compared with other approaches, such as distributed cognition and contextual inquiry which it is most often compared against (DeSouza & Redmiles, 2003a), AT's main emphasis on placing activity at the focal point of analysis is

useful. It allows many elements to be considered within the collaborative software development domain such as tools use, division of labour and desired outcomes.

More generally Karanasios et al (2021) draw attention to the difficulties and challenges that AT faces when analysing modern digital technology. Specifically the authors identify four main challenges and opportunities that digital technology presents for AT. Firstly they point to the generative nature of digital tools which lead to new structures and behaviours. Secondly, digital tools through Artificial Intelligence (AI) and algorithms impact our behaviour and free will. Thirdly digital tools automate lower level operations and elevate work to higher levels and finally digital tools change organisational structures by changing our interactions and communication patterns (Karanasios et al., 2021).

The application of AT to a specifically software development environment has been presented by De Souza & Redmiles (2003b), who regard the application of AT as a useful approach in that it is open-ended and allows for the introduction of new ideas. They also regard AT as a research method which is non-invasive using open-ended interviews or even more informal observations of work. Kaptelinin & Nardi (2006) have stated that a major strength of AT is its ability to address almost any situation and provide a broader perspective that caters for a variety of factors at multiple levels. “Some of the power of activity theory lies in the way it ties insights into larger wholes to provide a clarifying framework for the bigger picture” (Kaptelinin & Nardi. 2006, p.6).

De Souza & Redmiles (2003b) confirm that AT can be applied to studies within the IS domain and can be applied in several ways. For instance, Collins et al. (2002) have focussed on the identification of contradictions in a software development activity that led to important implications for tools, practices, and the divisions of labour for the actors. De Souza & Redmiles (2003b) used AT to model a software development approach building an instance which was refined through several iterations. This case study identified different tensions. A similar approach to developing and refining AT has been adopted in this study and is discussed below in Section 2.5.7.

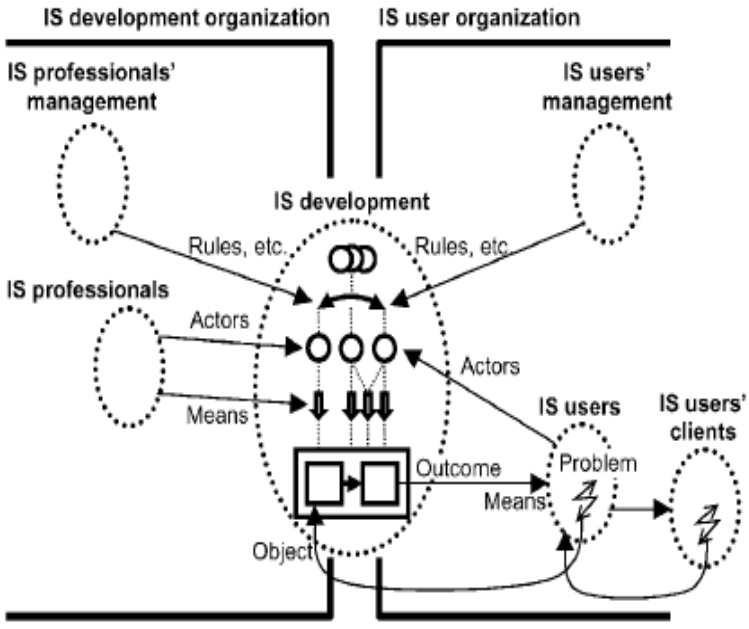
Barthelmess & Anderson (2002) applied AT to a software development environment providing a useful contextual description of the software development activity including examples of actions and operations.

> *"Software development starts with an extremely abstract object (e.g., 'develop a new system') and is realized via a highly creative application of actions that build and transform knowledge representations that are shared by a team. Operations may involve, for instance, drawing a diagram or writing a specification."*
>
> Barthelmess & Anderson (2002, p.16)

It has not been possible to identify further literature that provides a similar attempt at the decomposition of software development activity into these levels. It does appear that many studies that use AT apply it selectively. They mostly identify contradictions and friction points within their case studies, but it is apparent that they do not apply all the elements of AT (for example activities and actions and operations) to all aspects of the case under investigation.

The application of AT that comes closest to the D/STP Programme under consideration in this research, is the work by Korpela et al. (2002) regarding the consideration of IS development as an activity. Within their study, Korpela et al. (2002) provide a useful diagram (Figure 2.8) showing IS development as a temporary activity taking place at the border of two different functions. In general, these functions could be different departments within an organisation or even between two distinct organisations. The diagram is useful because it shows the consideration of a variety of AT elements such as roles (actors) the software development activity itself, object, and outcomes as well as rules and norms.

Figure 2.8: Temporary IS Development Activity (Korpela et al, 2002)



Further examination of the literature related to the application of AT to the IS domain shows that researchers tend to utilise only one specific element of AT that enables a particular analytical perspective to be undertaken. Typical of this is the study by Engeström (1997) himself, who examines a legal court scenario, and focussing entirely on a hierarchy of possible collaborative levels without any consideration of other elements such as operations or actions.

De Souza (2003) identified some similarities between AT and software engineering development approaches aimed at facilitating the design of computer based information systems as well as an overlap with object-oriented analysis approaches. De Souza (2003) drew attention to Korpela et al.'s (2000) attempt to reduce the gap between use-case diagrams and AT diagrams. De Souza (2003) suggests that more details need to be provided in terms of guidance on how to apply AT, pointing to work by Mwanza (2002) and Kaptelinin et al (1999) that provide some level of guidance. Additional guidance might make AT more accessible particularly without reducing its flexibility. De Souza (2003) points to the many positive benefits of applying AT within IS research, noting that although its open ended-ness is a challenge, AT facilitates flexibility for deriving new ideas and is a means of identifying issues requiring attention.

He praises its non-invasiveness and its iterative refinement capabilities, with the possibility of adding more detail as and when needed (de Souza, 2003). This was countered somewhat by Bardram & Doryab (2011) who view AT as less 'operational' than other approaches based on ethnomethodology. Further examination of the literature since these rather dated contributions does not reveal much progress towards providing more guidance in the use of AT. It is an intent of this research to provide a wide-ranging and consistent way of applying AT.

2.5.4 Learning within an Agile delivery context

Many studies have focussed mostly on the role of reflection in learning Agile approaches and processes. Babb et al. (2014) state that implicit within the Agile ethos is the view that Agile teams should regularly assess their processes and outcomes, and through reflection assess whether these need to be modified. Reflection is regarded as a key element as organisations progress through the lengthy and difficult process of implementing Agile project management approaches. Babb et al. (2014) have developed

a model (REALM - Reflective Agile Learning Model) that shows where and how to integrate reflective practice within Agile approaches. They combined elements of Schon's (1983) work pointing to other authors who have indicated a similar approach to incorporating reflective practice (McAvoy & Butler, 2009a; Highsmith, 2009).

Incorporating reflective practice within Agile practice is a difficult task for those not used to it. For example, Ayas & Zeniuk (2001) quoted Covey (1990) emphasising that reflective practice requires the breaking of old habits. Such habits can be embedded within organisations for decades so breaking them to introduce reflective practice can be difficult. Babb et al. (2013) list some of the learning benefits that occur once working within an Agile project management environment has actually begun.

1. The emphasis on teamwork
2. Emphasis on continual learning and reflection.
3. The existence of a situated, iterative and emerging solution process
4. Personalised knowledge capture and sharing.
5. Agile practices supporting individual and team approaches to knowledge sharing and learning (Chau et al.,2003)

Conversely, (Babb et al., (2013) also identify the following barriers to learning within an Agile context.

1. Multiple Goals (Projects): The separation across multiple projects meant that the benefits of group programming (joint team-based reflection in action) could not be realised.
2. Excessive Iteration Pressure: There is no time to set aside explicitly for learning after each iteration (therefore, people are less likely to share knowledge and reflect).
3. Level of Customer Involvement: The continuous use of one individual (product owner) deprives other team members of the learning experience.
4. Organisational Culture: Agile teams require informal organisational structures that do not inhibit information flow.

Overall, Babb et al. (2013) concluded that it is the organisational context that will selectively drive the utilisation of Agile practices towards productivity elements rather than reflection and learning aspects.

McAvoy & Butler (2009a) argue that a failure to adopt Agile is a failure to achieve double-loop learning. These authors pointed to Back & Seaker (2004) who stated that an individual's personality and traits will influence their ability to achieve double-loop learning. This concept led them to look at the traits of software developers to see if these traits are likely to affect their learning. From their analysis of the literature the authors conclude that, given the 'geek' factor in software developers, it would appear that their traits might present a problem for adopting Agile (McAvoy & Butler, 2009a, p26). They point to Argyris' Model I & II behaviour types, (Argyris, 1991) and note that,

> *"Model I - behaviour is efficient in dealing with routine problems – unlike typical Agile projects – while Model II behaviour is appropriate where there is a need for considerable cooperation and co dependence - as with Agile projects. Agile, therefore, should strive for and require Model II behaviours."*

McAvoy & Butler (2009a) argue that empowerment of software developers within an Agile context might have a major impact on the project, considering that software developer behaviour might be more in line with Model 1 behaviour. The authors considered the failure to learn to be a key element in the unsuccessful take-up and adoption of Agile project management approaches.

Adopting Agile methods is regarded as a culture change emphasising empowerment, collective ownership, teamwork, social interactions and a sense of community (Boehm & Turner, 2005; Highsmith, 2010; Cockburn & Highsmith, 2001). McAvoy & Butler, (2009a) regard implementing Agile as an example of change that requires learning dramatically new and different behaviours.

The logical question these points suggest is that when implementing or adopting Agile project management approaches how can organisations mitigate the issue of software developers' Model 1 learning behaviour that might impede the adoption of Agile practices? The use of an AT perspective in analysing the barriers, contradiction and discordances in this learning process may be useful in surfacing exactly these kinds of issues.

Gandomani et al. (2015) undertook a Grounded Theory study of nearly 50 Agile project management practitioners across 13 countries and identified four groupings of barriers to implementing Agile practices - Process, People, Management, Technical and Cultural. These authors identified 'Inadequate and Dysfunctional Training' as of most concern to

practitioners transitioning to Agile approaches. Their study only addressed traditional class-room based approaches to training, learning and development, but they pointed towards the more cultural and social aspects as being significant in impacting Agile practices. These may also be addressed through an Activity Theory perspective.

2.5.5 Practice Theory and Agile delivery methods

Newell & David (2006) examined the influence of situated learning compared to the use of formal project management methodologies. They found that informal social processes can be very productive, helping to guide problem solving and learning more than simply following plans. They noted that situated learning helps to explain why formal project management plans etc. are supplemented by informal community networks, and suggested that these social communities should be actively encouraged by 'facilitative adaptation'. They contend that such social processes distort traditional project management elements such as plans and visions but that this distortion is not necessarily negative. In fact, it may realise greater benefits than focussing on effective work practices. This is not poor management but a realisation that ad-hoc processes can be the norm (Newell & David, 2006).

This is especially relevant for this research as the *Agile Manifesto* (2001) states that there is a preference for 'Working together over comprehensive documentation'. Boehm (2002) has already stated Agile projects de-emphasis of documentation implies that much of the project knowledge is held tacitly, not explicitly. The implication is therefore that social processes and mechanisms such as CoPs that disseminate such tacit knowledge may have an important role within Agile project management environments.

Applying the Communities of Practice concept to Agile environments, Kahkonen (2004) states that there would be multiple overlapping CoPs that transcend team boundaries to share and standardise practices. He was much more confident than previous authors in that although CoPs arise naturally, organisations can influence their development. This view is also supported by Wenger, McDermott & Snyder, (2002). Kahkonen (2004) went further, advocating that Agile project management approaches should incorporate practices that lead to the creation of CoPs having found them to be useful in aspects of Agile methods as well as ultimately assisting with the agility of the organisation (Kahkonen, 2004).

More recently Paasivaara & Lassenius (2014b) were able to identify the existence of multiple examples of the adoption of Communities of Practice within a large distributed Agile project management environment (Ericsson). Examples include Coaching CoPs, Development CoPs and specific, feature-driven CoPs. The authors concluded that these CoPs supported the process of implementing Agile delivery approaches being central to easing the problems of the Agile transformation process. The authors suggested that further analysis is required to understand the role of other contextual factors such as organisational culture and structure and the role of products. These contributions show that there are many elements beyond CoPs that could well provide an insight into understanding learning within an Agile delivery environment.

Floricel et al (2014) evaluate three social theories that they consider will help to understand development and change elements occurring within the project management domain. They considered the application of AT as particularly beneficial in that it can assist in understanding the complex organisational forms that can be "analysed as networks of overlapping activity systems.

By doing so project researchers can explain how a group of people who have never met before can work together towards a common (or partially shared) 'object'. It is the idea of a common 'object' that enables such temporary and distributed organisational forms by allowing shared conceptions of the activity" Floricel et al (2014, p.1095)

Based on Nicolini's (2013) five dimensions of practice, Floricel et al (2014) state that AT can provide an appropriate theoretical and methodological lens to understand project management issues.

1. Uncover work and efforts: this sheds light on the illusion of rational decisions and actions. Using AT will focus on contradictions moving beyond current processes, and viewing organisational practices as evolving over time.
2. Materiality of projects: uncover the intertwining of project activities that prevents a rationalisation approach. Using AT, the mediating roles of artifacts are examined and their role in projects in perhaps supporting or hindering connections between practices is uncovered.
3. Provide a space for agency and creativity: entrepreneurial approaches are needed rather than ones based on rational decision-making. Using AT, tensions between the objects of different activity systems in a project can be examined.

They may account for the hesitant and inconsistent behaviour of project leaders. In addition, AT can help describe collaborative project work that is not co-ordinated from a control centre.

4. Transform our view of knowledge: from a centralised resource to a way of knowing that is shared with others and acquired through learning. With AT, human actions are represented by artifacts which become sociocultural reservoirs of knowledge developed earlier.
5. Emergent and diverse nature of interests and power: rather than a stable hierarchy of power relationships. AT does not provide a strong perspective on interest and power. It can however contextualize contradictions in a socio-historical context.

Consequently, from an Agile delivery perspective the application of AT represents a useful and valuable viewpoint, enabling consideration of issues that would not normally be addressed in project management literature, and increasing understanding of the project management domain. The next section briefly outlines the application of AT to software development environments to assess its contribution to understanding the software development activity.

2.5.6 Application of Activity Theory to the organisational learning of large-scale Agile methods.

From an AT perspective, Engeström (2009) makes some relevant observations regards the nature of learning and development and the ability of some theoretical perspectives to be able to account for the processes and activities that take place.

Who are the subjects of learning? Engeström (2001) states that the subjects of learning are contained within an activity system. Each activity system is inter-connected and each of them face their own internal contradictions, resulting in a learning process taking place.

Why do they learn? Engeström's (2009) view is that CoPs works well for novices in a field transitioning to valued experts in stable practices but argues that the motivations for risky expansive learning associated with major transformations is not well explained by mere participation and the gradual acquisition of mastery. This point is particularly relevant for the adoption of Agile delivery approaches which are regarded as major

transformational processes (Boehm & Turner, 2005). The implication of Engeström's view is that the CoPs perspective in itself, would be insufficient to account for all the required processes and elements that occur as organisations move to an Agile project management approach.

Engeström is particularly critical of the role that CoPs can play in terms of motivating learning when a major change is about to occur. It is the acknowledgment and articulation of contradictions that will be the first step of expansive learning (Engeström, 2009). This is a key point for this study and reflects the rationale for moving the focus of the study away from merely studying the role of Communities of Practice within Agile environments to examine Agile project management learning processes using an AT perspective that at some points also incorporates CoPs at the Community node of Engeström's AT triangle.

What do they learn - contents and outcomes? Within an activity system context, this could be a new pattern of activity. In an historical context this could mean that old and new patterns of activity may co-exist, and this may well lead to struggles and contradictions. Moving through the expansive cycle, these contradictions and conflicts could well result in an expansion and the creation of a novel and unprecedented approach. The co-existence of traditional and Agile project management is reflected in terms such as 'Water-scrum-fall', There are many instances within organisational project management domains where old (traditional) and new (Agile) patterns of delivery occur. This is likely to lead to discordances and conflicts as well as co-existence (West et al, 2011).

How do they learn? - what are the key actions and learning processes? Engeström (2001) makes the point that hitherto organisational learning theories have been typically weak when it comes to spelling out the specific processes that make up the learning activity. As mentioned in section 2.2.7, Engeström (2001, p.151) critiqued the SECI model that purports to address the conversation from tacit to explicit knowledge, pointing to the Socialisation step of the SECI model involving the "smooth, conflict free socializing, the creation of sympathized knowledge". This contrasts with the questioning of existing standard practice as the first step on the way to the adoption of Agile delivery approaches (Highsmith, 2009).

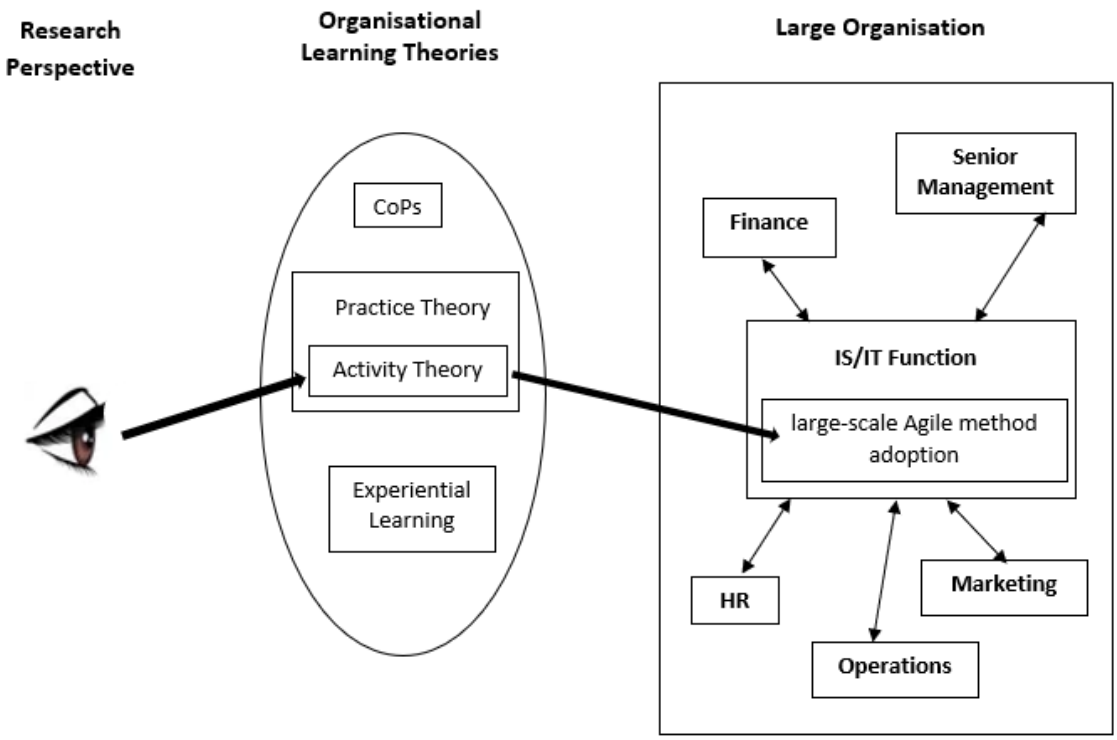
2.5.7 Conclusion

This section has shown that within the literature there has been consideration of the application of the socially and culturally constructed views of learning and development to the project management and Agile delivery domains. The section has shown the previously successful application of AT within these environments, influencing similar elements to those that the D/STP Programme consists of. In addition, the section showed the nature of the application of AT.

2.6 Research themes and research questions

This chapter has presented an outline of the challenges and issues facing organisations seeking to transition to Agile delivery methods. The chapter has specifically focussed on organisational learning and development issues surrounding the adoption of Agile practices. The chapter has further explored the use of Practice Theory as a suitable organisational learning approach to understanding the challenges and issues related to the adoption of large-scale Agile methods. This is illustrated by Figure 2.9 below.

Figure 2.9: Organisational Learning, Activity Theory and large-scale Agile



The initial research question that emerges from this literature review is

RQ1: What insights and understanding can a Practice Theory based organisational learning approach provide when adopting a large-scale Agile method?

Practice Theory has been suggested before for understanding learning and development within the project management domain, but this research theme specifically evaluates the use of the AT approach with regard to large-scale Agile delivery approaches. The theme aims to discover whether new insights and understandings can result from this organisational learning approach. This initial research question was applied in some preliminary research to provide a level of grounded exposure to the domain to determine the validity and value of the approach. This is discussed in the next chapter.

Chapter 3: Preliminary Research

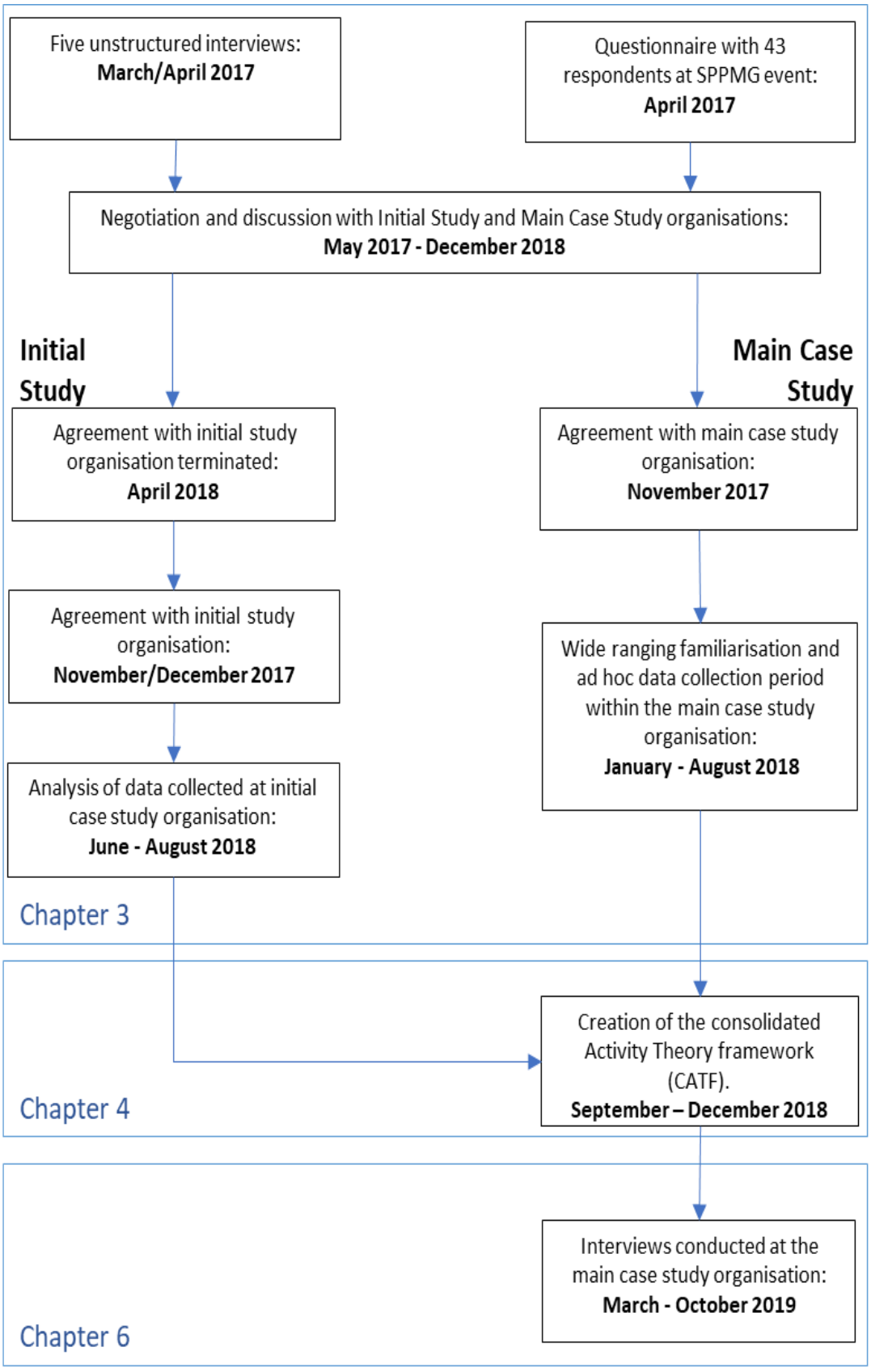
3.1 Introduction

This chapter outlines the main areas of preliminary research that were conducted in the earlier part of this study. The preliminary research consisted of the following three elements.

1. Five unstructured interviews with Agile practitioners in different organisations.
2. A questionnaire presented at a practitioner conference in April 2017.
3. An Initial Study which took place during 2017/2018.

These preliminary research activities were used to refine and develop the research approach and data collection for the main Case Study, as well as the catalyst to develop the consolidated Activity Theory framework (CATF) that is presented in Chapter 4. The three preliminary research elements and the main Case Study (undertaken in 2019) activities are outlined in Figure 3.1 below with an indication of the corresponding chapters that address these elements.

Figure 3.1: Data Collection and Analysis Timeline: March 2017 - October 2019



3.2 Practitioner interviews

The first step undertaken in this preliminary research was to interview five practitioners within the Agile domain. Rather than focus specifically on software developers it was decided to obtain perspectives from a variety of roles. The choice of interviewees was driven by the researcher's personal contacts and by recommendations. The five practitioners are detailed in Table 3.1.

Table 3.1: Interviewees, Roles and Organisations

	Interviewee Role	Organisation	Date	Interview Method
1	Web developer and Scrum Master	Tertiary education	20th March 2017	Face to face
2	Agile Coach	Independent consultant	22nd March 2017	Skype
3	Programme /Portfolio Director	Public Health Services	24th March 2017	Skype
4	Scrum Master	Financial services software	31st March 2017	Skype
5	Software Developer and Scrum Master	Financial services software	19th April 2017	Skype

Selection of only five individuals to interview in this step was a deliberate choice intended to quickly obtain tangible results which would help to shape further data collection procedures. All interviews were recorded either using an audio recorder (for face-to-face interviews) or a software screen capture tool for Skype interviews. The interviews lasted less than an hour each. An Edinburgh Napier University headed research consent form was emailed to each of the interviewees prior to the interview taking place and each form was signed by the interviewee. The interview format was open and unstructured, with only the following three questions used to prompt the interviewees.

1. How did you go about implementing Agile delivery approaches within your organisation?
2. What three difficult problems have you experienced with adopting an Agile approach?
3. What three things would you do now to improve the Agile delivery process?

The questions were open ended to encourage participants to relate problems and issues that could be identified as contradictions within the AT context. The questions posed invited the participants to provide their views on the organisational, cultural, historical, and behavioural difficulties related to adopting Agile methods, and on issues surrounding the development and improvement of Agile practices. The recorded interview transcripts were transcribed by the researcher (around 8000 words per interview) and were examined for examples of frictions, tensions, and contradictions. A significant challenge was categorising the types of contradiction described by the participants. For example:

- Distinguishing between primary and secondary contradictions can be difficult because determining whether the contradiction lies within a node or between two nodes within the activity triangle requires significant interpretation.
- Identifying tertiary contradictions is also challenging because it is not a simple matter to identify the attributes of a future more mature instance of an activity given the wide-ranging discussion.
- Distinguishing between quaternary and secondary contradictions is also problematic particularly in an Agile delivery domain which crosses multiple organisational functional boundaries. It can be challenging to unpack a description of an activity in this context and determine whether it is part of a project delivery activity or another associated activity.

These are significant difficulties, and the selected strategy was simply to be as consistent as possible in the approach followed. It would have been useful to have clearer guidelines and examples to enable quick classification of each contradiction. This would also have provided an additional measure of consistency. A frequency analysis yielded the following results in Table 3.2 (contradictions levels were discussed earlier in section 2.4.2).

Table 3.2: Interviewee Contradictions: Frequency Analysis

	Interviewee Role	Contradiction Levels				
		Primary	Secondary	Tertiary	Quaternary	Total
1	Web developer and Scrum master	8	7	3	6	**24**
2	Agile coach	5	8	1	2	**16**
3	Programme /Portfolio manager	3	4	0	0	**7**
4	Scrum master	6	2	1	1	**10**
5	Software developer and Scrum master	2	4	0	0	**6**
Total		**24**	**25**	**5**	**9**	**64**

From the above, the most apparent result is the high number of primary and secondary contradictions compared to tertiary and quaternary contradictions. This might be expected as individuals and groups contend with the initial introduction of a new approach and devote much of their focus and attention to these aspects (Dennehy & Conboy, 2017).

3.2.1 Limitations and lessons learned

The above somewhat simplistic quantitative analysis reveals some interesting indicative contradiction profiles that provided some direction for further research despite the open-ended questions and the susceptibility of the results to such factors as interview length and the pre-disposition of interviewees to be verbose. A more detailed analysis of the type and nature of the contradictions could also have been undertaken but complications may have arisen around the comparability of results from interviewees with different roles from different organisations. However, sufficient reassurance was obtained from this initial analysis for the researcher to proceed further. Some additional queries for research began to take shape, including

- Are some contradictions more difficult to resolve than others?
- Are some contradictions more important/significant than others?
- What does the existence of many contradictions at a particular level indicate about the likely success or take-up of a new approach and completion of the expansive learning cycle?

Overall, a major issue with this approach was the difficulty in collating the results and drawing significant conclusions from the variety of interviewees. Aside from a very

useful general awareness of issues and some anecdotes there was little incentive to take this approach further.

3.3 A serendipitous survey

A second research opportunity presented itself serendipitously almost immediately after the interviews, when a survey was conducted of practitioners attending the Scottish Project and Programme Management Group (SPPMG) conference. This one-day conference/meetup is normally held two or three times a year. The researcher had participated in these events over the last few years, often presenting seminars on aspects of project management. The event was held at Dundee University on the 25thApril 2017, and the participants were mostly from Scottish public sector institutions. The researcher decided to use the event to garner data from attendees on their experiences with implementing Agile approaches and methods. This was achieved by hosting a workshop entitled 'Managing the Transition to Agile'.

3.3.1 Questionnaire design and results

A paper questionnaire was distributed at the end of the workshop. After some background questions, the respondents were asked to answer questions similar to those used in the earlier interviews.

Q1. What is your current job role and responsibility?

Q2. What are your reasons for attending this workshop?

Q3. Which Agile method is your organisation considering adopting or is using?

Q4. What level of Agile implementation is your organisation undertaking?

Q5. Please indicate the top three obstacles that you think seriously hinder your organisation's transition to a more Agile way of project delivery.

Q6. If you had the ability to wave a magic wand and be able to deliver any capability, functionality, or improvement, what would be the top three things that you would wish for that would most help in improving your organisation's transition to a more Agile approach to project delivery?

There were forty-three (43) respondents in total. The distribution of results for these questions are graphed in Appendix A. The written results obtained were examined for evidence of contradictions such as problems, tensions, gaps, dilemmas, breakdowns and clashes occurring between different elements of project delivery activity that would

affect the project delivery teams' ability to achieve their objectives. Applying the collected data in the questionnaire survey to these concepts posed several issues.

- The data collected provided some useful starting positions but is not sufficiently detailed to be confidently categorised into the different types of contradictions as identified by Engeström (1987). For instance, does 'Communication and Collaboration' and 'BAU[1] engagement' point to a quaternary contradiction or are they elements of a secondary contradiction within an activity?
- As in the earlier interviews, there was insufficient background and contextual information available to make assessments of learning and development issues. Collecting data from multiple individuals and organisations could only provide a high-level overview of some of the issues. A more detailed investigative approach considering organisational contexts would then be needed.
- This study was focussed on organisational contexts of cultural, historical, and social elements and examines how these influence learning to facilitate and or inhibit the adoption of Agile approaches. A data collection approach based solely on surveys could not provide this level and depth of analysis.

The data collected provided some indicative pointers towards the types of contradictions and issues that appear at a high level (Appendix A), but illustrating these concepts was a challenge. Simple tables and bar charts did not provide the required contextual elements. Because the objective was to illustrate the key points and because frequency or numerical analysis was less important it was decided to aggregate the data into broader groups and present them within the context of an Activity Triangle shown in Figures 3.2 and 3.3 below.

[1] BAU is an acronym for business as usual. This is distinct from project activity which is associated with change.

Figure 3.2: Primary Contradictions: within nodes – A questioning of practice

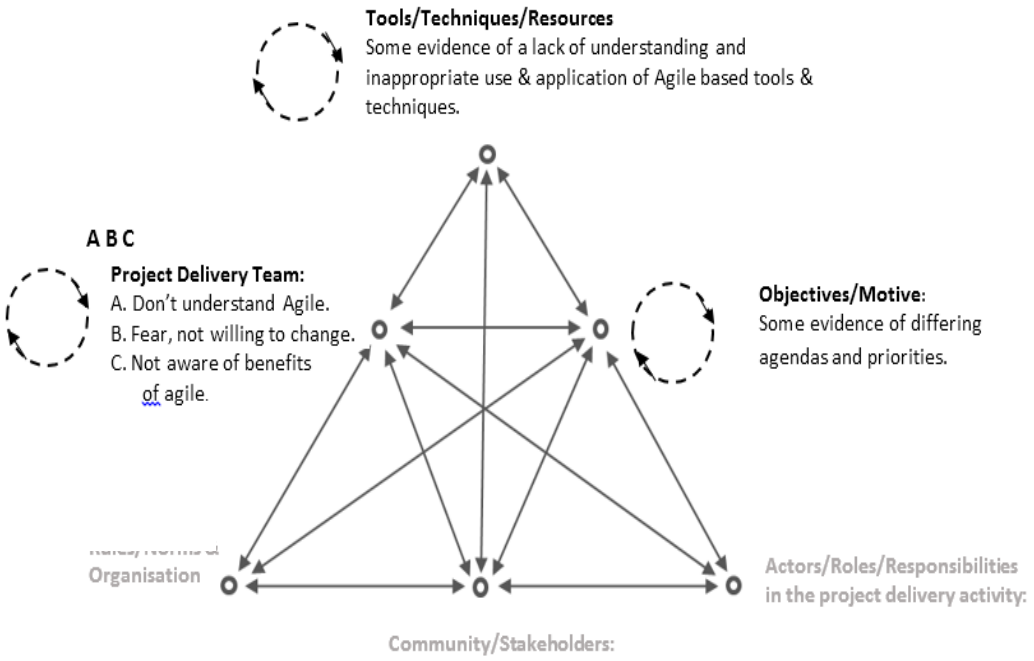
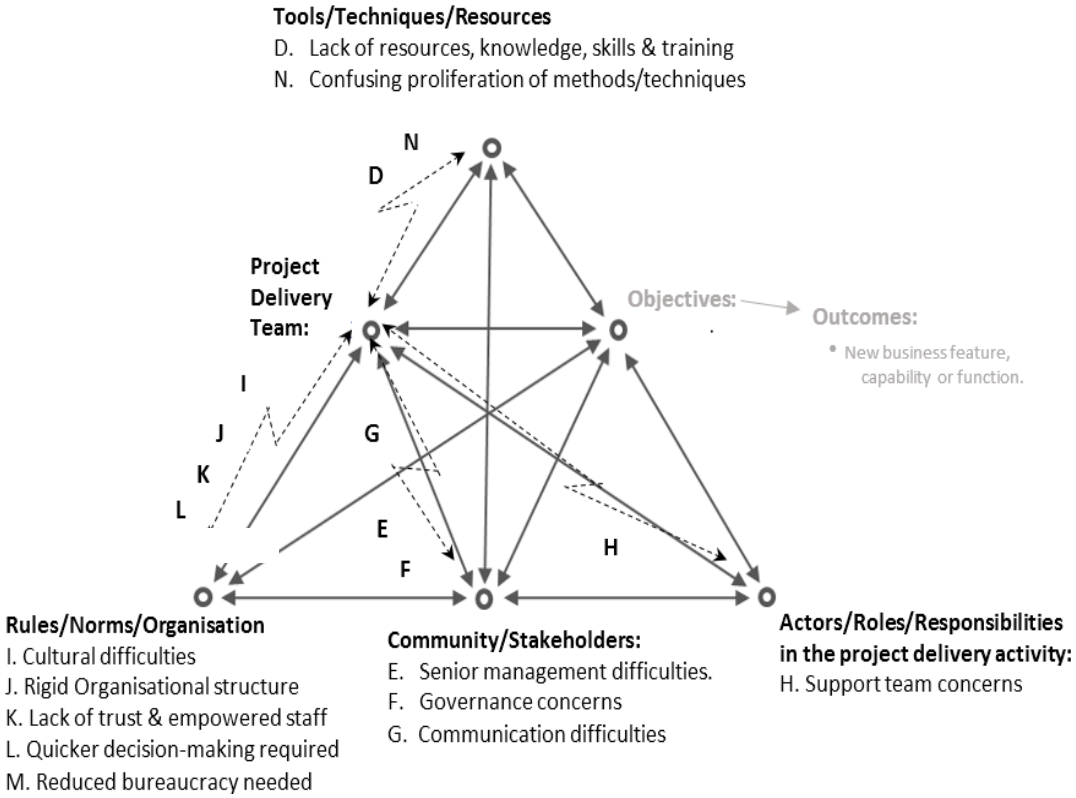


Figure 3.3: Secondary Contradictions between nodes – A deeper level of analysis



As can be seen in Figures 3.2 and 3.3, information is confined to an aggregated indication of the location of contradictions and issues either within nodes or between nodes. Similarly, tertiary contradictions between the current activity and an improved version

and quaternary contradictions between the activity and a neighbouring one, could be presented in a simple list form but would not enable further decomposition or analysis. The following table provides a brief description of the contradictions identified in the above analysis.

Table 3.3: Contradiction descriptions

	Activity Node/s	Description
Primary Contradictions		
Subject (Project Delivery Team)		Difficulties/friction in working together as a team
		Differing levels of experiences/knowledge
		Variable capacity/willingness/fear to change
Tools/Techniques/Resources		Agile practices and tools are unclear
		Tools and resources not linked with benefits
		Proliferation of different tools.
Objectives		Differing/conflicting views of objectives,
		Priorities and agendas are unclear.
		Objectives changed without notice/rationale.
Secondary Contradictions		
Project Delivery Team - Tools Objectives		Lack of knowledge or skills in how to use tools. Project team not trained to use tools/resources effectively.
Project Delivery Team – Rules/Norms - Objectives		Traditional project delivery approaches, rules, norms such as big design up front, sign-off procedures etc conflict with the adoption of agile practices.
Project Delivery Team – Roles - Objectives		Division of labour in terms or empowerment. responsibility and reporting conflict with agile practices.
Community -Tools – Objectives		Ancillary departments/senior management distrust of agile tools and practices
Community -Rules/Norms - Objectives		Organisational bureaucracy, compliance and governance impact adoption of agile practices
Community -Roles - Objectives		Wider organisational involvement doesn't include correct decision-makers, or may impose additional roles & responsibilities

3.3.2 Limitations and lessons learned

This initial examination provided some indication of research issues at a very high level. Extrapolations were somewhat constrained because the results had been obtained from multiple individuals and organisations. To progress this analysis further it would be necessary for detailed research to be undertaken of a full project delivery system that is embedded within an organisation's project delivery capability. This would provide much more significant insight into the learning and development obstacles that organisations face in their transition to and continued development of Agile delivery practices. Considering the points and lessons learned from the research activities undertaken, the next step was to undertake an initial case study to exploring these elements in depth.

3.4 The Initial Study: A Scottish Higher Education Institute

The first approach to the organisation was made via an interview request to a web developer and Scrum master employee in early March 2017 (row 1 in Table 3.1 above). The organisation is an established Scottish higher education institute and the research was conducted within the department dealing with corporate level communications. To preserve the anonymity of the organisation and its employees, descriptions are deliberately general. Henceforth the organisation will be referred to as Edu-Institute and the individuals discussed have either been assigned pseudonyms or are referred to by their roles (in italics). The web developer and Scrum master at the centre of this Initial Study is referred to using the pseudonym 'Raj'.

The total research activity with Edu-Institute comprised two interviews with Raj and four observed teamwork events consisting of two planning sessions, a client meeting, and a client demonstration. The interviews book-ended the observation events. They were recorded, and subsequently transcribed. Written notes were taken during the observations events which were each around a half day in length and took place during a four-week period in February to March 2018. No other interviews or observations were conducted for this Initial Study.

The first interview was one of the five that took place (Section 3.3.1 above) in March 2017 at the start of the research activity. Contact was maintained after the interview and there were further requests for his organisation to participate in the research. Raj was wary of the commitments required from him and his organisation, and requested an outline of the likely time and involvement that the research would require. Raj also relayed Edu-Institute's concerns regards the discovery and disclosure of organisational information that the research might uncover such as:

- Information that was confidential.
- Processes and workflows that may provide significant competitor advantage.
- Information regarding security of the organisation's information infrastructure.

Assurances were provided that the research would not impact on any of these areas, and the organisation waived the need for a Non-Disclosure Agreement (NDA). The organisation was also aware that attention would focus on those points in the delivery process that involved interactions within and beyond the development team.

Within an Agile development environment, this was most likely to include elements such as sprint planning meetings, retrospectives, interactions with clients including requirements gathering and software demonstrations.

By January 2018, confirmation was received that the study could proceed, and it was decided that research activity would follow the largest team consisting of six individuals whose work focussed on the design, build and maintenance of Edu-Institute's corporate web pages. The following discussion of the study is structured as follows.

3.4.1 Edu-Institute – introduction and origins of Agile methods.

3.4.2 Edu-Institute - adoption, growth and development of Agile methods

3.4.3 Observation of the planning sessions

3.4.4 Observation of a client meeting

3.4.5 Observation of a client demonstration

3.4.6 Termination of the Initial Study

3.4.7 Initial study findings

This structure affords an historical and organisational perspective to provide a suitable context for the application of the AT framework. Throughout this discussion the identification of contradictions, both current and resolved are noted. Contradictions that are identified within the project delivery activity are designated by an italics font in square brackets i.e. [*secondary contradiction*]. Nodes within the activity triangle are identified in square brackets without italics i.e. [Subject].

3.4.1 Edu-Institute - introduction and origins of Agile methods

The initial drive for an Agile approach came from Raj around 2008 but, due to various setbacks, such as opposition to the approach, personnel changes and organisational re-structures it had taken some time for the approach to become established [*past multiple secondary, tertiary and quaternary contradictions*]. Within the team there were mixed views on Agile practices, with some exhibiting scepticism towards the Agile approach [*primary contradiction*].

The team (initially three in number) started by using Kanban[2] boards and Post-it™ notes to keep track of deliverables. They quickly experienced benefits in terms of transparency

[2] A Kanban board is a visual tool used to communicate and model workflow and status using sticky notes and a large white board. Tasks are "pulled" left to right through different stages where each stage has fixed capacity.

of activities. The team used this approach to aggregate and view all their projects and current commitments and were able to identify the commitments more accurately (from an initial five to twenty-five projects). Initially, Raj was able to run small projects using Agile practices without his manager's involvement. This person was not convinced of the merits of an Agile approach. The manager, 'Stuart', was relatively new to the organisation and had expertise and experience in an unrelated domain. Stuart [Community] regarded the web focus of the team as an area of high risk and to an extent did not understand the principles and rationale of an Agile approach [*secondary contradiction*]. Instead, Stuart was very focussed on a more traditional PRINCE2™ [3]approach. When Raj explained how Agile could address his concerns, he refused to meet with the team further and communication thereafter was channelled through another senior manager [*secondary contradiction*]. The situation deteriorated significantly as the following quote shows.

> *"It was just horrible we ended up doing nothing other than support and so we weren't allowed to do our jobs, so we had this huge backlog of projects we had a vision to improve things… we understood the importance of where mobile was going to go, and we needed to address that and prepare for that. He didn't want anything to do with that… he didn't give us any time to actually find out what we were like or what we were doing he just pretty much ignored us and so we allowed that to run for about a year."*
>
> (Source: Raj's first interview)

This prompted some 'political' manoeuvring [*attempts to resolve a secondary contradiction*] behind the scenes where the team convinced the head of IT [Community] that Stuart was an obstruction to team progress. In addition, the team set-up another small team in another department whose head was supportive of their attempts at adopting Agile. This team was described as or perceived as being highly successful by senior management because its first project went well. The team was able to promote and build on its success, particularly with regard to its interactions with end users and clients. With the aid of key senior management sponsors (and an external consultant), this led to a management decision [Community] to adopt the DSDM Agile PM method department wide.

[3] PRINCE2™ is a registered trademark of AXELOS Ltd. PRINCE2™ is an acronym for Projects IN Controlled Environments. PRINCE2™ is a UK Government-sponsored project management methodology

Despite this success, there were issues within the development team itself which was split because one team leader favoured another Agile method rather than the selected method. This caused a rift within the development team with part of the group siding with this dissenter "through loyalty rather than because they believed in it and so there was quite a tension in the team" (Raj's first interview) [*primary contradiction*]. Resistance also came from team individuals who had been trained in PRINCE2 over the previous few years. They did not share Raj's enthusiasm for the Agile approach [*primary contradiction within subject node*].

From the above it is apparent that there are contradictions and issues with regards to the origin and development of the Agile approach. This would conform to the rather intuitive perspective as well as the steps of the Engeström's (1987) Expansive Learning cycle that states that initial issues and contradictions are likely to occur first within the nodes themselves. In this case after the development team-members had reconciled themselves with a new way of working, this then extended beyond the team [Subject] environment as the team started to actively use the Agile approaches within the wider organisation [Community] resulting in issues and friction.

3.4.2 Edu-Institute - adoption, growth and development of Agile methods

The corporate department within Edu-Institute selected the Agile method which most closely complied with the organisation's existing processes, procedures and decision gateway structures and which had an emphasis on the pre-project phase (Agile PM[4]). Within the development team, more technically focussed Agile methods which were different to the department method were being deployed.

The development team was content to continue to mix and match different Agile method perspectives. From 2014 through to 2016 all the development team and some senior staff [Community] attended Agile PM courses. This initiative and funding were taken by Raj as a positive commitment from management that they were content with the direction that was being taken "which was an amazing affirmation of what we were doing" (Source: Raj's first interview). From an AT perspective this represents the resolution of a secondary contradiction where the business external to the team [Subject] is supportive of its endeavours.

[4] Agile PM is a subset of Dynamic Systems Development Method (DSDM).

It appears that there had been significant resolutions of contradictions with the perseverance of the team and the gradual 'buy-in' and commitment of senior management. However, progress was limited because the team come up against the problem of building future capability whilst at the same time delivering objectives [*tertiary contradiction*]. Part of this problem stems from the lack of a senior individual committed to the Agile process who could interface with the business.

> *"So there was quite a dip in kind of morale at that point when we were trying to build the factory to build the thing but we were building the thing which was the factory and it was just this kind of you know we got ourselves into quite a few knots and I think if we'd had a stronger leader or we'd actually had a leader because we didn't have a head… at that point, who could have said look just give us six months and we'll be up and running."*
>
> (Source: Raj's first interview)

To some extent Raj was relatively content with the level of Agile practice that the software delivery team was achieving. He believed that more frequent and embedded testing would be beneficial, but the biggest issue related to having more frequent collaboration with and commitment from the internal clients. When business clients actively take part and are involved with the delivery of the outcomes of the activity then that role might be specifically identified within Agile practices as a 'Product Owner' or 'Business Ambassador'[5] and this issue represents a secondary contradiction involving the community node.

The organisation's structure created difficulties with fulfilling these Agile roles because individuals were performing so many roles that it was difficult to release them for long enough to assist the Agile development team. Raj's solution was to be bolder and to lay out team demands and requirements more forthrightly. This represents an approach to tackling the secondary contradiction relating to rules and behaviour norms. To the extent where clients were reluctant to participate, the team implemented solutions and warned clients that they would go live at a future date unless the clients intervened with specific points and requests. Raj and the development team were surprised at the success of the approach. Again, this is another resolution to a rules and behaviour norm problem [*secondary contradiction*] involving the secondary node. These examples show

[5] Roles within the Scrum and Agile PM methods

that as the software delivery team persevere in its endeavours, members learnt how to address and resolve contradictions.

The expectations of the management activity and the software delivery team activity represented a clear secondary contradiction and a consequence of management's capricious approach [*Quaternary contradiction*] to Agile methods was that almost all the team members had been off work with stress and illness. This represents a rather stark example of a contradiction where the problems were such that they not only impeded progress and development but also impacted individuals' health.

> *"…you know, so we love this place, and we wanted the best for it, so it was let's fight for it and fight for our own sanity and our own jobs and stuff and it was just horrible. It took to the entire team being off either most of us off on stress or illness for senior management to go 'you know what, maybe they've got a point, maybe we do need to listen to them' and that's really when things began to change."*
>
> (Source: Raj's first interview)

Continual pressure from within the development team as well as the promise made to clients of much faster delivery led to further deployment of the Agile method.

3.4.3 Observation of the planning sessions

Agile software development practices stipulate that, meetings and interactions should be kept to a minimum and that software development activity best occurs when everyone involved comes together (scrum) and then the development team proceeds to deliver (sprint[6]). The output is then demonstrated at the end of the sprint period. The two observed planning sessions took place two weeks apart and preceded each sprint. The development team followed a standard two-weekly sprint cycle and the team consisted of Raj as the project manager, a business analyst and team leader along with three content editors, a designer, and a web developer. The planning sessions had evolved over time with initial resistance and antipathy being overcome by empowering the developers and by retrospectives demonstrating benefits and success. [resolution of a *secondary contradiction*].

> *"I think we started off people hated planning sessions and we'd just go aww I can't be bothered. But actually, I think through a lot of, I guess certainly through a lot of retrospectives and a lot of tweaking things to*

[6] A sprint is a short (usually one to four week) period of uninterrupted software development activity.

give more authority or you know give more ownership to the developers and the content folks. They certainly owned it a lot better and so it took a lot of the pain out of planning sessions.

(Source: Raj's second interview)

The first planning session took place in the team's development office and began with a daily stand-up. The team members then used Trello[7] on their workstations. One of the team members displayed the Trello boards on the large screen at the end of the room (Figure 3.4). Some older task cards were displayed on the wall boards but most planning was done by identifying deliverables using Trello. The full use of the Trello board was instigated by accident.

"We started it because our team leader fell off the roof and broke his foot. We'd been using a whiteboard with post it notes on it to track how much work and who was doing bits of work. And then we moved to Trello pretty much, I don't know, a couple of weeks after it launched initially because A.N. Other had started to work from home".

(Source: Raj's second interview)

Team tasks were identified and included onto the Trello board. The team also undertakes Business as Usual (BAU) support work which accounts for 30% of their workload and this was also included as part of the planning session. Items were also passed on to the UniDesk tool (Support Desk) for resolution. There was a process of constant review and improvement with regards to these planning sessions

"I think it's probably a testament to us getting better at it, better at understanding what we were doing and working in that way with better communication. I guess. We did tend to run it much quicker and I think people got involved more."

(Source: Raj's second interview)

It is indicative here that the Agile practice of retrospectives at the end of each sprint leads to review and reflection which, in this case resulted in improved practice and the consideration of friction points [*secondary contradictions*] and their resolution. In addition, where the BAU planning activity interfered with the team's project planning activity then this led to friction and issues representative of a quaternary contradiction. With regard to their work environment, the team members were able to organise the

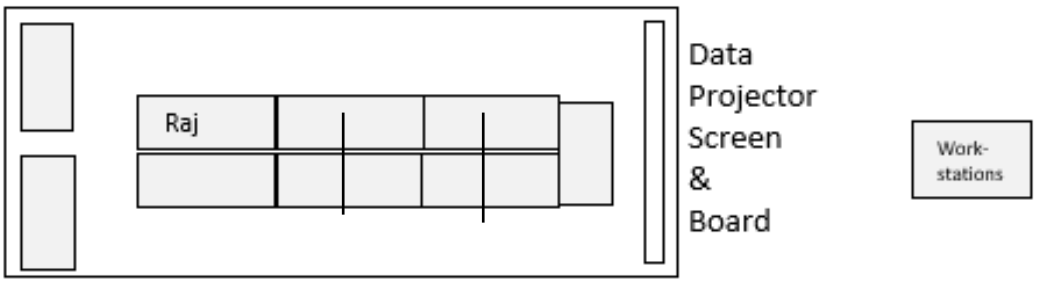
[7] Trello is a web-based agile project management planning tool

planning sessions and themselves in whatever way would align with the Agile practice of self-organising teams.

> *"My perception of it certainly was that we had complete autonomy and we were given the space to do and work the way that we wanted."*
>
> (Source: Raj's second interview)

The layout of the working environment had changed over time. The space had a large rectangular table in the centre of the room with around eight team members arranged around it. This is more than the original number of team members and it appears that additional individuals were drafted onto the team on an as-needed basis. Team members all had their workstations situated around the table and there was a noticeboard and data projector screen on one side. This is illustrated in Figure 3.4 below.

Figure 3.4: Work Room layout



This working arrangement came about due to issues with previous arrangements where a combination of the workspace and personnel created difficulties with collaboration activities and the delivery of software. These could be regarded as primary contradiction within the subject node and secondary contradictions between the subjects and behavioural norms and physical artifacts.

> *"Part of the problem was that… what we had … two members who would just sit and hide in the corner. And you would never know what they were kind of working on. It turns out that they weren't working on anything, they were sitting watching videos of films and stuff."*
>
> *"…we decided that… I say we decided… I thought it might be useful … what if we just had this big island in the middle and then people could move around and sit next to each other and we had a sort of hot desking kind of scenario or the ability for that."*
>
> (Source: Raj's second interview)

The planning sessions were conducted in a relaxed, convivial, and collaborative atmosphere with a lot of humour in the interactions and a variety of anecdotal stories.

The presence of humour was taken as a positive indication of team spirit. In addition, there was little or no questioning of the deployed Agile techniques or procedures.

3.4.4 Observation of a client meeting

The client meeting was a catch-up session with the customers of the development team. Agile approaches strongly advocate close collaboration with clients either through meetings or having client representatives embedded within software delivery teams. Raj and the delivery team were strong advocates of this approach and emphasised the need for such an arrangement from an early point. However, these working practices were not able to be maintained consistently.

> *"When we moved to DSDM, it was from my perspective it was a constant frustration that we didn't get more customers and clients involved and stuff. I think the early part of our program was very much about us writing the rules for the rest of the web and obviously that would involve stake holders and we did get them kind of into rooms and chatted to them and stuff but for the most part it was us kind of making it up or kind of writing down the rules that we already had."*
>
> (Source: Raj's first interview)

There were several factors that impacted on the team's ability to work closely with the clients. There was (a) initial client senior management reluctance for their personnel to be closely involved with the software delivery team and (b) a reticence from the software delivery team to be open to scrutiny.

> *"I think for the most part they were delighted to be asked and involved. I think some of their bosses were a bit more reserved in their enthusiasm. I think importantly the team… the response from the team was both a bit … initially hesitation because we were being watched and there was just a sense of 'oh they're coming in and we're going to get judged for what we're doing' but actually when we got people in and … face to face and speaking to each other and listening to one another that all changed and certainly the response from the team that was really helpful to actually hear from the people who do the work who know that part of the business to… to be able to ask the questions and to chat through and listen.*
>
> (Source: Raj's first interview)

There were significant obstacles and friction that had to be overcome to facilitate collaborative meetings of the software delivery team [subject] with its clients. Firstly, the lack of initial commitment from senior management can be regarded as a quaternary contradiction between two activities where the separate business activity requirements

preclude the release of representative individuals to take part in the software development activity. For this to be overcome, those involved in the client activity would need to have appreciated the value of their collaborative contribution to the software development activity. The second obstacle was overcoming the past behaviour and practices within the team as they attempted to deliver the objective [tertiary contradiction]. For this to be stabilised, a change in the client and software team relationship was required. This was facilitated by choosing to collaborate with those clients that the team were already comfortable with. These were regarded as 'safe' clients.

> *"…we were beginning to open this up to… and the projects immediately before these ones we were working on … there were clients that we'd worked with for a long, long time and had really good relationships with like admissions and corporate comms and so we … we weren't really kind of putting our head above the parapet... these were long established relationships and I think this was bringing new people in."*
>
> (Source: Raj's first interview)

The software development team's reluctance was overcome gradually, and the benefits flowed from a closer collaborative relationship with the clients and the business.

> *"Folks were then reflecting in retrospectives about what went well as how brilliant it was that we were doing this, and we were getting people and what they were getting out of it. Better relationships, better understanding, quicker understanding, able to ask questions there and then and get an answer rather than playing email tennis."*
>
> (Source: Raj's second interview)

In conclusion, it seems that persistence with both the team and the clients led to a better and more productive collaborative relationship, partially resolving some contradictions, resulting from the development team's own retrospectives as well as favourable responses and feedback from the clients.

3.4.5 Observation of a client demonstration

This session took place on Thursday 15th March 2018. It was originally intended to take place two weeks earlier, but adverse weather conditions led to its rescheduling which

perhaps explains why neither the Business Sponsor[8] nor the Business Visionary[9] attended. Raj's line manager 'Penny' was not specifically invited but she did attend the meeting. This was the first demonstration that the software team undertook with these specific business stakeholders present. Although other client demonstrations had taken place, they had either been internal to the team and line management or they had been with 'safe' clients. The meeting was planned the day before with an establishment of an agenda following a discussion of what should and should not be demonstrated. There was some concern that certain elements had not progressed much but, in line with Agile practices, the demonstration was regarded by the team as a good opportunity to obtain client feedback. 'Howard' the developer concerned, was keen to show something.

> "*This is not what it's going to look like but let's just show them something to give them an idea and let's get some feedback."*
>
> Source: Raj's second interview)

However, during the meeting, Penny overruled Raj and indicated that the team would not demonstrate the research site home page. Given the team's commitment to Agile practices and the logistical difficulties of scheduling further collaboration opportunities with clients, this decision was a complete surprise to the development team. The attending clients also noted that something was amiss.

> *"I think it came as quite a surprise to them because they looked quite uncomfortable about it. Actually, I think it was Client-A, I spoke to afterwards and he was like 'What was going on with that?'"*
>
> (Source: Raj's second interview)

As it later transpired, the situation had been developing for some time as noted by Raj.

> *"My biggest disappointment about that whole demo was when we got to Howard's home page mock-up and Penny had been saying to me for days 'I'm really disappointed' in the home page mock-up."*
>
> (Source: Raj's second interview)

This had been one of several disagreements between Raj and Penny. Raj had already pointed out that there were several reasons why the design could not be more dynamic and not being allowed to demonstrate the first pass of the web-site would leave the

[8] A role within the Agile PM and DSDM Atern method

[9] A role within the Agile PM and DSDM Atern method

software development team lacking in direction to move things forward in the next sprint.

> *"…in that meeting she said I don't think you should show it. I'm disappointed that I didn't push for it more. By that point I was just about on the verge of a breakdown"*
>
> (Source: Raj's second interview)

The origins of this contradiction and friction have been explored to identify several points. Firstly, Penny was already critical of Howard's work. He had been used to working from home as he lived fifty miles away from Edu-Institute. Penny decided that Howard's work performance was sub-par, and she stopped his remote working.

> *"[he]…was doing a lot of remote working… and as far as I was concerned there was no issue. And then something changed, and Penny decided that he needed to be in the office every day and that she thought he was slacking off at work and that he wasn't putting in all the hours. Which from my perspective as his line manager I had no basis for that at all."*
>
> (Source: Raj's second interview)

Secondly, Penny and Raj disagreed fundamentally regarding the implementation of Agile approaches with her preference for Big Design Up-Front.

> *"…she definitely had a bee in her bonnet about me because we were having fundamental differences at the start of the project about what was pre-project, and what was foundations and feasibility and what was exploration, engineering and deployment[10]"*
>
> (Source: Raj's second interview)

Thirdly there were other long-standing issues between Penny and Raj.

> *"The previous week she'd hauled me over the coals about a lot of stuff that she'd disagreed with and said that I was doing a terrible job and as far as I was concerned, I wasn't doing any different job to what I'd be doing on the previous project."*
>
> (Source: Raj's second interview)

[10] Stages of the DSDM Agile PM project lifecycle.

Fourthly, Penny would set deliverable dates without consulting the software development team. This was contrary to Agile practices which require the involvement of the delivery team in all planning activity.

> *"She had set the deadlines on certain things and said, 'right you've got two weeks to do Foundations and then we're starting building on this particular day' But I'd not had any input into that and neither had the rest of the team. So, she was just kind of pulling arbitrary dates out of the air to fit her schedule because her bosses were pushing her for a date for when it would start and when it would finish."*
>
> (Source: Raj's second interview)

This is indicative of a secondary contradiction between Penny and the behaviours, norms and practices when delivering the objectives of the software team. Fifthly Penny sought to re-assert her control and authority in the work of the delivery team.

> *"I was PM for this project, and we'd just have a kind of feedback and I would say that 'But I'm not doing anything different to the last ten projects that we've done and look we've had successes with all of them and I'm not worried about this.' And she'd say, 'well I am worried about this, I am worried about it', so it didn't seem to … I don't know what was going on."*
>
> (Source: Raj's second interview)

The source of Penny's approach and desire to control stems from a wider organisational context according to Raj.

> *"There's definitely an institutional aspect to it. It didn't matter how often we said essentially to the Executive who was sitting on our programme board. Didn't matter how often we explained to him what Agile meant and the way that we worked; he'd always say when is this project going to get finished exactly. I want this, when's this happening, why have you not done that?*
>
> (Source: Raj's second interview)

These contradictions and frictions can be grouped into two types.

1. There are the behavioural norms and rules adopted by Agile practitioners which in this case were overridden by Penny in points two (evolutionary development), four (plan together) and five (lack of trust and empowerment) above.
2. Then there were organisational norms and practices being re-asserted as in point one above where Howard was required to cease working from home. In

effect this reflected not only a conflict with accepted good management practice in terms of facilitating flexible working but also a contradiction with Agile principles of trust and empowerment.

The resolution of these contradictions cannot be extended as no further investigation was possible as explained by an email that was received by the researcher from Raj the day after the demonstration took place.

> "*Just a quick email to say that I will now not be in the office on Monday. I strongly advise that you stay away. I'm really sorry. This morning I have signed myself off with stress. It has been building for a while and this morning I broke down. I have an appointment with occupational health this afternoon."*
>
> *"In your research you said you were looking out for areas of friction—I've found some! How we get through this, I don't know. Or whether I want to, to be honest. I don't think [Edu-Institute] is ready for the reality of Agile."*
>
> *(*Source: email communication from Raj)

Apart from the obviously impossible situation that Raj had now found himself in, this perhaps represents a significant contradiction that resulted in the longer term absence of an employee from the organisation. Raj alluded to the organisation not being ready for Agile: this represents a quaternary contradiction between the software development activity and other organisational activities.

3.4.6 Termination of the Initial Study

The demonstration of the prototype home page for the research site was the catalyst for the conflict and disagreement that led to the termination of the research activity and Raj's subsequent departure from the organisation. Given that Raj was the instigator of the Agile approach within the organisation, it is likely that Raj's departure would have had a substantial impact on the software delivery team and function.

This may be regarded as a tertiary contradiction where the older or established method of delivery prevented the 'improved' version from succeeding.

Consequently, established processes and practices did not give way and ultimately prevented the Agile approaches becoming adopted. There was no opportunity to return

to the organisation to determine the extent of the hiatus in the adoption of the Agile approach or whether it continued at all.

3.4.7 Initial study findings

The Agile implementation within Edu-Institute was very much a 'bottom-up' approach where individuals such as Raj implemented Agile at the technical developer level first and then extended it upwards and outwards from there. The software development team, while embracing Agile approaches and practices, overcame primary contradictions within such nodes as Subject, Tools and Artifacts, and Rules and Norms.

Secondary contradictions were also identified, and they had either been overcome and stabilised or were still problematic. Significant community node based secondary contradictions remained as well as tertiary contradictions which prevented the organisation moving forwards with this change. These occurred between the software development activity and a future instance of it. Some key quaternary contradictions (between the software development activity and business activity) continued to pose problems at the point where the Initial Study was terminated.

The organisation's past use of conventional project management approaches caused significant and continuous barriers to the take-up of Agile practices. Small advances with Agile practices were susceptible to changes in personnel or organisational practices. Every-day organisational work practices and culture affected the take-up of Agile practices. A top down 'command and control' structure and conventional adherence to the iron triangle (cost, time and scope) view on project delivery continued to impede Agile practices.

The pace of change was very slow: only incremental changes within the team through the resolution of primary and secondary contradictions took place. However, when these changes were about to become embedded or permanent (resolution of tertiary contradictions) or when they impacted other business activities (quaternary contradictions) then there was strong resistance to change. The team did have some limited success, but this took place at an informal level where the team members self-organised and were empowered to develop relationships with other individuals in other activities. However, when attempts were made to formalise these relationships (closer client collaboration) there was significant resistance.

Throughout there were continual attempts to make changes but these were met with 'organisational antibodies' that resisted change. In the face of this the development team continued with their Agile initiative often in 'stealth' mode. In this preliminary research the AT perspective provided some assistance in understanding issues when implementing Agile approaches. This topic will be addressed further in later chapters discussing the main Case Study.

There were difficulties in contextualising these points and identifying their inter-relationships. More useful insights could have been obtained if the study had continued and there were still several points that could be addressed to greatly facilitate further work.

Overall, it is apparent that overcoming primary and secondary contradictions as part of the learning process has its difficulties and issues, but progress can still be made. There is evidence that the magnitude of tertiary contradictions is substantial and there are difficulties in resolving these contradictions.

3.5 Conclusions and lessons from preliminary research

Overall the three main elements that make up this preliminary research produced data that was fragmented, disparate and a challenge to consolidate especially with the potential for conflicting evidence. Nevertheless, a somewhat aggregated picture did emerge that related to the difficulties and challenges of learning new agile practices and adopting agile practices within an organisational environment that is culturally unused to and indifferent (perhaps unsuitable) to agile practices.

There were significant benefits of the approaches adopted:

- The combination of observation and interview data collection methods used within the Initial Study did provide some understanding of the rich complexity of elements involved with Agile implementation.
- Interviews were by far the most valuable source of information: observations were useful in providing supplementary evidence. Given that the area of research does not involve the use of new physical tools or new forms of interacting with physical objects then there is a limit to the value of observations. Similarly, due to the lack of focus on the detailed use of physical tools, the level of activity analysis could not extend to the operations level (activity → actions → operations) that involve sub-conscious aspects (such as changing gear whilst driving).

In addition the use of AT provided a useful framework for examining issues related to the implementation of Agile methods. Its emphasis on the social, cultural, and behavioural elements was particularly relevant because these are the areas of transition and development within organisations that are most likely to be affected by characteristic Agile practices such as empowerment, self-organising teams and closer collaboration as discussed in the Literature Review chapter.

Using the AT framework to analyse the data collected from the five interviews and survey provided a useful way to understand the types of issues and difficulties that implementing Agile methods produced (Table 3.2 and Figures 3.2 and 3.3). However, the data collected was not able to support in-depth detailed analysis providing context and information on inter-relationships and connections. In addition, a challenging task was categorising the types of contradiction that were observed or were being described in the interviews as well as their inter-relationships. For example:

- Distinguishing between primary and secondary contradictions was difficult in an activity context. That is determining whether the contradiction lay within a node or between two nodes required significant interpretation.
- Identifying tertiary contradictions was also challenging because it is not a simple matter to identify the attributes of a future, more mature instance of an activity given a wide-ranging discussion.
- Distinguishing between quaternary and secondary contradictions was also problematic particularly in the Agile project management domain which crosses multiple organisational functional boundaries. It can be quite challenging to unpack a description of an activity in this context and determine whether it is part of a project delivery activity or another associated activity.

There were further significant difficulties involved in the data gathering approaches adopted.

- Issues ranged from the span of interviewees and the broad questions posed to the survey of individuals from different organisations and the interview and observation approach involved in the Initial Study.
- The data collected was unstructured and inconsistent providing little indication of significant linkages and inter-relationships.
- The Initial Study took some time and there were also difficulties in identifying relevant issues from observation alone. There was also difficulty in balancing observation of the very busy development team with observing and interviewing the client side to obtain a balanced and nuanced perspective.
- A data collection approach based on interviewing individuals from different organisations, and on surveys with large numbers could not provide the necessary level and depth of analysis. Additionally, although observations were useful for providing background and contextual data, a more specific, efficient, and consistent approach to data collection would be needed.

As a result it became apparent that further research activity capable of addressing the first Research Question:

RQ1: What insights and understanding can a Practice Theory based organisational learning approach provide when adopting a large-scale Agile method?

would require a modified approach observing the following criteria.

- More specific structured questions closely based on the AT framework would have been much more beneficial in eliciting useful responses than asking the broad questions used in the preliminary research above. There may be concerns about 'leading' the respondents, but the questions could have been suitably worded to avoid this. This approach could have provided a level of focus and consistency that was missing from the preliminary research interviews and survey.
- In addition, it would have been useful to define some clear rules and examples that could have been used to categorise contradictions quickly. For example, there is a lack of clarity as to how management relates to the team, i.e. whether both are part of the community node of a single activity system or are parts of a separate neighbouring activity system. This approach would have provided an additional measure of consistency and avoided the difficulties identified above. With so many contradictions and issues all related to one project delivery activity, it is difficult to understand which ones are significant, what their sequence is and what their inter-relationships are.

Many of these identified issues could have been addressed if there was a standardised approach to defining an activity. This would be especially beneficial within an Agile environment, where activities are not closely defined. This would facilitate the deconstruction of the project activity into more granular activities and would help to address many of the above points and would open up the activities to more complex and in-depth exploration.

To achieve these elements, it is necessary to re-visit the literature in both the Practice Theory and Agile delivery domains. The next chapter describes the development of the resulting CATF framework.

Chapter 4: Development of the consolidated Activity Theory framework (CATF) analytical tool

4.1 Introduction

Analysis of the output from the preliminary research (Chapter 3) led to a re-examination of the features of Activity Theory (AT) and its use as an analytical tool to investigate the implementation of large-scale Agile delivery methods. The main issues that emerged from the preliminary research are summarised as follows.

1. Applicability and demands of the observational and ethnographic approach to data gathering.
2. Unstructured data with little opportunity to link different elements together.
3. Difficulties in determining contradiction types without extensive knowledge of context.
4. Difficulties in determining what constitutes a separate activity and the level it operates at.
5. The need for a more comprehensive and granular level of analysis.
6. The need for more guidance and direction and a standardised consistent approach.

To build on this learning, it is necessary to re-visit both the AT literature and the Agile methods literature to develop a more structured, consistent, repeatable, granular, and closely defined analytical framework for the much larger main Case Study. Although this re-examination of the literature was grounded in the experiences of the preliminary research activity, the subsequent re-examination of the literature gave rise to an evolved consolidated Activity Theory framework (CATF) that goes further than solely addressing the issues raised by the preliminary research. This chapter consists of seven sections each addressing an aspect of the development of the CATF. The first section (4.2) reviews three of the five underpinning principles of AT. This section presents a modified hierarchical activity structure that helps to further define the approach to be used for activity analysis. The section also examines the role of artifacts and adopts three levels of artifacts that have been identified within the literature.

Section 4.3 considers in depth Engeström's Expansive Learning Cycle in which the four contradiction levels are sub-divided into learning actions at each level (Engeström et al., 2013). These learning actions are applied to the main Case Study to provide a more granular analysis of learning events. This should provide a much greater level of analysis and understanding of the expansive learning cycle than was possible in the preliminary research. Section 4.4 focuses on the Community node of Engeström's activity triangle to provide greater clarity of the constituent elements of the activity triangle. Researchers have varied opinions on the elements that make up the Community node, so this section clarifies the position adopted in this study. This position has significant impact on the development of the CATF and the subsequent identification of 'variants' of secondary contradictions such as 'local' and 'external' contradictions.

Section (4.5) introduces the concept of temporary stabilisations (Allen et al, 2013) which accompany contradictions and which, instead of leading to substantial change and evolution, result in some form of stability. There was some evidence of these stabilisations within the Initial Study (Edu-Institute) where the delivery team was able to make some progress with implementing change. Because activities almost continuously progress through change by contradiction resolution (Engeström, 2001) the intermediate points of stability are worthy of analysis. Similarly, Section 4.6 introduces the co-ordination, co-operation, and co-construction levels of collaborative activity as they relate to the resolution of contradictions. Identification of these collaborative activity levels within the main Case Study provides some indication of likely progress towards contradiction resolution.

Section 4.7 addresses the operationalisation of the CATF, returning to the source literature after reviewing the outcomes of the questions deployed during preliminary research. The open, general questions of the preliminary research are replaced by a revised question-set that is more specifically targeted at the elements of Engeström's activity triangle. Finally, Section 4.8 addresses the definition of activities within the Agile delivery domain, in response to the preliminary research's difficulties with assembling a detailed analysis when the whole project delivery cycle is regarded as a single activity. The Agile maturity model literature is examined to closely define the scope and elements of an Agile activity. This section identifies six generic activities that can be applied to all Agile delivery methods.

The developed CATF analytical tool complies with the following criteria.

1. Adheres to Activity Theory principles.
2. Provides a structure to guide and direct research questions so that the key issues and elements that need to be examined can be quickly identified.
3. Is clearly articulated, facilitating a consistent, coherent, and granular investigative approach across multiple functions, organisations, and environments.
4. Facilitates detailed analysis that can yield significant results.
5. Relates to the Agile methods delivery domain, and is accessible to other researchers.

Following application to and feedback from the main Case Study, the CATF is capable of evolution and amendment. It is presented in a format that can be easily utilised in future work with a discussion that provides a rationale for its use. The following sections form this discussion.

4.2 Re-visiting the Activity Theory literature

AT literature varies in its emphasis, and is at times confusing (Sannino, 2011) with various authors (Roth, 2009; Kaptelinin, 2005) often critiquing others as to how well their approach aligns with some of the originating work by Vygotsky (1978) and Leont'ev (1978). The published literature has created a complex and sometimes disorienting domain that makes it difficult to extract useful guidelines and principles for the application of AT. The following significant complicating elements have been identified.

- Developments and changes in Activity Theory perspectives over time (Hasan et al, 2017)
- Different schools of thought that emphasize different elements of AT (Bertelsen & Bodker, 2003; Kaptelinin,2005; Hasan et al., 2017).
- Highly selective application of different elements of AT. Sometimes the focus is on contradictions, sometimes mediation and less frequently expansive learning (Kaptelinin & Nardi, 2006; Engeström, 2013; Bardram, 1998).
- Many studies that apply AT to some extent often explain its merits and basic elements but then do not discuss or explain in detail how it is has been applied (Bodker, 1996; Collins et al., 2002; Hasan et al., 2017).
- Some authors look to combine AT with other approaches (Riechert et al., 2016).
- AT has been applied at different levels in different domains with different emphasis on HCI (Kaptelinin & Nardi, 2006); software programming (DeSouza & Redmiles, 2003a); health and social studies (Engeström, 2000; Vilela et al., 2014); surgical practice (Bardram & Doryab, 2011); the legal profession (Engeström et al., 1997). In each domain different aspects are applied, and different elements of work are considered, so it can be difficult to assess common elements and draw generic lessons.

The lack of in-depth guidance in the literature became evident during the preliminary research, with difficulties in identifying and describing discrete activities and how these activities contributed to the learning and development overall. In the Initial Study's Agile environment, it was unclear what constituted or characterised the activities. Additionally, there were other issues such as the consistency of activities within a function or across different departments within the organisation. Similar questions also arose regarding lower AT levels: Actions and Operations. This caused some difficulty

when attempting to develop a consistent approach. Direction and assistance were needed for the following aspects.

- Level of activity: Does software development constitute a single activity or a collection of multiple activities along a timeline?
- Is project delivery in itself a coherent single activity?
- At what level should all this operate - is requirements elicitation (Martins & Daltrini, 1999) a separate activity from software programming or testing activity or are these actions?
- Should a trajectory or timeline along which activities interact be identified, and should this follow a typical project delivery or software development lifecycle.

Consequently, it became necessary to re-visit AT's five underpinning principles, to identify guidelines upon which to construct a research approach. Prompted by the problems and issues arising from the preliminary research, this section has re-visited AT principles to develop an adapted approach to enable a more structured and detailed analysis of the main Case Study.

4.2.1 Activity Theory principle - hierarchical decomposition

Hierarchical decomposition impacts on the unit of analysis (Mursu et al, 2007; Sannino, 2011; Roth, 2009) and is especially important for this study given the diverse nature of the main Case Study and the level of detailed analysis required. In the Initial Study (Chapter 3), the focus was on software development, but there are wider elements involved in the delivery of projects such as attending client meetings and eliciting requirements. In addition, the artifacts to be considered for each of these activities vary. For example, a development tool could be an artifact for programming, but managing delivery might use a completely different tool (e.g. a Gantt chart, an Excel spreadsheet). Similarly, the rules and behavioural norms for each activity would be different, as might the constituent elements that make up the Community node and Division of Labour nodes. Although Engeström (2000) suggests that a merit of activity theory is that it transcends different levels of analysis (e.g. micro, macro, mental or material), there is little guidance available on how to apply AT consistently across a broad range of contexts. Much is left to the researcher's interpretation; an example of interpretation is

provided by Barthelmess & Anderson's (2002, p.16) research into the actions and operations elements of the software development activity:

> *"Software development starts with an extremely abstract object (e.g., 'develop a new system') and is realized via a highly creative application of actions that build and transform knowledge representations that are shared by a team. Operations may involve, for instance, drawing a diagram or writing a specification."*

The difficulty with this interpretation of operations (the lowest level within an activity, occurring at the sub-conscious level) is that the statement "Operations may involve, for instance, drawing a diagram or writing a specification" is counter-intuitive because it is difficult to conceptualise how "drawing a diagram or writing a specification" can be a sub-conscious act similar to that of changing gear whilst driving? AT literature mostly refers to one or two key contributions (Engeström, 1987; Engeström, 2000). Sannino (2011) states there have been various critiques of the use of Engeström's (1987) original representation of AT as a conceptual model for analysis of social practices. Of special significance is the work by Bedny & Karwowski (2004, p.135) who disagree with Engeström's definition of an action in his study of child medical care (Engeström, 2000). Instead, they regard Engeström's 'actions' as 'tasks' which they regard as "a problem-solving endeavour with an underlying subjective mental representation of the task".

To illustrate, these authors critique Kuutti's (1995) examples of hierarchical decomposition wherein Kuutti (1995) describes 'building a house' as an activity and 'fixing the roof' as an action. Instead Bedny & Karwowski (2004, p.136) state that these elements are part of a process consisting of a sequence of tasks. Each task is an activity which can then be decomposed into actions which themselves can then be broken down into "psychological operations". Bedny & Karwowski (2004, p.141) define a task as

> *"…a logically organized system of mental and behavioural actions directed towards an ultimate task-goal. The task is the basic component of activity and human lives can be conceptualised as an ongoing attempt to solve tasks as problems, typically tasks are organized in a logical sequence the performance of which enables attainment of final system objectives."*

A recent paper by Cash et al. (2015) draws extensively on this aspect of Bedny & Karwowski's (2004) work and on Bedny & Harris's (2005) attempt to build a multi-level theory applied to the engineering design process. In their paper, Cash et al. (2015) ask the relevant question.

"At what scale do distinct design activities and tasks occur and how are the various scales related?"

This is an important question that is equally applicable to the realm of project delivery and software development. In this context, it can be re-stated as "At what scale do distinct software development and project delivery activities occur, and how are they related?". Cash et al. (2015, p.2) state that "as with any technical system, the ability to describe behaviours and properties of the system across multiple scales is essential for generating deep scientific understanding". Borrowing from Bedny & Karwowski (2004), Cash et al. (2015) arrive at an 'Activity → Task → Action' structure that differs from the Engeström (1987) structure of 'Activity → Action → Operation'. Cash et al. (2105) define their levels as,

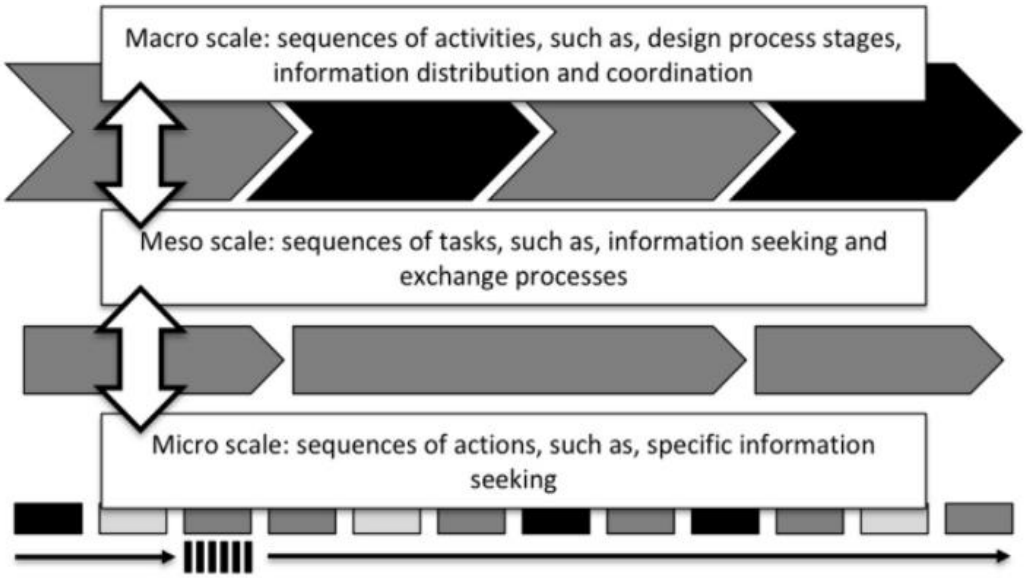
Activity: A goal directed system where cognition, behaviour and motivation are integrated (after Bedny & Karwowski, 2004). Activities are associated with several conceptually linked tasks and an example activity identified is the development of a new design concept.

Task: A logically organised system of actions required to achieve a goal under a specific condition (after Bedny & Karwowski. 2004). Tasks can be identified in reference to the completion of specific goals which are aligned with the motivation of the associated activity.

Actions: Discrete parts of a task that fulfil intermediate conscious goals. They can be identified as the completion of sub-goals required to complete a task.

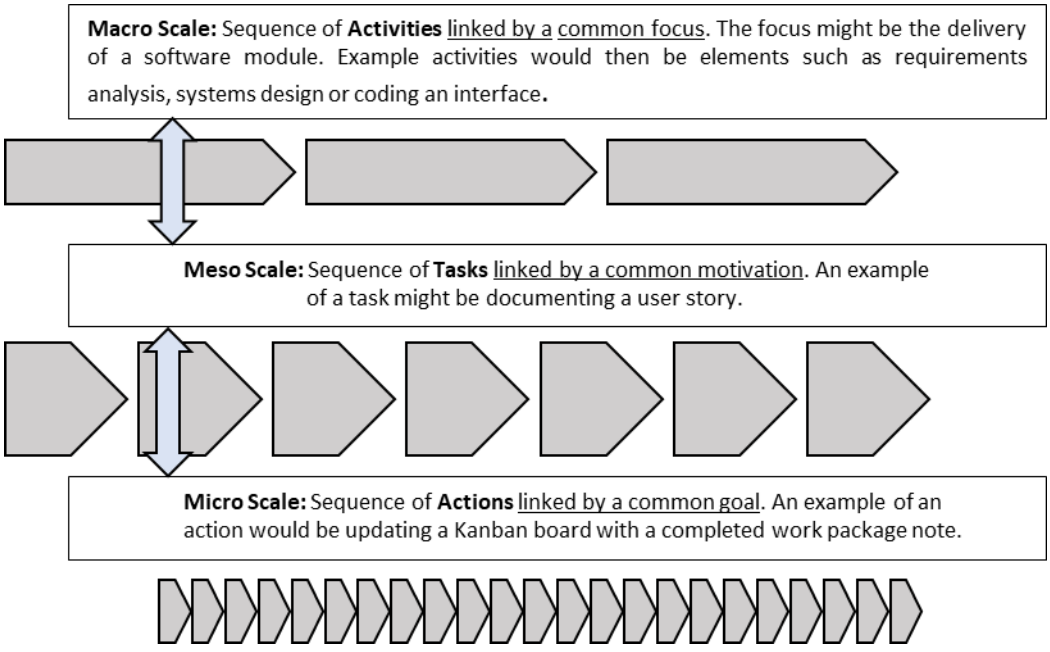
This differs significantly from the usual application of hierarchical decomposition within the IS/IT domain (Kaptelinin, 2005; Kuutti, 1995), particularly with regards to the HCI discipline which mostly relate to the top part (Artifact) of Engeström's triangular framework. Bedny & Harris (2005) view the production process as a sequence of transformations of raw material into finished products. Processes contain three elements, namely human activity, the means of work (tools and equipment) and the product itself. Cash et al. (2015) apply this to the design process arriving at the following illustrative diagram which also has these three levels.

Figure 4.1: Framework showing different levels of Activities, Tasks and Actions (Cash et al., 2015)



This structure can be similarly applied to the Agile delivery environment as illustrated by the following diagram.

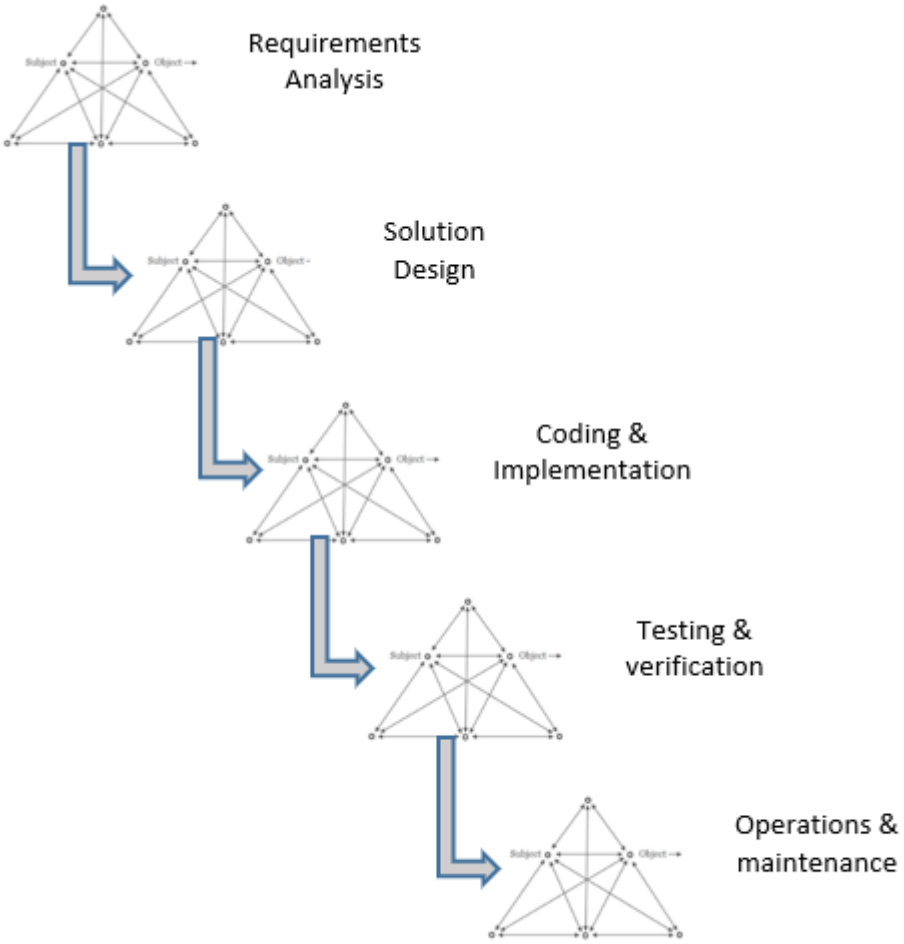
Figure 4.2: Levels within the Agile Delivery environments (adapted from Cash et al., 2015)



For data gathering and analysis, this represents a much more detailed approach to the application of AT rather than the approach that had first been envisioned where the whole of an Agile delivery project was regarded as single activity.

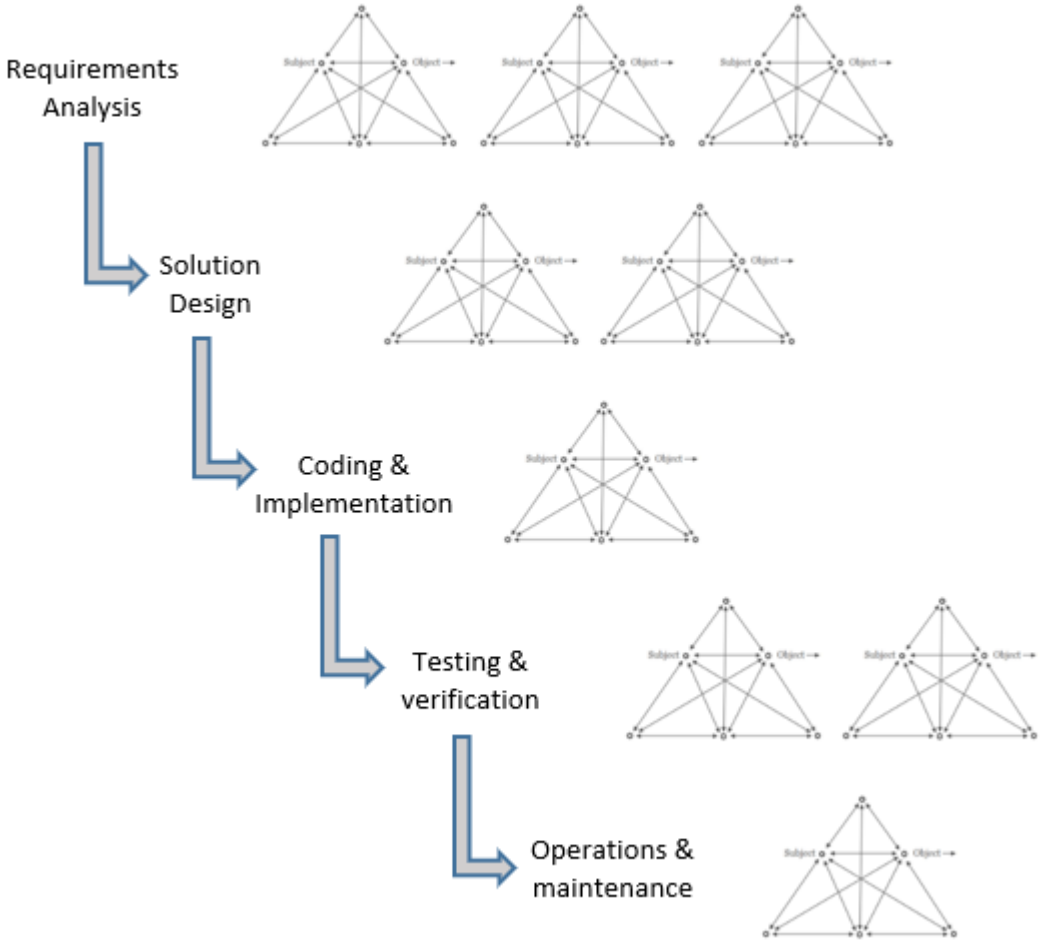
Applying the Cash et al. (2015) approach to the software project delivery cycle could proceed by considering each stage of the software delivery life cycle (SDLC) to consist of separate activities as illustrated in Figure 4.3 below.

Figure 4.3: Each stage of the Software Development Life Cycle (SDLC) as an activity



This rather linear approach might well fit some delivery environments, but most are likely to have more than one activity taking place simultaneously. For example, risk management activities are likely to occur at multiple points in the lifecycle. This is illustrated in Figure 4.4 below.

Figure 4.4: Multiple Activities at each stage of the SDLC



To obtain further guidance as to how the software development and Agile delivery environment may be deconstructed into viable activity-based units of analysis, it is necessary to return to Cash et al.'s (2015) discussion of the engineering process and its decomposition into three distinct levels. It is logical to start at the lower level with actions. By building on the lower level first, it is possible to arrive at a coherent understanding of the three levels applied to the Agile delivery environment (this application is capable of being applied generically). This is illustrated in Tables B.1 to B.3 in Appendix B. This hierarchical decomposition approach to identifying appropriate levels of analysis provides a useful perspective for this study's focus on organisation wide historical and cultural elements, by providing a consistent method of structuring the activities within the main Case Study.

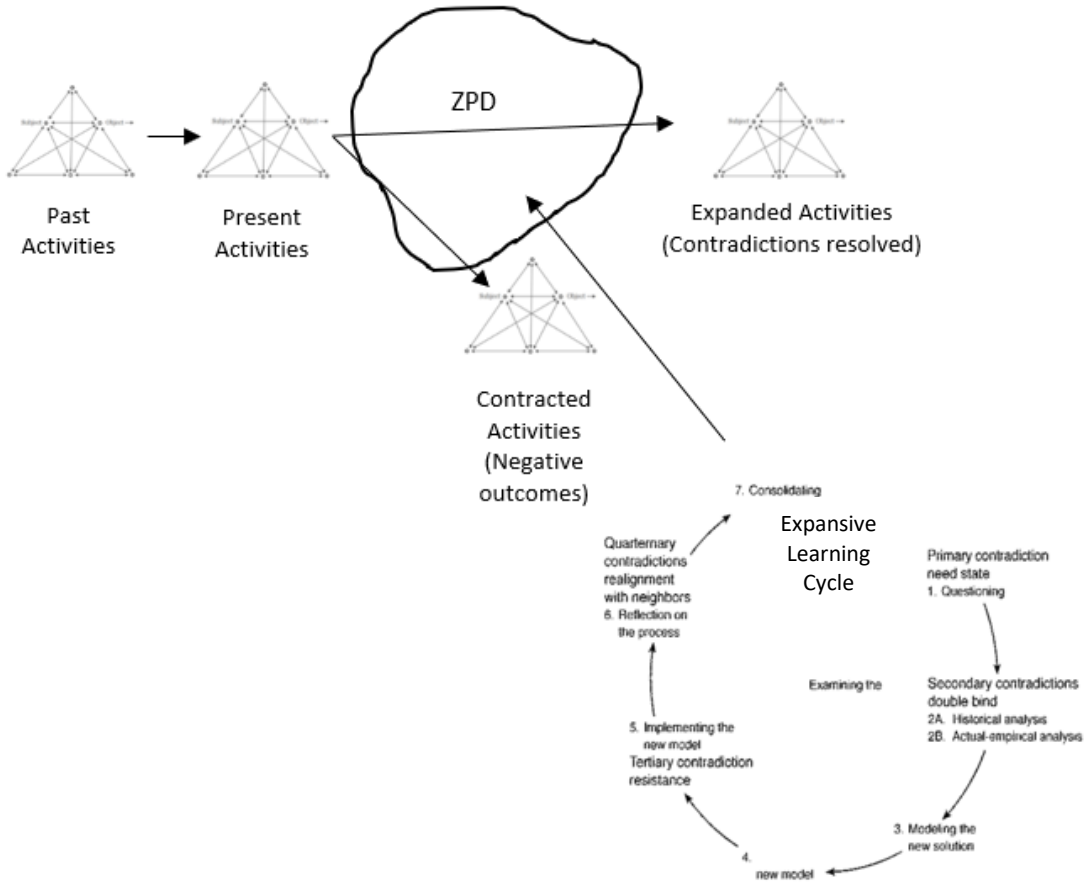
These two changed perspectives of a) possible multiple activities at different points within the software development lifecycle and b) the adoption of Cash et al., (2015) decomposition of activities into tasks and actions would have offered a more appropriate and structured perspective had they been deployed in either of the three

elements of the Preliminary Research discussed in Chapter 3. Combined with the identification of generic agile activities and the scoping work set out in Section 4.8, these perspectives would have enabled a much more detailed and consistent cross comparison and analysis involving all three elements of the preliminary research.

4.2.2 Activity Theory principle – activity development

Martins & Daltrini (1999) state that understanding an activity requires considering how the activity has developed over time. Engeström (1987) identifies the Zone of Proximal Development (ZPD) for any collective activity as the area between the activity's present and its foreseeable future forms. The future form is a solution to a contradiction (or a double-bind) that is embedded within the activity. Engeström (1999) states that the Zone of Proximal Development (ZPD) can only be crossed by undertaking new kinds of actions. Given the above discussion on hierarchical decomposition, this research assumes that this notion also refers to tasks. In a later account, Engeström (in Sannino et al. (2009, p.312)), expands on this area by suggesting that the ZPD is often regarded as "a vertical step that leads to a higher stage or level". This is depicted in Figure 4.5 below. The circle in the lower right of Figure 4.5 is the same expansive learning cycle presented earlier in Figure 2.8 in chapter 2 and in Figure 4.7 later in this chapter.

Figure 4.5: Activities and the Zone of Proximal Development (ZPD) (after Engeström, 1999)



- Past Activities – historical roots and contradictions.
- Present Activities – what is happening now.
- Expanded Activities – future activities where contradictions have been resolved.
- Contracted Activities – future activities where contradictions are not resolved and instead there is a contraction and elimination of opportunities.

This is a useful perspective for viewing the development of large-scale Agile delivery environments where improvement occurs across the ZPD by resolution of contradictions, tensions, and conflicts. Drawing on the work by Bedny & Karwowski (2004) and Bedny & Harris (2005), these contradictions, conflicts and tensions can occur at the task, sub-task and action levels within an activity (defined in section 4.2.1). This follows the expansive learning process as outlined by Engeström (1987, p.125) where contradictions at the action level give rise to new tasks and contradictions at the tasks level give rise to new activities. This perspective provides another approach that was not

able to be deployed in the Initial Study because the activities' and constituent levels had not been closely defined. This is addressed further in Section 4.8.3 and Table 4.8.

4.2.3 Activity Theory principle - mediation

The subject-object dimension of an activity is mediated by tools/artifacts. Artifacts have a fundamental significance within AT. Artifacts are anything that can be used within the activity, including physical as well as non-physical elements such as language or signs. These artifacts may vary at different points in the activity. The artifacts may be continuously transformed to meet the evolving needs of the community (Bardram, 1998). Engeström (1987) states that the introduction of a new form of mediating tool, work practice or technology can impact a collaborative activity, initiating a new process of learning by giving rise to new questions, tensions and contradictions. Kuutti (1996) views artifacts as representing the accumulation of historical experience, retaining within them an 'historical residue' of the development of that activity.

This is typical of much of the IS/IT centred AT literature discussion on mediation focussing on the use of tools and their role in mediating activity (Kuutti, 1995 Kaptelinin et al., 1999). They concentrate on the top half of Engeström's (1987) triangle) because it aligns with their HCI focus on the use of Information and Communication Technology (ICT) to achieve objectives, and on how best to design relevant tools. Jonassen & Rohrer-Murphy (1999) explain that artifacts mediate activity and, as they are used and internalised, they influence mental development. A further decomposition of artifacts is provided by Bertelsen (2000) who draws on the work of Wartofsky (1973). Bertelsen's (2000) classification (unfortunately follows the same nomenclature as contradiction types) of artifacts is as follows.

1. **Primary**: these types of artifacts are used directly in the practice of the activity. They are likely to be external, tangible, or physical and include elements such as instruments, machines, and computers and so on. They are likely to produce changes to the object of the activity.
2. **Secondary**: are representational artifacts that may be used to transmit practices, modes of actions and skills. They are likely to be psychological and consist of language, signs, systems development methods, models and ideas and are

usually internal, symbolic, and mental. They are likely to influence the behaviour of the subjects (team) involved in the activity.

3. **Tertiary**: are not directly related to the activity practice and indirectly influence activity practice by mediating changes in modes of perception (secondary) and consequently the object. They influence modes of perception and modes of action. They consist of cultural systems, context etc where mind and culture will act together (Kuutti, 1996).

Hasan & Banna (2010) state that tool meditation is a key AT principle, and that consideration of the primary, secondary, and tertiary tools is necessary. This deconstruction of artifacts into three levels should facilitate a more detailed examination of the use of artifacts within Agile delivery environments. In particular, there is the analysis of an organisation shifting from traditional project management to Agile delivery methods. The former focusses on secondary level artifacts (for example PRINCE2 has 26 different documents); the latter relies on a mix of secondary level and tertiary level artifacts (such as retrospectives, trust, empowerment and self-organisation). This is exemplified by 2 statements within the Agile Manifesto which prefers the elements on the left (underlined) to those on the right.

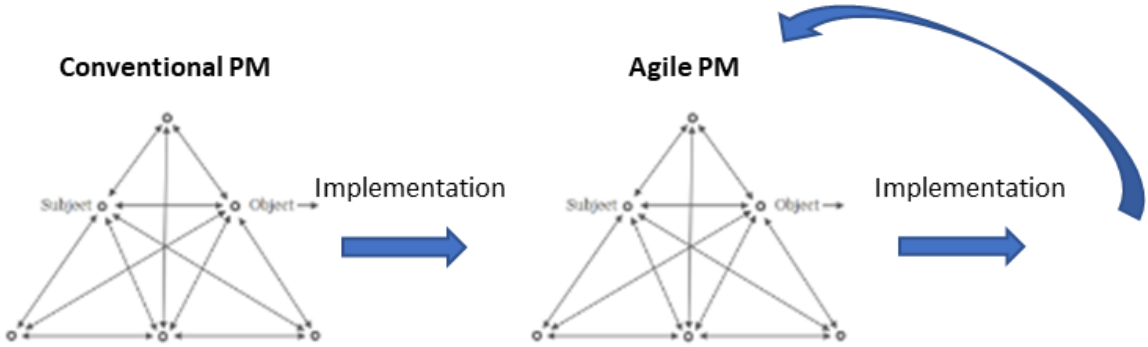
> *"Individuals and Interactions over processes and tools*
> *Customer collaboration over contract negotiation"*

The introduction of these different levels of artifacts was expected to result in Artifact related contradictions which can be examined according to the different levels.

Within the Preliminary Research discussed in Chapter 3, there was no opportunity to deconstruct the analysis of tools into these three levels. Tools were merely identified as outlined in Section 3.3.1 and Figures 3.2 and 3.3 in Chapter 3. Consequently a greater level of detailed analysis could be conducted. This would have been especially interesting with the context of the identification of activities outlined in Section 4.2.1 above and the scoping work set out in Section 4.8.

In relation to physical tools, it should also be noted that within the iterative, incremental Agile approach the phased delivery of software (outcome) itself acts as a mediating tool for the next incremental delivery. This is illustrated in Figure 4.6.

Figure 4.6: Delivered software as a mediating tool



4.2.4 Activity Theory principle – object orientation

The principle of object orientation states that every activity undertaken by a Subject (individual or team) is motivated towards an Object that exists (Engeström, 1987). For example, the writing of software code is the object of a programmer's coding activity (Kaptelinin et al., 1999). This is foundational to the whole concept of an activity, with no evident departures from this perspective in the literature. Hence there was no requirement to consider any variation of this principle in this study.

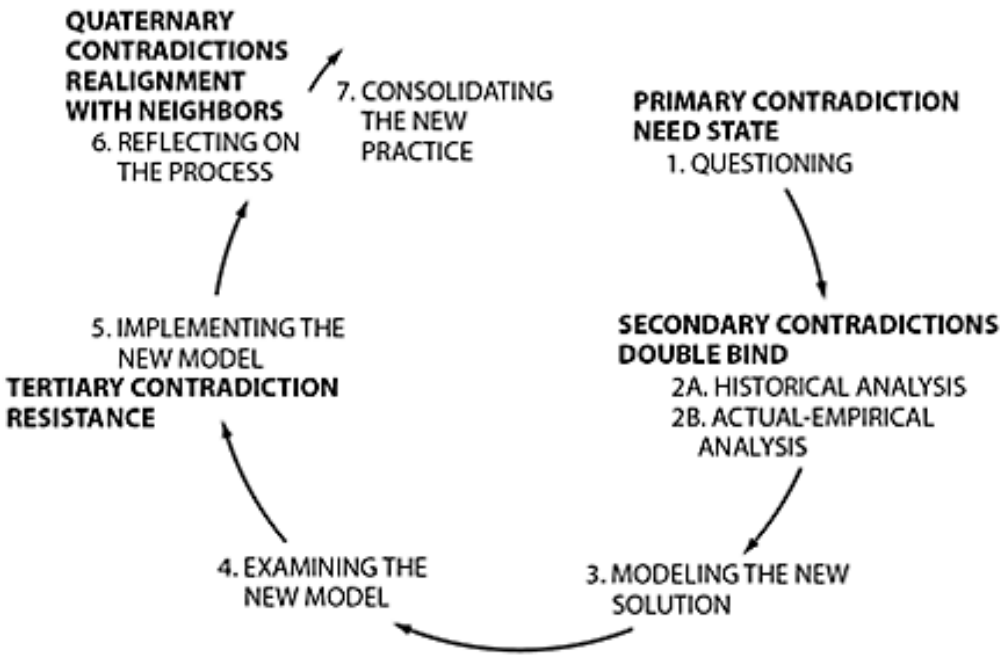
4.2.5 Activity Theory principle – internalisation/externalisation

AT states that any individual's internal mental processes cannot be understood effectively if they are analysed separately from the individual's external activities, and that it is the constant transformation between external and internal activities which is the basis of human cognition (Kaptelinin et al., 1999). This is a two way process where external elements may become mental representations (internalised) by carrying out external actions (Dennehy & Conboy, 2019). Similarly, externalisation takes place when internal concepts are represented by external actions such as recording an idea on a whiteboard (Kaptelinin et al., 1999). Internalisation and externalisation form a fundamental principle of AT and this study does not consider any variance to this principle.

4.3 Expansive Learning Actions

Engeström states that expansive transformation occurs when the object (see Section 2.4) and the motive of the activity are re-conceptualized to embrace a radically wider horizon of possibilities than in the previous activity mode. Engeström (Illeris, 2009, p.58) states that Expansive Learning extends Gregory Bateson's (1972) ideas into a systematic framework and that such activity produces culturally new patterns of activity. Reconsideration of expansive transformation can be informed by Engeström et al. (2013) and Engeström & Sannino (2010) who provide further granularity and depth by deconstructing the expansive learning cycle into what they call 'learning actions'. These learning actions provide a more detailed understanding of each of the seven steps of the Expansive Learning Cycle as shown in Figure 4.7.

Figure 4.7: Expansive Learning Cycle



(adapted from Engeström et al. 2013)

There are 21 learning actions which are sub-divisions of the seven steps of the Expansive Learning Cycle (Engeström et al., 2013). These learning actions are not evenly distributed across the seven steps as can be seen from the list below.

1. **Questioning**: *(Primary Contradiction)*

Involves questioning, criticizing or rejecting some aspects of the accepted practice and existing wisdom and will consist of:

Q1: Challenging participants into questioning

Q2: Criticizing existing practice

Q3: Questioning the proposed development

2. **Analysing**: (*Secondary Contradiction*)

Analysing the situation involves mental, discursive or practical analysis of the situation in order to find out causes or explanatory mechanisms. Analysis evokes 'why?' questions and explanatory principles. One type of analysis is historical-genetic which seeks to explain the situation by tracing its origins and evolution. Another type of analysis is actual-empirical which seeks to explain the situation by constructing a picture of its inner systemic relations. (Engeström et al., 2013). This step consists of the following elements:

A1: Articulating needs and ideas

A2: Historical analysis

A3: Articulating problems or challenges

A4: Identifying contradictions

A5: Weighing alternative solutions

3. **Modelling**:

Involves modelling the newly found explanatory relationship in some publicly observable and transmittable medium. This means constructing an explicit, simplified model of the new idea that explains and offers a solution to the problematic situation. This will consist of:

M1: Sketching the initial idea of a model

M2: Exploiting existing models

M3: Naming and defining the model

M4: Fixing the model in material or graphic from

M5: Varying and adapting the model

4. **Examining** the model:

An examination of the model running, operating and experimenting on it in order to fully grasp its dynamics, potentials, and limitations. This will consist of

E1: Discussing the model critically

E2: Enriching the model.

5. **Implementing:** (*Tertiary Contradiction*)

   Implementing the model by means of practical applications, enrichments, and conceptual extensions.

   I1: Demonstrating implementation

   I2: Preparing implementation

   I3: Actual use of the new model

   I4: Reporting on the use of the new model

6. **Reflecting** on and evaluating the process of expansive learning: (*Quaternary Contradiction*)

   R1: Reflecting on the process

7. **Consolidating** and generalizing the outcomes into a new stable form of practice

   C1: Consolidating and generalising

The above cycle of learning actions provides more detailed direction as to how learning and development progress will occur. On examination of the frequency of occurrence of these learning actions, Engeström et al. (2013) discovered that those actions of step 2 (Analysing) occurred most frequently, and these were followed by the actions making up step 3 (Modelling). The authors do not expand on the significance of this other than to note that as interventions proceeded within their study, later expansive learning actions became more frequent. This might have been expected, the authors also suggest that these learning actions will "appear in different but not fully arbitrary combinations and iterations" (Engeström et al., 2013, p.83)

Engeström et al., (2013) state that the above learning actions do not constitute a definitive set but that they are simply the ones that were observed. The authors provide some clarification regarding the significance of these learning actions stating that at least four of them must exist "in a meaningful order" to provide evidence of an expansive learning cycle having taken place (Engeström et al., 2013, p.90).

The expansive learning cycle itself is also subject to an earlier caveat by Engeström & Sannino (2010, p.7) who cautioned that "The cycle of expansive learning is not a universal formula of phases or stages" and that

> *"In fact, one probably never finds a concrete collective learning process which would cleanly follow the ideal-typical model. The model is a heuristic conceptual device derived from the logic of ascending from the abstract to the concrete."*
>
> by Engeström & Sannino (2010, p.7)

Within the expansive learning cycle, Engeström & Sannino (2010) have also suggested that there are miniature learning cycles that are potentially expansive but that these may not become larger cycles of expansive learning. That is, some learning happens but it does not trigger wider learning. In further qualifying the applicability of the expansive learning cycle, the authors quote earlier work by Engeström who stated that.

> "*The occurrence of a full-fledged expansive cycle is not common, and it typically requires concentrated effort and deliberate interventions. With these reservations in mind, the expansive learning cycle and its embedded actions may be used as a framework for analyzing small-scale innovative learning processes."*
>
> (Engeström, 1999, p.385)

A further qualification is provided by Engeström & Sannino (2010) in referencing earlier work by Sannino & Nocon (2008), who suggest that expansive learning may fail in one locale, but it may occur elsewhere, being adopted by others without necessarily precipitating major organisation wide changes (Engeström & Sannino, 2013).

These caveats and clarifications serve to highlight the variable nature of the expansive learning cycle and its constituent elements. It has not been possible to discover further work addressing the cycle and related learning actions. There are several points that can be derived from the above literature regarding the identification and application of the expansive learning cycle.

1. Multiple occurrences of expansive learning will lead to a transformation of all components of the activity system (Engeström & Sannino, 2010).
2. Engeström & Sannino (2010) refer to the sequence of the whole expansive learning process stating that "The process of expansive learning should be understood as construction and resolution of successively evolving contradictions". The authors suggest that as the cycle proceeds there is

"expanded scope of and participation in the learning actions" (Engeström & Sannino, 2010, p.7).

3. Engeström & Sannino (2010, p.7) are open to improvements in the model stating that "Every time one examines or facilitates a potentially expansive learning process with the help of the model, one tests, criticizes and hopefully enriches the theoretical ideas of the model."
4. Engeström & Sannino (2010, p.7) point to the merits of expansive learning in comparison with conventional change management approaches "In this light, it is necessary that the model of expansive learning is more detailed than for instance the very general sequence of 'unfreezing, moving, and refreezing' suggested by Lewin (1947)." Moving from comparisons with change management to organisational learning Engeström & Sannino (2010, p.9) state

> *"In theories of organizational learning, the criteria of learning are usually somehow connected to measured improvements in the performance of the organization. In the theory of expansive learning, criteria and yardsticks of learning are built by means of historical analysis".*

These concepts discussed by Engeström & Sannino (2010) and Engeström et al. (2013) serve to illustrate the complexity of expansive learning and the different perspectives of it. This study draws on these elements and on the learning actions, to provide a more detailed understanding of the expansive learning processes and elements that are likely to occur when implementing an Agile approach.

This consideration of Expansive Learning Actions was prompted by the problems and issues related to the identification and understanding of contradictions that took place within the three elements of the Preliminary Research discussed in Chapter 3. In Section 3.2 and 3.2.1 there were issues related to difficulties in differentiating between the different types of contradictions and it is intended that the inclusion of Expansive Learning Actions would provide greater guidance and better clarity.

4.4 Clarification of the Community node

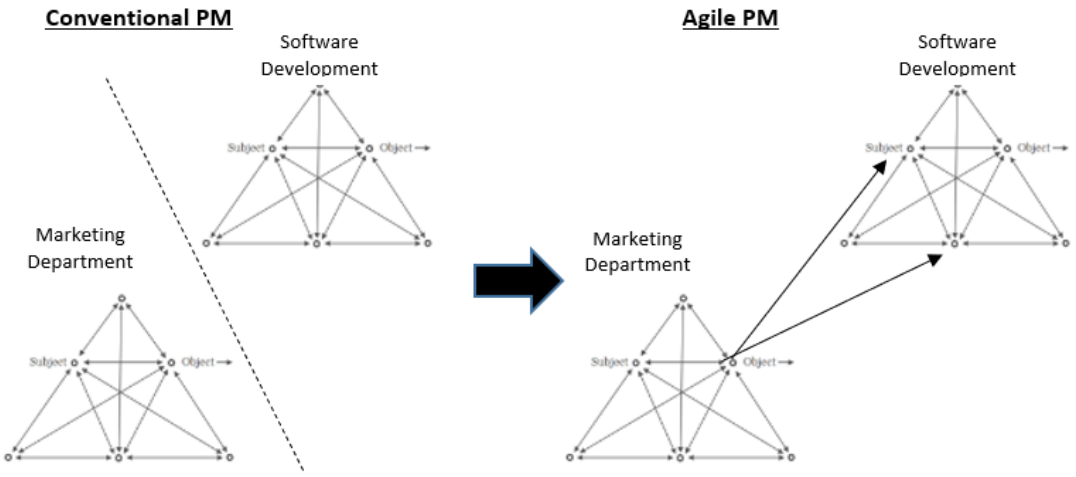
In the Initial Study, there was some confusion as to whom the Community node referred to. For example, was Penny part of the Community node; are senior management or indeed the whole organisation part of the community node? Jonassen & Rohrer-Murphy (1999) explain that any activity can only be described within the context of the community within which it operates. Identifying the nature and extent of the community that has a stake in the implementation of an Agile delivery activity is not always clear.

Mwanza (2000) broadens out the extent of the Community node by determining that the whole organisation within which the activity takes place is represented by the Community node. However, Hasan & Banna (2010) view the Community node as only representing the IS function or the developers and business analysts directly involved in the activity. This can be extended to other external IS/IT professionals who may constitute a wider Community of Practice. Sannino (2011) sheds a little light on this when discussing a critique by Roth (2009) of the shortcomings of Engeström's (1987) representation of AT. Roth (2009) provides the example of a fish culturist making reference to "the community of fish culturists" (Sannino, 2011, p.578). The implication is that the Community node represents a group of people who have similar objectives and motives as those held by the Subject(s) of the activity. Therefore, this would support Hasan & Banna's (2010) perspective that different departments in a large organisation (e.g. Accounting, HR) are unlikely to have the same objectives as the IS/IT function. Martins & Daltrini (1999) also state that the community is formed by all the subjects who share the same objective.

When identifying constituent elements of the Community node in the main Case Study the approach to be adopted follows Hasan & Banna's (2010) perspective using the heuristic of 'similar objectives and motives' to determine which elements of an organisation can be categorised as part of the Community node. However, there is one important exception to this heuristic, namely an individual or department that does not normally share the subject's objectives and motives but who is subsequently drawn into the activity as a key stakeholder in the outcome or transformation of the object. This is a usual consequence of the adoption of Agile practices related to encouraging closer collaboration and co-operation with clients. To illustrate, a marketing department would not normally be associated with the requirements elicitation element of a software

project or be part of its Community node. However, where an objective of the software development activity is to determine the requirements of, for example, a customer relationship management (CRM) system, then the marketing function would become involved. In theory, within an Agile environment with its emphasis on embedded clients, close collaboration, and iterative and incremental feedback, it may well be the case that the marketing department has more in common with the Subject node than the Community node. This is illustrated in Figure 4.8 below.

Figure 4.8: Community node within an Agile Delivery Activity



Adopting the heuristic of 'shared objective and motive' provides a more specific categorisation of elements that make up the Community node. The above discussion also serves to highlight the dynamic nature of the node, so that functions may be part of the community node in one Agile activity (see section 4.8) but not in others.

This clarification of the constituents of the Community node should provide a useful and more consistent heuristic for future research. In the Initial study element of the Preliminary Research in Chapter 3, (Section 3.4.2 and Section 3.5), there was some doubt as to whether stakeholders such as management related to the community node within an activity system or whether they related to a separate activity system with which the software team would interact. This heuristic provides clarity with a more useable and applicable definition.

4.5 Contradictions and congruences

Allen et al. (2013, p.840) take an holistic activity perspective, stating that the term contradiction refers to,

> *"…anything within the system that opposes the overall motive of the system, the aim or purpose that subjects within the system are individually or collectively striving toward."*

This is a useful generic definition expressed in terms of the elements of the activity itself without recourse to multiple illustrative examples. If contradictions oppose the overall motive of that activity, they threaten its existence (Allen et al., 2013). Additionally, contradictions also promote learning and change (Engeström et al., 1999). They can hence be viewed as the 'motor of change' (Allen et al., 2013). Activities are therefore constantly in flux due to contradictions (Kuutti, 1995) that transform the activity between the states of extinction and radical transformation.

Another perspective is suggested by Allen et al. (2013) with the introduction of the concept of congruence. Allen et al. (2013) state that, although the identification, acknowledgement and resolution of contradictions has the potential to change an activity, this may not always happen. Allen et al. (2013) envisage contradictions as a form of feedback leading to a congruence or a 'temporary stabilisation' or stabilizing forces within an activity system. These congruences are regarded by Allen et al. (2013) as developments that lead to balance rather than precipitating change within an activity. These authors stress that it is important to recognise elements that promote reproduction as well as those that give rise to change, and that while there will be tensions (contradictions) that provoke change there are also issues related to the development of congruencies. These can originate from multiple sources within and external to the activity. Within the preliminary research there was evidence of some stabilisations and some partial contradiction resolution.

In their case studies, Allen et al., (2013, p.851) observed a process of feedback and action where the contradictions were transformed into congruencies. They state that,

> *"While there are clear links and explanatory paths that show the power of contradictions and tensions to provoke action which in turn develops activity systems in new and expanded ways there are also issues of existing congruencies and potential future ones."*

Allen et al.'s (2013) study focused on congruences associated with primary and secondary contradictions. Later, Dennehy & Conboy (2019) identified congruences associated with tertiary and quaternary contradictions. Dennehy & Conboy quote Allen et al. (2014) who state that identified congruences can be immediate where things work better within an activity or give rise to longer term congruencies. Forsgren & Bystrom (2017) identified contradictions and congruences that emerged as people made social media meaningful within their daily information sharing. In the Initial Study element of the Preliminary Research in Chapter 3, there were examples of congruences which were arrived at by development team persistence and these congruences provided greater understanding of the learning and development process but these were not able to be identified as such in the Initial Study (section 3.4.4).

From their study, Dennehy & Conboy (2019) concluded that identifying the congruence of contradictions was important in explaining the evolution and development of activities. Identifying congruences and contradictions is included in the analysis of the main Case Study as a means of further understanding the development of activities in the implementation of an Agile approach.

4.6 Collaborative Activity

This section continues the focus on a further detailed understanding of expansive learning by investigating the role of collaborative activity as the basis for the resolution of contradictions. Engeström et al. (1997) focused on the Subject-Object-Subject interaction (where the Subject transforms the Object and simultaneously is being transformed by the Object). These authors identified a three-level hierarchy of collaborative activity moving from co-ordination to co-operation and then to co-construction. This process leads to the resolution of the contradiction.

4.6.1 Co-ordination

This is the "normal scripted flow of interaction" (Engeström et al, 1997, p.372) where individuals will focus on their own assigned roles, objects, and actions. The script may consist of written rules and unwritten traditions. Participants within the activity are coordinated without question or discussion. An example activity provided by Kuutti (1995), is the house building activity, where the actions of transportation of wood, assembling of pipes and inserting electrical wiring are all co-ordinated. In this paper, the focus is on each individual actor. Barthelmess & Anderson (2002) state that this is a shallow view of work seeing it as a sequence of operations represented by a process model. In the context of a software development environment, Barthelmess & Anderson (2002) state that over-specification might lead to frequent breakdowns due to a mismatch between the process script and actual work practice. These authors state that such detailed specification might be typical of a maturity model specification. They also point to a lack of the concept of a community in this type of collaborative activity. (Barthelmess & Anderson, 2002).

4.6.2 Co-operation

At this level, instead of focusing on assigned roles, actors focus on a shared problem or object in order to find an agreed solution. Actors move beyond the confines of the script or specification but do not explicitly question or reinterpret it. In the house-building activity this might be a simple example of a joiner and electrician jointly resolving a difficult wire-routing problem. According to Bardram (1998) the important difference between coordinated and cooperative levels is a shared objective; the actors balance their own actions with those of their partners to achieve a common goal.

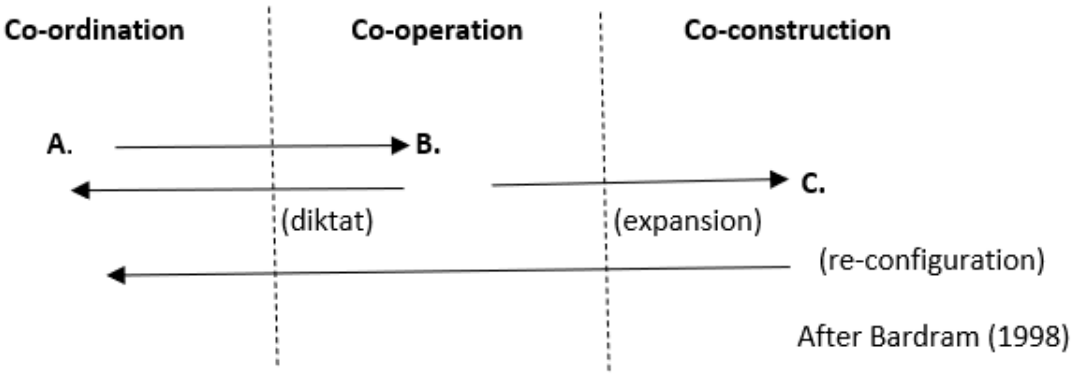
4.6.3 Co-Construction

At this level, termed 'Communication' by Engeström et al. (1997), actors reconceptualise their roles and interactions with the shared object or problem. According to Engeström et al. (1997) the script may be re-conceptualised as well as individuals' interactions with each other. Bardram (1998) states that the objective (motive) of the work is not stable and has to be collectively constructed. Bardram calls this process 'co-construction'. Actors will pose questions such as "What is the meaning of this problem in the first place? Why are we trying to solve it - and who benefits from its solution? How did the problem emerge?" (Bardram, 1998, p.9). Barthelmess & Anderson (2002) emphasise collaboration, stating that if there is a lack of support at the co-operative level then co-construction is precluded or limited.

Barthelmess & Anderson (2002) state that there is a close interplay between these three levels as they are all part of 'collaborative activity' and that a pattern of dynamic transformations between these levels can be observed. In a software development example, writing software might occur in a co-ordinated way. Here a developer might encounter a problem perhaps with a specification (friction). This might then become a collaborative activity as the developer and business analyst collaborate to resolve the problem. Once resolved the activity returns to a co-ordinated state. It might be a serious problem that requires a more considered approach involving re-thinking practice (activity, task or action). In this case the collaborative activity becomes a co-constructive effort in which practice is questioned and re-conceptualised. Following this, the activity then returns to the co-ordinated state. At this level it may be argued that practices, whether formal or informal are improved to some extent. This may occur up to a tertiary level contradiction where the new improved activity could be met with resistance.

Engeström et al. (1997), state that transition to Co-construction (Communication) level is rare in the normal flow of daily work actions, and that the mechanism of transition will include discordances, disturbances, ruptures and expansions. Transitioning to co-operation and then onto co-construction leads to some expansion as discussed earlier (Engeström, 2001). Extrapolating this in a diagrammatic way leads to Figure 4.9.

Figure 4.9: Moving between different levels of collaborative activity



An observation from Engeström et al. (1997), was that resolution of disturbances occurred either regressively (by diktat) or progressively by expansion. Within this research's main Case Study, occurrences of these types of collaborative activity were identified to help understand the elements involved in contradiction resolution and expansive learning. Another level of understanding was achieved in determining whether contradictions were resolved by means of expansion or diktat. The Initial Study (Chapter 3, Section 3.4.4 and Section 3.4.5) identified occurrences of both, but further analysis was impeded by the lack of an appropriate structure and framework.

4.7 Developing the Standard Question Set

The preliminary research used open-ended questions resulting in a large collection of data to be analysed for relevance and importance. Allen et al. (2013, p.842) use an interview approach "guided by activity theory" because they regarded this as the best way of achieving detailed understanding of the elements relating to organisational change due to an IS implementation. They also incorporated field observation to observe the complex elements. Dennehy & Conboy (2019) also used an interview approach that was closely based on the six nodes of Engeström's activity triangle. Dennehy & Conboy (2019) state that these nodes form a set of 'intellectual bins' (after Miles & Huberman, 1984) that help to structure data collection and analysis. A more specific AT related set of questions was applied to the main Case Study, after further guidance was sought with regards to the question set itself. This is the subject of this section.

Mwanza (2001) provides a useful 'Activity Notation' to assist in managing the complexity of the AT triangle structure. The notation consists of six sub-triangles that follow a regular structure consisting of one objective (Object), two possible actors (Subject(s) or Community), and three potential mediators (Artifacts, Rule or Norms and the Division of Labour) around which the activity is focussed.

This is a useful decomposition that helps to deconstruct the Activity Triangle into discrete manageable relationships which helpfully centre on the objective of the activity, i.e. the purpose of the activity. Mwanza's (2000) notation is combined in Table 4.1 below with Jonassen & Rohrer-Murphy's (1999) questions regarding their Step 4 ('Analysis of Mediators').

Table 4.1: Mwanza (2000) subject based Activity Notation and Jonassen & Rohrer-Murphy (1999). Step 4: Analysis of Mediators

	Mwanza's Activity Notation (2001)	**Jonassen & Rohrer-Murphy (1999) Analysis of Mediators.**
1.	**Subject/Artifacts/ Object [S-A-O]**	• What physical and cognitive tools are used in the activity and how available are they to the participants? • How have they changed over time? • What models, theories or standardised methods guide the activity? How are they used and is their use flexible?
2.	**Subject/Rules/ Object [S-R-O]**	• What formal and informal rules, laws or assumptions guide the activities? • How might these rules have evolved (formal/informal; internal to external)? • Are the rules 'task' specific? (action specific) • How widely understood are the rules?
3.	**Subject/Division of Labour/Object [S-D-O]**	• Who traditionally assumes the various roles? • How does this the affect group work? • How do the roles relate to people's experiences and qualifications? • What forces drive role changes? • How much freedom do individuals have to take on new or different roles within the group?

The same questions can be repeated for the Community/Artifacts/Object; Community/Rules/Object; and Community/Division of Labour/Object sub-triangles. Analysing the data that is gathered from these questions involves focusing on the tensions and contradictions within and between activity systems. Table 4.2 provides some examples of these contradictions in terms of Mwanza's (2001) Activity Notation.

Table 4.2: Mwanza (2001) Subject based Activity Notation and Contradictions

Contradiction Type	Mwanza (2001) based Activity Notation	Typical examples of Contradictions
Primary contradiction: These occur *within* a node of the activity.	Within the nodes themselves - Subject, Artifacts, Rules, Object, Community, Division of Labour [S; A; R; C; O; D]	• Tool has a problem with its operation. • Subject doesn't have requisite skills. • Organisation is dysfunctional. • Rules are outdated and inappropriate.
Secondary contradiction: These occur *between* the nodes of the activity	Subject/Artifact/Object [2_S-A-O]	An individual has not been trained to use a tool correctly.
		The tool being used is ineffective in helping to achieve the objective.
	Subject/Rule/Object [2_S-R-O]	Behaviour patterns or norms affect the way the subject works. This could be overly bureaucratic organisational procedures that stifle creativity or flexibility.
		Behaviour norms or patterns interfere with the achievement of the objectives are not conducive to its development such as excessive reporting or control arrangements.
	Subject/Division of Labour/Object [2_S-D-O]	Roles and supervisory arrangements impact on the subject's ability to work effectively.
		Not all the roles assigned are co-ordinated or have the achievement of the objectives as a priority.
Tertiary contradictions: These occur between an activity and a later more advanced form.	[3_Act-Act+]	For example, an advanced form of planning might involve closer customer collaboration, but the people involved are reluctant to take this on board because of the changes in work practices involved.
Quaternary contradictions: These occur between different activities (either within or external to the organisation).	[4_Act1-Act2]	For example, where management finance and organisational structures might impede software development activity.

Quek & Shah (2004) provide a comparative survey of five different activity-based methods applied in IS development environments. This survey includes the above Mwanza (2001) and Jonassen & Rohrer-Murphy's (1999) approaches. These approaches are summarised in Table 4.3 below.

Table 4.3: Summary of activity based methods (Quek & Shah, 2004)

Authors	**Method name**	**Method summary** according to Quek & Shah (2004)
Korpela, 1997	ActAD	Provides a framework for IS developers to analyse the sociocultural features that can inform the development of an IS.
Kaptelinin, Nardi & Macaulay, 1999	Activity Checklist	Intention is to enable researchers to identify the contextual factors that influence the use of computer technology.
Mwanza, 2001	Activity Oriented Design Method (AODM)	Intention is to contribute to the early phases of systems development supporting requirements capture, analysis and design relating to HCI aspects.
Jonassen & Rohrer-Murphy, 1999	Framework	Framework to be used for the design of Constructive Learning Environments (CLE) consisting of six steps where each is divided into sub-steps. Quek & Shah (2004) note there are a lot of questions. Interestingly they state that the level of granularity is not always clear.
Martins & Daltrini, 1999	N/A	An approach used for requirements elicitation consisting of three steps. The framework focusses mainly on the hierarchical decomposition principle - activity, action, and operation.

From the above table, each of these approaches has its own specific emphasis and approach, ranging from an HCI focus to a broader learning environment objective. Given that the nature Agile environments involves a mix of these elements, each of these approaches has been examined for aspects that not only comply with Mwanza's (2001) approach but also were suitable for application to the main Case Study. The resulting analysis is available in Appendix C ('Activity Theory methods and questions'). Working through these methods yielded a large number of potential questions that was refined iteratively resulting in a final set outlined in Appendix D ('Standard Question Set').

When using this question set to interview the participants in the main Case Study it was realised, after the first interview, that illustrative diagrams would be useful to help focus interviewee's attention. Hence a set of activity diagrams was produced. These are

provided in Appendix E ('Interview diagrams and tables'). The question set and the activity diagrams were the principal data collection tools for the main Case Study. They provided a repeatable and consistent approach to data collection.

The development of a Standard Question Set is a significant step that enables a much more detailed and focussed level of analysis. The data gathering conducted in the Preliminary Research in Chapter 3, relied on very high level, general questions during the practitioner interviews (Section 3.2) and the serendipitous survey (Section 3.3.1). These general questions focussed on overall obstacles and problems regards the implementation of agile practices produced a wide-ranging set of responses not easily amenable to classification and context understanding. The Standard Question Set is geared specifically around the nodes of the activity system so will provide a more discerning and granular set of responses.

4.8 Determining Activity scope

Having defined the constituent elements of an activity, attention turns to the application of these criteria within the Agile domain. This level of analysis was not possible in the preliminary research and Agile activities should be closely scoped within the main Case Study. The Agile literature is re-visited to derive a set of generic Agile activities that encompass all Agile development activity, and which form a logical, coherent, and consistent set. It is anticipated that this set is applicable to the implementation of any Agile approach.

4.8.1 Agile Manifesto Principles

The Agile Manifesto (https://www.agilealliance.org/agile101/the-agile-manifesto/), is based on twelve principles that constitute the essential and fundamental elements of all Agile approaches. The principles are as follows:

Table 4.4: Agile Manifesto principles

1	Our highest priority is to satisfy the customer through early and continuous delivery of valuable software.
2	Welcome changing requirements, even late in development. Agile processes harness change for the customer's competitive advantage.
3	Deliver working software frequently, from a couple of weeks to a couple of months with a preference to the shorter timescale.
4	Business people and developers must work together daily throughout the project.
5	Build projects around motivated individuals. Give them the environment and support they need and trust theme to get the job done.
6	The most efficient and effective method of conveying information to and within a development team is face-to-face conversation.
7	Working software is the primary measure of progress.
8	Agile processes promote sustainable development. The sponsors, developers and users should be able to maintain a constant pace indefinitely.
9	Continuous attention to technical excellence and good design enhances agility.
10	Simplicity – the art of maximising the amount of work not done – is essential.

11	The best architectures, requirements and designs emerge form self-organizing teams.
12	At regular intervals the team reflects on how to become more effective, then tunes and adjusts its behaviours accordingly.

The principles underpin the rules and behavioural norms that constitute the major activities within the Agile approach. Consequently, it is important to ensure that they are valid and applicable in all circumstances. What constitutes a 'principle' is open to interpretation: general definitions of a principle vary ranging from 'a fundamental truth or proposition that serves as the foundation for a system of belief or behaviour' or for a chain of reasoning to 'a fundamental source or basis of something' and 'a general scientific theorem or law'[11].

Meyer (2014) critiques the twelve manifesto principles stating that not all of them qualify as principles but that they are a mix of assertions, practices and platitudes. Meyer's (2014) view is that the founding principles should display additional characteristics such as - be abstract in nature, be prescriptive and generally applicable as well as be falsifiable in the sense that it could be imagined that someone could propose the opposite position. Given these characteristics, Meyer (2014) identifies the following problems with regards the above twelve Manifesto principles

- Principles Three and Twelve are practices rather than principles as they are practical, concrete and regular.
- Principles Six, Seven and Ten are not principles but assertions (a statement about the real world).
- The sentiment behind Principle One is repeated in Principle Three and in Principle Seven.
- There is no mention of the testing activity despite it playing a key role within all Agile approaches.

[11] Oxford Dictionaries: https://en.oxforddictionaries.com/definition/principle

4.8.2 Meyer's Agile principles

Meyer (2014) develops his own set of principles, which he regards as more accurate and practical, and which underpin all Agile methods. These principles, which he calls a 'usable list' are divided into two groups – Organisational and Technical - and are listed in Table 4.5 below. In addition, the Agile Manifesto Principles that most closely correlate with Meyer's principles are indicated e.g. (P1) in the second column. It is also indicated where Meyer's principles diverge from the Manifesto principles.

Table 4.5: Meyer's Principles and Agile Principles

	Meyer Principle	**Corresponding Manifesto Principle**
Organisational:		
1	Put the customer at the centre	P1 and P4
2	Let the team self-organise	P11 and P5
3	Work at a sustainable pace	P8
4	Develop Minimal Software: 4.1 Produce minimal functionality. 4.2 Produce only the code requested. 4.3 Develop only code and tests.	New
5	Accept change	P2
Technical:		
6	Develop iteratively: 6.1 Produce frequent working Iterations. 6.2 Freeze requirements during Iterations.	P1, P3, P7
7	Treat tests as a key resource. 7.1 Do not start any new development until all tests are passed. 7.2 Test first.	New
8	Express requirements through scenarios.	New

In three instances (principles 4, 6 and 7), Meyer provides 'sub-principles' that provide further expansion. The first Meyer principle (Put the customer at the centre) correlates with Manifesto principle one which identifies satisfying the customer as the highest priority. Meyer's first principle also relates to Manifesto principle four which indicates that business clients and developers should work together.

Meyer principle two (Let the team self-organise) correlates with Manifesto principle eleven and indicates that good design comes from self-organising teams. In addition, it could also be argued that Manifesto principle five (Build projects around motivated

individuals) is more realistic when teams are self-organising. Meyer principle three (Work at a sustainable pace) is equivalent to Manifesto principle eight (Agile processes promote sustainable development) and this requires little further explanation.

Meyer principle four (Develop minimal software) could relate to Manifesto principle ten and relates to limiting the extent that the development teams are overburdened with producing functionality that may not be needed. This has a negative effect on development team productivity and performance. It is typified in the Agile domain by the slogan 'YAGNI' (You Ain't Gonna Need it) (Meyer, 2015). The fifth Meyer principle (Accept change) is a somewhat diluted version of Manifesto principle two that states that change ought to be welcomed. Meyer further clarifies this with his technical sub-principle 6.2 that suggests that no changes to requirements should occur during an iteration.

Meyer principle six (Develop Iteratively) has no direct equivalent in the Manifesto Principles but it may be inferred from Manifesto principles one (Early and continuous delivery), three (Deliver working software frequently) and seven (Working software is the primary measure of progress). Meyer principle seven (Treat tests as a key resource) has no equivalent in the Manifesto principles and its inclusion is reflective of Meyer's (2015) emphasis on testing as a key enabler in the delivery of quality software.

Finally, Meyer Principle eight (Express requirements through scenarios) also has no Manifesto equivalent. It can be regarded as an extension of Meyer's principle seven (Test as a key resource) because Meyer (2014) regards use cases and user stories (both are included in the term 'scenario') as more abstract versions of tests (Meyer, 2015, p.78). Several Manifesto principles do not appear in Meyers (2015) 'usable list' of principles.

- Principle Six (Face-to-face communication) is regarded as a practice.
- Principle Seven (Working software as the primary measure of progress) is seen as a repetition of Principle Three.
- Principle Ten (Simplicity) is regarded as an erroneous assertion.
- Principle Twelve (Reflect on practice and adjust accordingly) is regarded as a practice.

It is apparent that Meyer's 'usable list' of principles provides some clarification, as well as consolidating the rationale and core concepts that lie behind the Manifesto Principles into a more logical, granular and discrete list.

Therefore, this study utilised Meyer's principles as the basis for further analysis and investigation. The rationale for this approach is that:

1. Meyer's principles are consistent and coherent and avoid the issues presented by the original manifesto principles. They are more granular, providing a logical, robust principles-based foundation for Agile approaches.
2. They are more comprehensive, and avoid repetition and redundancy. For example, the Manifesto Principles do not mention key Agile concepts such as iterative development and concurrent testing.
3. Meyer's principles are a succinct distillation of the main guiding concepts underlying all Agile methods.
4. Meyer's principles are independent and objective. As an academic and a relative late-comer to the field, Meyer has no particular methodology or technique to proselytise in contrast to some of the original consultants who were party to the development of the Agile Manifesto.

Meyer (2014) goes further by identifying other elements, based on these principles that characterise Agile methods. These elements including Roles, Artifacts and Activities; these are discussed in the following sections.

4.8.3 Identification of distinct Agile activities

This section starts with the most basic elements that Meyer (2014) identifies which are Roles and then considers Artifacts and finally Activities.

Agile roles:

The traditional project manager roles identify goals, agree deadlines, assign tasks, and interfaces with management and customers. They also enforce rules and methods as well as coach and mentor. Within Agile environment many of these roles are replaced by self-organising and cross-functional teams. Meyer simply adheres to the standard roles and remits that exist within the Scrum approach to Agile delivery. The three main roles of Product Owner, Scrum Master and development team are well discussed elsewhere (Sutherland, 2015).

Agile artifacts:

Agile artifacts support the principles that have been previously identified. Virtual artifacts are abstract concepts that are agreed and followed by the delivery team. In addition, there are physical artifacts that support some of the virtual artifacts. For example, product backlogs and team velocities are virtual artifacts that are then represented by physical lists or cards and graphs which are then viewed and manipulated by the team (Highsmith, 2009). Representative physical artifacts of Agile approaches include open informative workspaces and story boards.

Agile Activities:

Meyer (2014) identifies several practices that he regards as the regular 'almost ritual' activities that must be undertaken in order to conform with and apply the Agile principles. He identifies a number of practices that could form the basis of activities. He groups them into two elements – Managerial and Technical then sub-divides the technical elements into three main activities. These are software development, release practices, and testing and quality. In addition, he also adds 'meetings' as an activity. Meyer's activities are listed below:

Technical:

1. Development – software development that includes pair programming, shared code and refactoring.
2. Release Practices – based on frequent releases and integration activities.
3. Testing and Quality – reflects Meyer's focus on quality and relates to standards and testing.
4. Meetings – made up of daily stand-ups, planning and retrospectives.

Managerial:

5. Managerial Practices – a catch all that includes team activities and scaling Agile activities.

There are several issues that relate to Meyer's set of Agile practices. Firstly, there is the omission of any requirements gathering activity alongside the identified technical activities of development, release practices and testing and quality. Given Meyer's Eighth Principle 'Express requirements through scenarios', it is arguably odd to find that there is no specific mention of an activity to support the principle. Secondly, there is the

choice of 'Meetings' as an activity. Meetings in themselves do not support principles. They are a means of achieving principles, in that it is what happens during meetings that is significant.

Further meetings can vary in purpose e.g. release-planning activities, demonstrations or retrospectives to support specific principles.

Thirdly, there is no mention of activities that relate to learning and development. Meyer asserts that the twelfth Manifesto Principle, addressing team reflection, is a practice, not a principle. However, he does not then include it as a practice that supports the other principles. Finally, it may well be that it was not Meyer's intention to provide a comprehensive overview of Agile practices and perhaps his list is merely indicative. However, it was the intention of this study to identify all the generic Agile practices and to propose a logical grouping of Agile activities and tasks. This is depicted in Table 4.6 below which builds on Meyer's list with a few additions. The table rows are ordered according to the software development sequence for ease of comprehension.

Table 4.6: Proposed set of Agile activities and tasks

Activity name	Abbreviation	Contents and Tasks
Governance and Support	G&S	Incorporating Meyer's Management practices and other organisational support elements (discussed later)
Requirements Engineering	RE	Customer focus, gathering and developing user stories, use cases etc.
Development	Dev	Frequent iterations, simple and incremental design and evolution refactoring, coding standards and shared coding
Testing and Quality	T&Q	Test driven development.
Release Management	RM	Planning, Continuous Integration and Configuration Management
Learning and Development	L&D	Retrospectives for incremental improvement.

Having reviewed Meyer's practices/activities and arrived at a proposed set of activities and tasks that could be present within all Agile delivery methods, there was a requirement to validate this set of activities according to published literature to provide a wider appraisal and comparison with other perspectives. This was drawn from literature that discusses Agile maturity models. Such literature is based on two approaches. The first aims to align Agile processes[12] and practices/activities with traditional maturity model approaches (Silva et al, 2014), the second aims to define separate Agile maturity models (Fontana, 2014).

Using a systematic literature review approach, a recent study by Fontana et al. (2018) aimed to evaluate 'currently proposed Agile maturity models'. The authors focussed on research questions such as 'What is maturity in Agile software development?' and 'Which are the maturity models proposed for Agile software development?'. The authors identified 14 contributions that were considered important for their analysis. This study has adopted these same contributions as the literature that is most representative of the wider perspectives on what constitutes Agile practices and activities. The analysis that maps the contents of these contributions to the identified generic Agile activities is provided in Appendix F ('Agile maturity models comparison'). A summary is provided in Table 4.7.

Table 4.7: Agile Maturity Models: Practices & Adopted Approaches

	Maturity Model Literature	**Identification of Practices/Activities**	**Maturity Model Approach Adopted**
1	Nawrocki et al. (2001)	Splits the 12 XP practices into 4 main groups, and add an additional 'facilities' practice	A four-level maturity model based on traditional maturity approaches that rates organisational adoption of the practices in terms of Non-Compliance, Initial, Advanced & Mature
2.	Lui & Chen (2006)	Focus is on XP practice adoption within inexperienced teams. Identify clusters of inter-related XP practices	Lowest maturity levels start with the XP practices that have the most inter-dependencies & connections.

[12] This study views a process as a sequence of activities/practices.

	Maturity Model Literature	Identification of Practices/Activities	Maturity Model Approach Adopted
3	Packlick (2007)	Based on the 12 XP practices that are most required by development teams. These are re-organised into five categories	Maturity levels are not based on specific practices but on attainment levels across all practices starting with Awareness, Transformation, Breakthrough, and Optimisation & Mentoring.
4	Sidky et al. (2007)	Forty Agile practices are identified and organised according to one of five identified Agile principles that they support.	A five-level maturity model that identifies specific practices/activities at particular levels. So the unit-test activity/task supports the Technical Excellence principle at Level 3 (Effective).
5	Qumer & Henderson-sellers (2008)	Identifies six characteristics of an Agile method - agility, processes, people, product, tools and abstraction.	A six-level maturity model where each level focuses on different practices.
6	Patel & Ramachandra n (2009)	No attempt to redefine principles or categorise the supporting Agile practices or activities.	A five level maturity model similar to (4) and (5) above in specifying different practices occur at different maturity levels of Initial, Explored, Defined, Improve & Sustained.
7	Patel & Ramachandra n (2009)	Narrow, specific focus on requirements elicitation and the use of story cards. Practices/activities & tasks relate to story cards only	Four-level maturity model relating only to story card practices. Different maturity levels relate to different practices.
8	Benefield (2010)	Focus is on development and testing and quality practices within a large telecoms organisation.	Maturity levels relate to how well these practices are adopted, establish a process and the extent of interactions, integration and synchronisation across teams.
9	Fontana et al. (2014)	Authors consolidate Agile practices and map them to the Software Engineering Body of Knowledge resulting in a total of 13 development focussed practices.	Indicate that the maturity model approach is not that useful due to the variability in organisational circumstances. The authors do not regard a traditional maturity model approach as being suitable for Agile. In addition, as experience grows some companies abandon some practices and so rather than following prescribed paths, Agile teams tailor the Agile method to suit their circumstances

	Maturity Model Literature	Identification of Practices/Activities	Maturity Model Approach Adopted
10	Silva et al. (2014)	Identifies 18 process areas (a series of practices)	Similar to (4), (5) and (6) above in terms of the notion of specific practices occurring at particular maturity levels.
11	Silva et al. (2015)	From reviewing 81 articles, the authors identify ten activities and practices that are most commonly cited within the Agile literature.	Maps Agile activities to CMMI and similar to studies (4), (5), (6) & (10) above in terms of specific practices occurring at particular maturity levels.
12	Ozcan-Top & Demirors (2014)	Agile processes and practices are grouped under five 'meaningful' definitions that broadly relate to a development lifecycle of Exploration, Construction, Transition, Management & Culture	Identified practices are grouped into agility (maturity) levels characterised by Agile principles at each of the three levels of Performing Aspect Practices, Simple & Iterative and Technically Excellent & Learning.
13	Soares & Meira (2015)	Focus is on the implementation of CMMi practices in an Agile manner. Identifies several Agile process elements.	Agile processes are mapped to CMMi maturity levels following a standard categorisation and approach.
14	Stojanov et al (2015)	Adapts Sidky approach for SAFe with 24 additional activities/tasks and three existing practices altered.	See (4) above with an additional 24 practices and three altered practices spread across all five levels and principles.

This analysis verifies the proposed set of Agile activities and tasks against current literature hence avoiding reliance on the reviewed work of a single author (Meyer, 2015). Table 4.8 below provides an indicative mapping of Agile tasks and artifacts used that were identified in the maturity model literature to the proposed set of Agile activities. The proposed Agile activities are listed at the top of each column with the tasks and artifacts listed below. The numbers in brackets relate to the numbering of the 14 articles outlined in Table 4.7 above.

Table 4.8: Generic Agile Activities identified in this study

Agile Activities					
Governance & Support (G&S) 	**Requirements Engineering (RE)** 	**Development (Dev)** 	**Testing & Quality (T&Q)** 	**Release Management (RM)** 	**Learning & Development (L&D)** 
TASKS					
Daily stand-ups	Customer Collabor-ation (4)	Coding standards (4)	Test Driven Development (2,4)	Estimation (4)	Sprint Retrospectives
Self-organizing empowered teams (4)	Manage requirement changes (1)	Pair program-ming (4,1)	Unit testing (1)	Frequent small releases (1,2,4)	Training (10)
Scrum of Scrums (14)	On-site customer (1,2)	Shared code ownership (1)	Acceptance testing (1)	Release/ Iteration/ Sprint Planning (1)	Knowledge Management (10)
Development Environment (5)		Refactoring (1,2)	Defect Analysis (6)	Agile Release Train (14)	Project Retrospectives
Risk Management (10)		Spiking solutions (1)	Regression Testing (8)	Integrate often (1)	
Sustainable pace (6)		Architecture Configur-ation (9)		Continuous Integration (2)	
				Configuration Management (8)	
Artifacts (Conceptual and Physical)					
Product Backlog	User story (1)		Automated Testing (14)	Planning game (6)	
40 hour week (1,2)	Story card (6,7)	Project Velocity (1)			
Burndown Charts (5)		Metaphor (2)			

This defined set of Agile activities was circulated to five Agile coaches and consultants within the Edinburgh area in January 2019 to gain feedback. No contrary issues were identified, and feedback was in broad agreement with the defined grouping of Agile activities. Comments centred on the individuals' own preferences, such as not distinguishing between Requirements Engineering (RE) and Testing and Quality (T&Q) and whether Release Management (RM) is a separate activity, within a DevOps environment.

These generic Agile activities are defined as the main Agile activities that make up the Agile implementation within the main Case Study. It is these activities and their relationships that will be used to structure the analysis of expansive learning with the implementation of Agile approach.

In combination with the definition of an activity (Section 4.2.1), this section which defines the scope of an activity has provided a detailed guidance structure for the application of Activity Theory to circumstances where organisations have chosen to adopt Agile methods. Had such a comprehensive tool been applied to the interview (Section 3.2) and survey elements (Section 3.3) of the Preliminary Study (Chapter 3), then they would have produced much more specific and detailed data from which more useful insights could have been obtained.

4.9 Conclusion & additional research questions

Prompted by the difficulties and issues that arose from the preliminary research in Chapter 3, this chapter has re-visited the AT and Agile literature to obtain further guidance and clarification on the application of AT to the Agile domain. The result is the consolidated Activity Theory framework (CATF) that was applied in the main Case Study. The CATF consists of a mix of clarifications and additional perspectives. These are grounded in the literature, and are rationalised and explained. They are intended to provide an integrated, coherent, and generic analytical approach that may be applied to any Agile implementation. The review has also served to further clarify the application of AT to enable a consistent investigative process that provides in-depth analysis. In summary the consolidated elements of the CATF consist of the following elements which were applied to the main Case Study.

1. An Activity is hierarchically structured as Activity → Task → Action (Section 4.2.1).
2. Artifacts within activities are categorised as Primary, Secondary and Tertiary (Section 4.2.3).
3. Constituent elements of the Community node are defined (Section 4.4)
4. Resolution of contradictions result in an expanded activity through traversal of the ZPD (Section 4.2.2).
5. Contradiction resolution is examined in more depth through identification of the twenty-one learning actions of the expansive learning cycle (Section 4.3).
6. Congruences and stabilisations associated with contradictions within the expansive learning cycle are identified (Section 4.5).
7. Collaborative activity consisting of Co-ordination, Co-operation and Co-construction are identified (Section 4.6)
8. A generic Standard Question Set developed to identify the above elements is defined (Section 4.7 and Appendices D).
9. A generic set of six Agile activities is identified (Table 4.6).
10. Each generic Agile activity has associated tasks and artifacts (Table 4.7).

The above raises the question ‘what are the benefits of the application of the CATF to the main Case Study that other analytical or consulting approaches do not provide?’ The response is that the AT-based focus on historical, cultural, and behavioural aspects is

usually not the first item to be considered when examining problematic change within organisations. Indeed, the first port of call is often organisational structures followed by formal organisational procedures, policies, and processes (Floricel et al., 2014). The transition to a new way of working is often focussed on dismantling existing structures and implementing new approaches without any consideration of the informal 'under the surface' elements that are often very important factors that significantly impede or facilitate change.

It is these elements that the CATF surfaces in an analytical, structured, and accessible framework that identifies obstacles to progress and learning. Engeström (2001) affirms that development and learning new practices comes from identifying and understanding contradictions and conflicts within existing activities. Such learning and development follow a cycle of expansive learning (Section 4.3). In addition, Barab et al. (2004) confirm that contradictions within an activity/practice are potential opportunities for intervention and improvement. They see contradictions as providing elements or functions of a growing and expanding activity system. This approach can be viewed as a 'gap-analysis' exercise.

Korpela et al (2000) agree with these sentiments, stating that AT has great potential for application in IS research and practice. They suggest that its suitability will be determined by whether the method can be used for everyday practical applications and whether it can move beyond a descriptive context to constructive uses that deliver new approaches and methods. For it to become constructive, they advocate that it needs to be better applied to IS, to address wider applications such as requirements elicitation. They state that the method and its description must be made available as a 'cookbook on activity theory in IS' so they are more easily available to practitioners. Other than more research and application, these authors provide little indication as to how this can be achieved. The analysis in this chapter resulting in the development of the CATF produces one such variant 'cookbook' which could be easily applied to guide research. It provides a consistent, granular, and practical approach to operationalising the use of AT within the Agile implementation domain.

The preliminary research outlined in Chapter 2 was a form of grounded exposure to the field which addressed the initial exploratory research question that was stated as:

RQ1: What insights and understanding can a Practice Theory based organisational learning approach provide when adopting a large-scale Agile method?

Having become sensitised to the field under examination, ~~the researcher enhanced~~ the research approach has been enhanced with the production of the CATF. This has led to the development of a further refined research question which is stated as:

RQ2: How can a consolidated Activity Theory framework (CATF) provide a contextual and relational understanding of the cultural and behavioural obstacles when adopting large-scale Agile delivery methods?

This research question gives rise to a further research question that assesses whether the developed CATF can be extended to provide a repeatable, scalable and progressive structured analytical tool.

RQ3: To what extent can a consolidated Activity Theory framework (CATF) contribute towards the assessment of the obstacles to learning involved in developing an organisation's large-scale Agile capability?

Following the outcome of the preliminary research and the development of the CATF, the next chapter (Chapter 5) sets out the research philosophy, strategy and data collection and analysis methods that was applied in the main Case Study.

Chapter 5: Research Methodology

5.1 Introduction

Creswell (2012, p.28) states that researchers are responsible for devising research processes that serve their purposes best. This chapter explains the rationale for the approach adopted in this research as well as its context, and details the main Case Study used to address the research questions.

Sections 5.2 and 5.3 discuss the research philosophy underpinning the research approach and the mixed research methods that are deployed. These are influential elements because social research cannot be separated out from issues related to social ontology, and the related assumptions and commitments, that influence the formulation of research questions and the conduction of research (Bryman, 2016, p. 30). This research adopts an explicitly social constructivist/pragmatist perspective because contradictions and congruences are social constructions arising from individuals' experiences and interactions. The Agile activities within which these events occur are social practices that are made up of individuals undertaking tasks and interacting with each other. These are continuous processes, with individuals having different perspectives as they construct their own social realities.

Section 5.4 discusses the merits of the selected case study strategy. Section 5.5 outlines the main Case Study organisation (Health Care Org.) a large public organisation within the health care sector in Scotland. This section describes the circumstances which gave rise to the large change programme, including adopted large-scale Agile delivery methods at this organisation. Section 5.6 outlines the data collection approaches that were undertaken, based on the main objective of identifying and analysing potential contradictions, expansive learning actions, collaborative activity and congruences occurring during the change programme. Section 5.7 describes how the collected data was subsequently prepared and coded prior to its analysis using the NVivo software qualitative analysis tool.

5.2 Research Philosophy

This section explains how the chosen philosophical perspective shaped this research. Tadajewski (2004) states that "scholars need to be aware of the philosophical assumptions embedded in their research output because all research is underpinned and delimited by a particular stance towards the world they study (ontology) and how this is investigated (epistemology) which, in turn, influences the methodology used to seek knowledge" (Tadajewski, 2004 cited by Baker & Foy, 2008, p.20). Robson (2011, p.41) cites Carter & Little (2007) who state that researchers who understand this context are more likely to use their research methods in a nuanced and flexible way, rather than blindly following recipes, and that they will feel more confident. This results in more reflexive and creative researchers evolving the research work as well as avoiding outmoded traditional approaches.

Because this research examines the application of a consolidated Activity Theory framework (which itself is a research approach) within the organisational learning domain, this section considers the philosophical aspects of research in some depth to provide an informed contextual perspective. The case for the examination of both ontological & epistemological elements of learning within organisations is made by Brandi & Elkjaer (2011). These authors point out that organisational learning theory based on individual learning is unable to explain how individual learning outcomes become organisational learning outcomes. They state that "learning is a practical rather than an epistemic accomplishment, and it is a matter of identity development and socialization" (Brandi & Elkjaer, 2001, p.28). It is within this context that this research took place, accompanied by different positions regards the nature of reality (ontology) and the possibilities of knowing about it (epistemology) (Gomm, 2008; p.2). These elements are considered in the following sections.

5.2.1 An ontological perspective

Ontological considerations relate to the nature of reality and the debate as to how accurately we can assess the nature of reality. According to the Sage Handbook of Qualitative Business and Management Research Methods: History and Traditions, an ontological perspective on the metaphysical assumptions underlying academic inquiry addresses whether reality represents "an objective existence external to and

independent from individual cognition" or "a product of individuals' subjective consciousness" (Cassell et al., 2018, P.17). There are two main views regarding this ontological perspective (Bryman, 2016, p.4). The first is the Positivist (Objectivist) view that regards reality and social events as external phenomena over which individuals have no control, and influence values and behaviour. The second is the Constructivist (Interpretivist) view that regards reality as not given, objective or external but as socially constructed and given significance by people (Easterby-Smith et al., 2008, p.58). In this perspective, reality is emergent, negotiated and in constant flux (Bryman, 2016, p.30).

Collis & Hussey (2003, p.48) state that these two main paradigms are best regarded as the extreme ends of a continuum, and that as one travels from one end to the other then gradually the features and assumptions of one are relaxed and replaced by those belonging to the other. Along this spectrum lie intermediate 'isms' such as 'Critical Realism' (Bhaskar, 1975) and 'Pragmatism'. The latter states that there are no pre-determined theories that shape knowledge and understanding, and that they are only relevant if they lead to action (Easterby-Smith et al., 2008, p.76).

Within this broad ontological continuum, another spectrum is identified by Allen et al. (2011) who point to work by Schatzki (2005) which suggests that researchers explaining social phenomenon are divided into two groups – those that examine the properties of individuals and those that explain matters by reference to groups. Allen et al. (2011) advocate a 'third way' by proposing a social ontology that emphasises the dualism of individuals and groups (society). They alight on AT which they regard as neither the result of positivism nor the outcome of subjective interpretivism. They state that AT is 'highly applied' according to Ponomarenko (2004), and that AT is an interventionist research approach (Miettinen, 2006) based on dialogue between researchers and the people they study (Allen et al., 2011, p.780).

Spinuzzi (2020) states that Engeström's development of AT is specifically oriented to interventionist research and that the famous triangle structure was developed as a mechanism to assist in communication amongst researchers. Miettinen (2006) suggests that both AT and American pragmatism are useful approaches in understanding social practice. This researcher points to their shared philosophical roots in the Hegelian tradition of change and dialectics, also pointing to the views of Russell (1951, p.143) and Joas, (1991) on the similarities of the pragmatic approach and AT's Marxist foundational

concepts of activity and praxis. Miettinen (2006) also suggests that both approaches share the idea that subjects and objects emerge together and are interactively transformed by practical activity.

According to Miettinen (2006), both pragmatism and AT regard practical experimentation and intervention as core elements of studying change in human practice. He refers to Bakhurst (1991) who confirms that both dialectical and activity theory researchers have avoided identifying with either the realism or the constructivism approaches. Miettinen (2006) continues by pointing out that there are ontological, epistemological and ethical reasons underlying the significance of intervention and experimentation as a research approach. He also states that AT has been oriented to studying change and development in human activity. Miettinen (2006) suggests that AT researchers have developed an interventionist research approach with relevant concepts such as a working hypothesis, remediation and developmental contradiction.

Much of the interventionist approaches can be seen in the third generation of AT as developed by Engeström (1987). Engeström has applied the 'interventionist' approach in the Change Laboratory (CL) work consisting of a series of interventions where an organisation faced major transformation. The method was first implemented in 1995 in Finland (Sannino et al., 2016). In this method, participants are formally interviewed, video-recorded and queried either in situ or in a research laboratory. A CL intervention typically consists of six to twelve weekly sessions lasting about two hours each, with subsequent follow-up sessions. Other researchers such as Bardram & Doryab (2011) have drilled down to minute-by-minute analysis of daily activities in a case study involving surgeons and haematologists.

This study adopted a middle path between detailed systematic observation and large-scale interventions, by focussing on specific activities involved in large-scale Agile approaches. The aim was to identify where contradictions, expansive learning, collaborative activity and congruences take place. This approach was prompted by previous developments within the AT domain such as the Activity Checklist Model (Kaptelinin et al., 1999) and the Activity Oriented Design Method (Mwanza, 2001).

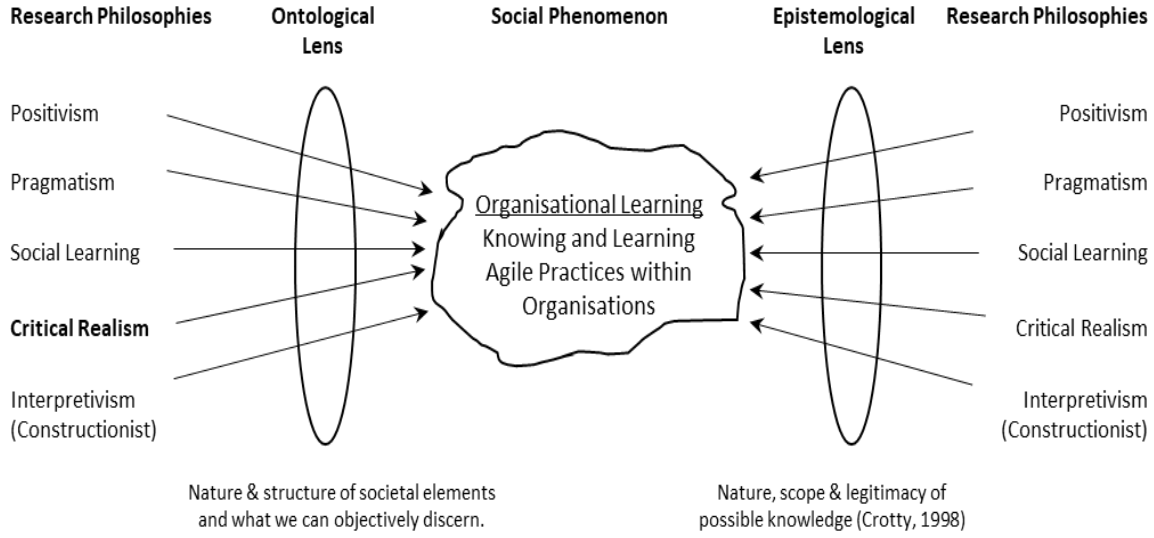
5.2.2 Epistemological considerations

The epistemological considerations relate to what is deemed to be knowledge. The Positivist view was first expressed by the French philosopher August Comte (1798-1857) who refuted the notion that human perceptions and interpretations of the real world are what matter (Baker & Foy, 2008, p.17). From a Positivist perspective, the social world should be measured using objective methods instead of being subjectively assessed through feelings, intuition, or reflection (Easterby-Smith et al., 2008, p.57).

The Positivist approach is useful in the physical sciences but less appropriate for the science that deals with culture and human activities (Easterby-Smith et al., 2008, p.58). Social Constructivism (Constructionism) originates from the perspective that reality is not objective and external to humans but is socially constructed and given significance by them (Easterby-Smith, et al., 2008, p.58). The significance of the Social Constructivist view is that it focuses on individuals' own construct of reality and the importance that they ascribe to these. Easterby-Smith, et al., (2008, p.59) state that the social constructivists aim to understand why people have different experiences, rather than seeking out external principles that explain their behaviour.

It is worth noting at this point that there might be some confusion with this research focus because it may appear somewhat convoluted. That is, its focus is on obtaining knowledge of a particular social phenomenon relating to the knowing and learning that takes place within organisations. Figure 5.1 may help to resolve such confusion by illustrating how knowledge is the social phenomenon under examination using different perspectives (lens).

Figure 5.1: Ontological & Epistemological Perspectives of the Social Phenomenon of Organisational Learning

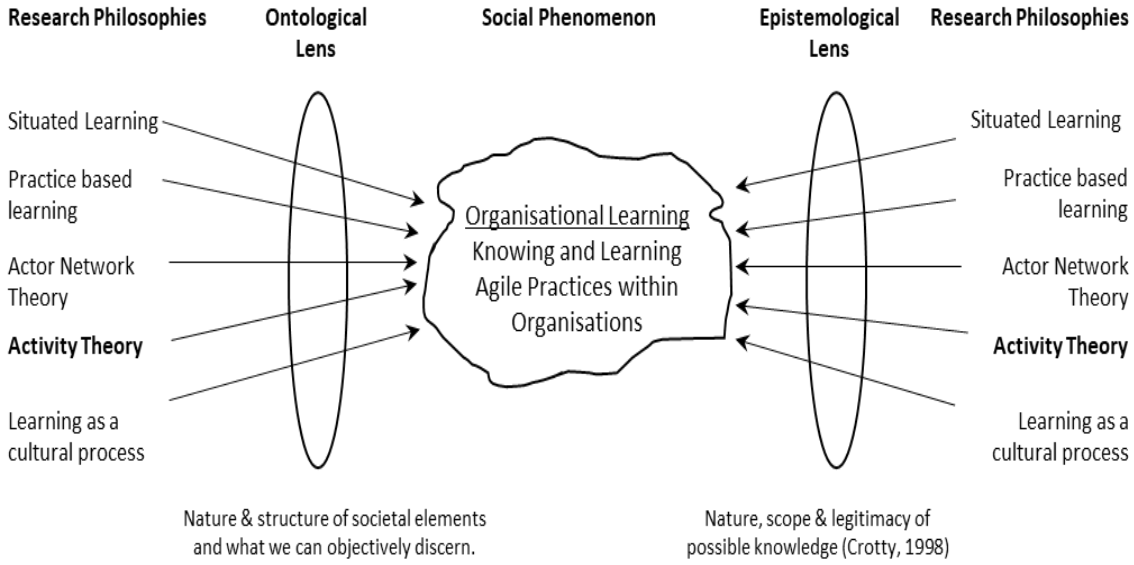


As shown in Figure 5.1, each of the philosophies and approaches mentioned above has its own ontological understanding of the structure of any social phenomena's reality, as well as its own epistemological perspective around the assumptions and validity of the knowledge that is possible. These research philosophies each have their own emphasis so, for example critical realism's focus (bold in Figure 5.1) is on ontology not epistemology (Sayer, 2000 cited by Wheelahan, 2007, p.185).

Brandi & Elkjaer (2011) refer to another research perspective which is recognised as the social perspective on organisational learning. They state that social learning approaches each have their own ontological and epistemological perspectives such as 'situated learning' (Brown & Duguid, 1991), 'practice-based learning' (Gherardi, 2000), 'actor-network theory' (Fox, 2000), 'cultural-historical activity theory' (Engeström, 2001) and 'learning as cultural processes' (Cook & Yanow, 1993). These perspectives are depicted below in Figure 5.2.

The common element in these perspectives is the understanding that learning is rooted in participation in social processes that emphasise issues of knowing and being. In the words of Brandi & Elkjaer (2011, p.24) "Social learning theory considers both the issue of human existence, development and socialization (ontology) and the issue of people coming to know about themselves and what it means to be part of the world (epistemology)".

Figure 5.2: Ontological & Epistemological Perspectives of the Social Learning Approaches



Brandi & Elkjaer (2011, p.24) state that the social learning perspective regards learning as an ongoing endeavour that cannot be controlled: that only its environment (organisation) can be altered. Such organisational changes cannot take place without affecting the individuals concerned. Hence these authors' pragmatic perspective stresses the coexistence of ontological and epistemological elements in organisational learning. These authors state (2011, p.31) this is a social constructionist view of the relation between the individual and the organisation representing one philosophical research approach to understanding organisational learning.

5.2.3 Research perspectives and Activity Theory

White et al. (2016) apply AT to understanding Operational Research (OR) interventions, regarding AT as a powerful tool for integrating social constructivist developments into the understanding of OR interventions. Their social constructivist perspective provides a view of the 'power dynamics' within activity systems bringing to the fore the socio-cultural aspects of human activity. In terms of research philosophies in the broader field of Information Systems (IS), Bertelsen (2000, p.16) acknowledges that IS research builds on a variety of disciplines, stating that it is a "hodgepodge where it is hard to say that one result of research is better than another; it easily becomes a matter of taste" Similarly, Allen et al. (2013) state that IS have diverse impacts and concerns, leading to important implications for IS research philosophies. These are polarised into the two

extremes of positivism and interpretivism and the authors suggest that this has led some to search for other ways forward such as critical realism and AT.

A complicating factor in this research is that it examines individuals and activities not only within the IS domain but also within other organisation functions. Hence it exists within the management research sub-set of the social sciences discipline. Easterby-Smith et al. (2008, p.6) state that management research poses a set of problems not normally experienced within the social sciences. Table 5.1 below lists the elements that relate to management research.

Table 5.1: Distinctive Feature of Management Research (Easterby-Smith et al, 2008; p.6)

Key Feature	Implications for Management Research
Management research methods are eclectic	Researchers need to be aware of different underlying assumptions.
Managers are powerful	Research depends on the support of managers, and researchers are much less in control than in 'normal' science.
Managers are educated	Managers will have an academic interest in the research process/results and may want to contribute to direction of work.
Action is a frequent outcome of management research	Research results may both derive from and lead to practical action. Both traditional analytic research and action research are legitimate activities.

From the above discussion there are several research philosophical implications for this study. These range from the location of AT within the positivist/constructionist continuum, via its location with the individual/group spectrum to its deployment within the IS domain within a management research context. Although there have been studies deploying AT within a positivist approach (Engeström, Miettinen & Punamaki, 1999), and although others have indicated that AT can be explained in a positivist way within a behavioural and cognitive perspective (Levitt & March, 1988), the approach deployed in this study is that of the practice perspective, by adopting a pragmatist/social constructivist approach.

The research questions in this study were formulated under the assumption that knowing and learning processes, and the adoption of large-scale Agile methods within organisations, are not external or objective but are socially constructed by individuals engaged in these activities. The learning processes within social organisations are in constant flux and are continuously being reassessed through activities and practices. Consequently, the research philosophy of this study was socially constructed as

1. Individual's views and perspectives are deemed to be important.
2. Information will be gathered mostly from the beliefs, values and understandings of the participants as expressed in interviews.
3. The research involves understanding how people behave or learn in a particular way and the organisational, cultural, and social aspects that influence this learning.

5.2.4 Research theory development

Bryman (2016, p.18) states that theory is important because it provides a context and justification for being constructed, as well as a framework within which social phenomena can be understood. In terms of the relationship between theory and research there are two different positions.

One, known as deductive theory, takes the stance that theory will guide and direct the research efforts of data collection and analysis. The other, inductive theory, views theory as emerging from the collection of data and its analysis. The two approaches are briefly outlined by Bryman (2016, p.23) as

> **Theory → Observation/Findings** (Deductive)
> Starts with a general theory and becomes progressively specific.
> Is likely to be concerned with testing and affirmation of a hypothesis.
>
> **Observation/Findings → Theory** (Inductive)
> Starts with local and specific observations moving towards a theoretical perspective. Is likely to be open and exploratory.

The position adopted in this study was informed by a mixture of both perspectives. The preliminary research (Chapter 3) started with a largely inductive approach in which a wide-ranging, high level perspective was taken, using open-ended questions and passive

observation. AT was regarded as a rudimentary framework to discover specific learning and development issues this enabling formulation of theory.

The difficulties encountered in analysing data collected from this very small, specific study resulted in a re-appraisal of the approach. The resulting elements contributed to the mostly deductive approach (CATF) that was applied in the main Case Study. The intent was that this CATF would be a useful tool for understanding learning and development issues related to changes when adopting large-scale Agile delivery methods.

5.3 Research methodology selection

Research methods can be regarded as either quantitative or qualitative. Quantitative approaches involving the measurement and description of the occurrences of phenomena had been dominant in the social sciences up to the mid-1970s. After this, they were overtaken by qualitative methods (Bryman, 2016, p.149). Qualitative approaches were developed as a response to critiques of quantitative methods (Flick, 2014, p25). They are designed to capture participants' subjective perspectives about the real world and do not try to understand or objectively represent an external real world (Easterby-Smith et al., 2008, p.167). Baker & Foy (2008) state that the discussions around qualitative and quantitative approaches are polarised, with qualitative approaches often being regarded as lacking in rigour and leading to inconclusive results.

Qualitative research is about representing how participant's understandings are arrived at through social interactions (Easterby-Smith et al., 2008, p.167). Silverman (2011, p.113) contrasts this approach with the quantitative researcher "who uses methods like surveys and laboratories experiments to get an overall picture of society, we try to get inside the fabric of everyday life". Bryman (2016, p.375 citing Bryman & Burgess, 1999) states that qualitative research is characterised by an interpretivist and constructionist philosophical perspective but cautions that it is not that straightforward.

Most AT related studies adopt qualitative research approaches. Hakkinen & Korpela (2007) provide a qualitative study using AT as a framework for examining participatory methods for understanding information needs and user requirements. Hasan & Banna (2010) used AT because its holistic and contextual emphasis was appropriate for qualitative and interpretative research. They state that AT was a well-developed, powerful tool for providing deep understandings of complex and dynamic settings such as in public healthcare.

An alternative approach is to deploy both qualitative and quantitative perspectives in a mixed methods approach. Creswell, (2015, p.16) addresses the philosophical foundations of a mixed methods approach by posing the question - where a qualitative approach is associated with an interpretivist perspective while an experiment based, and numerical data collection approach is associated with a positivist philosophy then where does a mixed methods approach trace its origins? Creswell (2015, p.16) then states that typical research philosophies that underpin mixed methods approaches

originate from Pragmatist and Critical Realism perspectives. Creswell (2015; p.2) defines mixed methods research as

> *"An approach to research in the social, behavioural and health sciences in which the investigator gathers both quantitative (closed-ended) and qualitative (open-ended) data, integrates the two and draws interpretations based on the combined strengths of both sets of data to understand research problems"*

A major assumption underpinning the deployment of a mixed methods research approach is that the combination of both approaches provides a better understanding of the problem than either would do alone (Creswell, 2015, p.2). However, Easterby-Smith et al. (2008, p.71) have reservations about mixed methods research because they represent distinct ontologies. These researchers indicate that, in some instances contradictory results may be obtained due to different approaches to data collection.

To an extent this point is addressed by Creswell (2015, p.6) who advocates the integration of the data sets derived from a mixed methods approach (reconciliation of a descriptive narrative with statistical data). A necessary step in understanding these issues is to be aware of the different research configurations that are at the core of all mixed methods design. These research configurations are summarised in Table 5.2 below.

Table 5.2: Mixed methods design (adapted from Creswell (2015, p.6 and p.83)

Method	Description	Data Integration Type
Convergent Design	Research intent is to collect both quantitative and qualitative data, analyse both and then merge the two sets of data with the objective of comparing the results.	Merging where results of the analysis of qualitative & quantitative data are brought together and compared.
Explanatory Sequential Design	Research intent is to first use quantitative approaches followed by qualitative that will help to explain the quantitative result in more depth.	Explanation where the qualitative data is used to explain the results of the quantitative data.
Exploratory Sequential Design	Research intent is first to use qualitative methods to explore the area as the question may only be partially understood. Thereafter a quantitative approach is used to measure the	Building of data when qualitative data is used to build a quantitative phase such as discovery of new variables.

Method	Description	Data Integration Type
	identified variables. The identified results are then analysed and assessed.	

Similarly, Miles and Huberman (1994, p.41) outline four distinct research designs. Two of these are aimed at parallel quantitative and qualitative data collection procedures. The others alternating qualitative and quantitative data collection processes. Also, Swanborn (2010, p.11) states that a relatively recent development is the blending of qualitative and quantitative approaches. This approach consists of extensive analysis and quantification, combined with intensive studies such as case studies, to provide in-depth perspectives. (Swanborn, 2010, p.5).

This study adopts a mixed methods approach which aligns, to a certain extent with the 'Exploratory Sequential Design' approach outlined in Table 3.2 above. The combination of qualitative and quantitative research methods is also in alignment with the social constructivist and pragmatic realism philosophical approaches outlined above.

5.4 Research strategy

Designing a research activity is about making decisions early on about what elements will and will not be examined (Easterby-Smith et al. (2008, p.82). The following considers research designs that are mostly based on a social constructivist approach although the case study approach has a much broader perspective. The subsequent sections consider different approaches from the perspective of their suitability and applicability to the research to be undertaken.

The Initial Study (discussed in Chapter 3) adopted a loosely ethnographic based research strategy where the researcher is immersed within the activities of a social group whose behaviour is the subject of the research. According to Gomm (2008, p.269) ethnographic research is based on 'naturalistic' observation, through accurately capturing events irrespective of the research activity, and takes place in a 'natural' environment. Robson (2011, p.142) states that ethnographic study takes place over a long period of time and is a means of getting close to social phenomena. This researcher states that such closeness would not be possible using other research approaches such as experimental or survey research strategies. Robson (2011, p.145) also notes that an ethnographic research strategy is centred on a constructionist perspective. This author quotes Hammersley's argument (Hammersley, 1989) that this constructivist approach is combined with a realism perspective that recognises that the researcher is not independent of the phenomenon under study.

For this research, such close involvement presents a number of potential problems as occurred in the Initial Study (Chapter 3) where following an observed retrospective and client demonstration, the participants sought the researcher's views as well as advice on ways forward. Issues of access, the notion of overt versus covert observation, and whether the researcher plays a passive or active role are identified by Bryman (2016, p.425) and Bayer & Foy (2008, p.153).

Easterby-Smith et al., (2008, p.155) state that the objective of ethnographic approaches is to gain an insider's perspective to obtain a detailed understanding of other people's realities. An ethnographic approach could help develop a richer understanding of the area under research, including participant's different perspectives. However, the duration of time involved in ethnographic research was a major limitation due to the researcher's full-time occupation and the reluctance of host organisations to allow an

external person access for a long time. Ethnographic research is likely to be beneficial when considering observations of people's behaviour, culture, and norms within the AT perspective (Bardram & Doryab, 2011). However, unless the research is conducted on a similar basis to Engeström's Change Laboratory (Sannino et al., 2016) as outlined in section 5.2.1 above, it is extremely difficult to research individual behaviours and interactions. This research, involving the examination of the adoption of a large-scale Agile method within a large organisation, involves a completely different set of circumstances to the examination of a localised use of a novel artifact or software interface as has been conducted elsewhere using AT (Kaptelinin, 1996).

This study did not have the resources to be able to stage interventions on the scale of Engeström's Change Laboratory (Engeström et al., 2013). Also, it would not be practical to video record interactions in a third-party organisation. Consequently, the main data collection process consisted mostly of interviews conducted very much after events were concluded. In addition, the event (adoption of a large-scale Agile method) under consideration was made up of many participants in various teams such as developers, business analysts, senior managers, product managers, users and clients, undertaking multiple complex inter-related activities such as requirements analysis, building and coding as well as governance and support.

Within the main Case Study organisation, some elements (e.g. meetings and discussion groups) were observable, but much of the learning and development was not observable as these were liable to take place in informal conversations, email exchanges and individuals' use and modification of organisational practices. The required levels of observation would have been excessively burdensome on participants so it was unlikely that any organisation would have agreed to such intrusion. Consequently, inability to gain access to individuals and their work practise and time and resources constraints made ethnographic research approaches unviable. Because this study's theoretical perspective already exists and is not grounded in the data (section 5.2.4) then Grounded Theory is not regarded as a suitable research strategy (Corbin & Strauss, 2015).

An Action Research strategy involves an interventionist approach where researchers work with the individuals within the organisation under study (Easterby-Smith et al., 2008, p.165).

Applying such a strategy to this research might have initially appeared to be appropriate in that the organisation under scrutiny was undergoing a process where the overriding driver was development and improvement. Also, some participants within the Initial Study had approached the researcher for advice. This resonates with the Action Research strategy but there would have been no opportunity to implement the researcher's suggested actions after data collection and analysis had been undertaken. Therefore, the Action Research approach also was not appropriate for this study.

5.4.1 Choice of case study research strategy

This research study adopted a case study strategy. The University of Southern California Library Guides provide a definition of a case study research paper as

> *"A case study research paper examines a person, place or event, phenomenon, or other type of subject of analysis in order to extrapolate key themes and results that help predict future trends, illuminate previously hidden issues that can be applied to practice, and/or provide a means for understanding an important research problem with greater clarity "*
>
> (USC Libraries Research Guides, 2019)

According to Yin (2009) a case study is "a strategy for doing research which involves an empirical investigation of a particular contemporary phenomenon within its real-life context using multiple sources of evidence". Yin (2014, p.15) makes it clear that the case study method is a distinct research method in its own right; case studies are not just a prelude to another research method, and are not to be confused with ethnography or participant-observation. The case study method is compatible with multiple positions on the research philosophy spectrum and can utilise a mixture of qualitative and quantitative research methods (Yin, 2015, p.19; Bryman, 2016, p.61). Easterby-Smith et al. (2008, p.97) confirm this, pointing out that although the case study approach derives predominantly from the positivist end of the spectrum it can be undertaken in a constructivist manner to examine in depth one or more events, organisations or individuals over time.

Swanborn (2010, p.10) suggests that the label 'case study' has been used for numerous purposes, and that there are many strands of case study research originating from different disciplines as political science, psychology, cultural anthropology and health science.

Swanborn (2010) also states that the case study method is most often used for the study of organisations and organisational functions such as marketing, management, information systems and strategy. Swanborn (2010) identifies some key characteristics of a case study: Is a study of a social phenomenon.

- Occurs within the case's natural context.
- Is carried out within the bounds of one or more social systems such as individuals, groups and organisations.
- Monitors a phenomenon over time or collects information afterwards with respect to the development of the phenomenon over time.
- Is focused on describing and explaining people's values, expectation, opinions, perceptions, resources, controversies and decisions within unfolding social processes that people engage with.
- Is where the researcher is guided by an initially broad research question, explores the data and only after some time, formulates more precise questions whilst keeping an open eye to unexpected elements abstaining from pre-arranged procedures and operationalisations.
- Uses several data sources mainly documents, interviews and observations.

Almost all these characteristics were applicable to this research. Also, importantly, all were achievable in the context of the case study organisation, the researcher's constraints and the focus of this study. In addition, Swanborn (2010) suggests that case study research can occur at several levels.

- Micro-level: dealing with one or more individuals and their interpersonal relationships.
- Meso-level: dealing with one or more organisational/institutional level and their networks and relationships.
- Macro-level: dealing with large communities and social systems.

The micro and meso levels aligned with many of the objectives of this study because it addresses social activities at a combination of these levels. From a research philosophy perspective, according to Yin (2014, p.11), there are three important steps prior to establishing a research method.

They are in order.

1. Identify the type of research question.
2. Determine whether the researcher has control over the events.
3. Is the research focus on contemporary events?

Concerning the first step, this research had three research questions asking 'what' and 'how' questions. Yin (2014, p.11) indicates that, where 'what' questions are exploratory any research method can be used. He also states that 'how' and 'why' questions are likely to favour a case study, experimental, or historical approach. For step two, the researcher had no control over participants or their host organisation. For step three it is clear that the focus was very much on contemporary events, albeit within the context of an historical, cultural and social environment. Robson (2011) quotes Miles & Huberman (1984) who state that the term 'site' might be preferable because "it reminds us that a 'case' always occurs in a specified social and physical setting; we cannot study individual cases devoid of their context in a way that a quantitative researcher often does".

Dennehy & Conboy (2019) in their analysis of contradictions within activity systems, indicate that a case study approach was valuable as they explored practice-based problems. These merits consisted of:

- Where the experience of the actors (subjects) is important.
- Where the context of the action is critical.
- Where the phenomenon being studied lacks observed substantiation.
- Where it is important to identify how conditions changed over time.

The advantage of the case study approach is that it can provide a detailed perspective involving extensive descriptions capturing multiple aspects of a situation in some depth (Denscombe, 2010, p.60). However, case studies can be time consuming, and can involve the capture of large data-sets that can still fail to capture significant elements (Yin, 2008).

According to Bryman (2016, p.62) there are also some concerns regards the external validity and the extent to which it is possible to generalise from the findings from a single case study. Denscombe (2010, p.60) counters the accusation with three arguments. Firstly, although each case may be unique it is still a single example of a broader class.

Secondly, the ability to generalise depends upon the extent to which the case study is similar to others of its type. Thirdly the case study information should provide enough details to enable others to make an informed judgment regards its relevance to other instances.

Flyvbjerg (2006) takes up this defence, addressing case study research misunderstandings. He states that cases have an important role in learning; as individuals transition from beginners to experts, their evolution is founded on knowledge of extensive numbers of cases. Drawing on a variety of historical (Galileo's experiments) and published sources as well as his own experience, Flyvbjerg (2006) concludes that one can indeed generalise from a single case study, and that the case study method may well be core to scientific development as a supplement or alternative to other methods.

5.5 Main Case Study - Health Care Org.

Health Care Org. is the pseudonym given to the organisation that is the subject of the main Case Study. Health Care Org. is a public sector body, designated as a National Board, that delivers over 55 health-related services. As a single body employing over 3500 people, Health Care Org. leverages efficiencies of scale and reduced infrastructure costs in the delivery of its services. The demand for these services has grown as local Health Boards face increasing challenges due to an ageing population, health inequalities, increased mental health issues and the requirement for the integration of health and social services. These challenges must be met within the context of strict financial constraints.

A key focus of Health Care Org. is to support local Health Boards with better data and intelligence to help them deliver better health-care. Delivering these services requires Health Care Org.'s own IT systems to be continually improved. A strategic review in 2016 concluded that the way that Health Care Org. could deliver on its future mandate was to "invest – and achieve a revolution - in the way that it delivers digital services and operations" (Health Care Org. Internal Report, Digital Transformation Strategy, 2016, p.2) . This requires the use of digital technology to deliver services, and putting the customer at the heart of these. Hence the Digital/Service Transformation Programme (D/STP) was designed to transform Health Care Org.'s service delivery to a modern digital approach. This two year D/STP is the focus of the main Case Study.

Eight delivery themes based on business functions were selected to form the D/STP. The programme had two phases. The first of these (Digital Transformation) taking place in the first year of the programme was aimed at delivering the digital capability and infrastructure that would underpin the delivery of services. The second phase (Service Transformation) focussed on transforming services through re-design and development. Although the second phase continued to build capability, its focus shifted to increasing the pace of delivery of the more critical services. Throughout the programme a core of around 100 people in different workstreams was engaged in the programme at various levels. At times, however, almost 200 people were engaged.

The strategic review in 2016 highlighted the urgency of the situation as well as the limitations of conventional delivery approaches. Given the complexity and interconnectedness of the organisation, it was not possible to deliver the transformation

through piecemeal approaches. The head of the organisation had indicated that “A few years ago there was a serious need for change within [Health Care Org.] and incremental change would not be enough” (CEO, Health Care Org. personal communication, May 2019). Consequently, there was a requirement for a new way of working. This led directly to the adoption of a large-scale Agile method via the Scaled Agile Framework (SAFe) structure. This is aimed at synchronising the alignment, collaboration and delivery of multiple Agile teams (Leffingwell, 2007). The utilisation of the SAFe approach on a large transformation programme in a complex public sector organisation (with limited software development involved) was a major challenge.

Multiple reasons were given for the D/STP to adopt the SAFe framework large-scale Agile method. These included the need to deliver rapidly, to realise value quickly and an acknowledgement that delivery speed would be dependent upon getting people from different parts of the organisation to work together much more closely than previously possible. A senior manager from an External Department, indicated that “We could see that Agile worked with individual projects or a small set of projects but because we had many large, related projects (workstreams) delivering in parallel and we needed to keep the pace, the alignment and the management of risk across the piece, then SAFe was a really good way of doing that” (OI-1206 in Table 5.8 below:).

Overall, there were several reasons for the selection of Health Care Org as the main Case Study organisation.

1. Accessibility: Health Care Org. is a public sector organisation overseeing multiple services for the public health sector in Scotland and was easily accessible by the researcher.
2. The Digital/Service Transformation Programme was a large-scale implementation of SAFe (Scaled Agile Framework) of which there are few within Scotland.
3. The organisation had little previous experience of Agile methods, and has substantial legacy and heritage elements that would provide historical, cultural, and social perspectives.
4. The researcher already had several contacts at various levels of the organisation’s senior management.

5. As a public sector organisation, there were less concerns over confidentiality issues than were likely with other local large organisations (predominantly within the financial services sector). Conversely, a public sector organisation raises other issues such as those identified by Allen et al. (2013) who refer to Ackroyd et al. (1992) with regard to concerns with technology and innovation in the public sector.

The research period within Health Care Org. was from March 2017 to September 2019. This approximately matched the duration of the D/STP, (started in May 2017 and ended in April 2019). The following table indicates the main dates and events of this period.

Table 5.3: Chronological account of the data collection process

Date	**Event and researcher's role**	**Where and Comments**
24 March 2017	Interview with Health Care Org. Programme/Portfolio Director; start of involvement	Skype interview: One of the first 5 interviews in preliminary research
5 December 2017	D/STP: stand-up session. Observer	Health Care Org. HQ Edinburgh
13 December 2017	D/STP: Cloud Project: Sprint delivery stream planning session. Observer	Health Care Org. HQ Edinburgh
29 January 2018	D/STP: Cloud Project: Sprint delivery stream retrospective. Observer	Health Care Org. HQ Edinburgh
5/6 February 2018	D/STP: PI Planning - 4. Observer	COSLA, Verity House Haymarket Yards. Edinburgh
25/26 April 2018	D/STP: PI Planning - 5. Observer	COSLA, Verity House Haymarket Yards. Edinburgh
13 June 2018	D/STP: Identity & Access Management Work Stream. Observer	Health Care Org. HQ Edinburgh
23 January 2019	D/STP: PI Planning - 8. Researcher presented paper 'Models to assist with Agile Adoption and Transformational Change'	Hilton Hotel Edinburgh
18 February 2019	D/STP: Cloud Services Stream. Re-focusing Event. Observer	Health Care Org. HQ Edinburgh
2 April 2019	D/STP: Show & Tell. Last event following closure of the D/STP programme. Observer	Health Care Org. HQ Edinburgh

Date	Event and researcher's role	Where and Comments
May to September 2019	30+ structured Interviews	Skype and at Health Care Org.'s HQ Edinburgh

The top half of Table 5.3 (to the double border) took place when it was intending to collect data from several organisations including Edu-Institute (See Initial Study in Chapter 3). This accounts for the somewhat sporadic data collection during this period. Most of the data collected up to this point was observational. It served to provide context for later analysis. During this period negotiations were taking place to finalise the research agreement.

During March 2019, through negotiation with key Health Care Org. personnel, several developments took place that greatly facilitated both the planned research activities and a fuller understanding of the programme. Firstly, the main Health Care Org. contact sent several emails to the D/STP personnel introducing the researcher, explaining his presence and indicating the nature and duration of the research being conducted. Secondly the researcher was granted full admittance to the building and facilities. This greatly facilitated ease of access because the researcher could come and go without the need to be accompanied by Health Care Org. staff. Thirdly access was provided to the organisation's Wi-Fi network and available hot desks. Fourthly, access was provided to the programme intranet including data sharing tools such as BaseCamp and Trello. These developments were indicative of a high level of trust and co-operation from the participating organisation. This was undoubtedly facilitated by the long-standing and mutually beneficial relationship between Health Care Org., the researcher and the researcher's university.

5.6 Data collection

Research activities within Health Care Org. utilised a variety of data collection methods, and a broad spectrum of data sources, to enable cross-checking and validation of findings. This section briefly identifies the main data collection methods in previous studies that have used AT then outlines the methods deployed within Health Care Org.

There are several examples of the application of the AT framework within the IS domain that are similar to the situation faced by this study. The following details some examples of these, identifying the main methods of data collection used where the unit of research was work activity where people were engaged in practice and learning. In demonstrating the application of AT to IS research, Crawford & Hasan (2006) provide five vignettes where AT has been applied, very briefly outlining some of the data collection and analysis techniques that are appropriate for such research. The tools used included content-analysis tools, video recordings of team sessions and transcriptions of group interactions.

Allen et al. (2013) used an interview-based approach across two case studies dealing with paramedic activity. They determined that this was the best way of obtaining detailed understanding of the elements giving rise to changes related to the implementation of information systems. They also undertook over 100 hours of observations. These were captured in field notes. These authors state that their reason for conducting ethnographic work was to study the work activity as a complex mixture of social, cultural and political elements.

In an analysis of contradictions within IS development, Dennehy & Conboy (2019) selected representative individuals to interview using role-based sampling and length of industry experience. They structured their AT approach based on the six elements of Engeström's third generation activity triangle (Tools, Subject, Object, Rules, Community, Division of Labour). They conducted open-ended interviews allowing respondents the freedom to convey their experiences and personal views.

In an AT based examination of the police's use of mobile technology in mobile work, Karanasios & Allen (2014) used different forms of data collection, including interviews with project team members, senior officials, IT suppliers and users. They also undertook observation of meetings as well as shadowing police officers, and examined the use of

the technology in situ. The interviews ranged from forty-five minutes to two hours. Interviewees were identified initially through the researcher's own contacts but were subsequently expanded using the snowball-sampling technique. The interviewees varied according to rank, role and experience. The authors noted that, in their experience, this was the most effective method of obtaining in depth access to what they term a 'closed' organisational setting (Karanasios & Allen, 2013).

Bardram & Doryab's (2011) Activity Analysis approach is aimed at the analysis of collaborative activity in practice. It consists of two parts: the first deploys qualitative sociological methods to provide detailed studies of a particular situation in terms of the activity, the people (subjects) the place and the artifacts. The second element examines the collected data by coding it according to a schema involving activity, actions, operations, context and actors. By considering the three levels (Activity, Actions and Operations) this approach provides a detailed insight into many aspects of activities.

These examples illustrate the well-developed path of using AT within IS research and the mixture of data collection methods ranging from observation, video recording and interview approaches.

5.6.1 Data collection within Health Care Org.

Within both the Initial Study and the main Case Study, direct observation was undertaken to collect data. Direct observation took place mostly by attending project team meetings, retrospectives, and client demonstrations. Theoretically it is possible to employ direct observation of related events such as Scrum masters being approached by business analysts. It is also theoretically possible to use indirect observation such as observing changes occurring on a Kanban board. However due to the limited time-frame, the large number of participants within the D/STP programme and the number of delivery streams involved this was not logistically possible. There is also the potential disadvantage that participants may change their behaviour as a consequence of being observed. According to Easterby-Smith et al. (2008, p.160) the observation approach is of limited use for those who have adopted a social constructivist perspective. The observer role is often disliked by participants because it seems like 'snooping'.

Another option considered was the use of document analysis. Silverman (2011, p.229) defines text as "data consisting of words and/or images which have become recorded

without the intervention of a researcher". This can include blogs, e-mails and documents produced by the organisation. Silverman (2011, p.230) provides the following merits of collecting textual data:

Table 5.4: The advantage of textual data (Silverman, 2011, p.230)

Richness	Close analysis of written texts reveals presentational subtleties and skills.
Relevance and effect	Texts influence how we see the world and the people in it and how we act.
Naturally occurring	Texts document what participants are actually doing – without being dependent on being asked by researchers.
Availability	Texts are usually readily accessible and not always dependent upon access or ethical constraints. Because they may be quickly gathered, they encourage us to begin early data analysis.

It was originally intended to use document analysis throughout the research. Access was provided to the intranet repository tool (BaseCamp) where extensive D/STP documentation was available. The main problem was the very considerable volume of documentation provided by the large number of people involved in the programme. There were insufficient resources and time available to explore all the documentation. A sampling approach could have been adopted but it would have been necessary to research each document's background and context. This approach might have been appropriate for an embedded individual, but it was impractical for a part-time researcher.

Interviews were the main data collection tool deployed. Open-ended interview questions allow researchers to explain complex issues to the participants. Also, they allow researchers to gain participants confidence hence potentially eliciting information on sensitive topics. This might not be possible using a web-based or paper-based questionnaire. Some of this research's interview results were confirmed by observations of group interactions. Easterby-Smith, et al. (2008, p.143) state that a major issue with interview approaches is the level of structure that is to be applied. This can range from highly structured, to semi-structured, to unstructured. The latter is similar to a free-ranging conversation. Each level has its own merits: structured interviews provide

standardised data; semi-structured and unstructured interviews provide richer sources of data which can be more personal.

Noaks & Wincup (2004, p.77) state that the interview strategy selection is influenced by several factors such as the characteristics of the research data set, the sensitivity of the topic, location of the interview and the timescales. They provide the following typology of interview strategies:

Table 5.5: Typology of interview strategies (Noaks & Wincup, 2004, p.79)

Type of Interview	Required Skills
Structured	Neutrality; no prompting; no improvisation; training recommended for the interview task
Semi-Structured (qualitative)	Some probing; rapport with the interviewee; a need to understand the context of the project to aid in identification of significant themes
Unstructured (qualitative)	Flexibility; rapport with interviewee vital; social skills important
Focus Group	Facilitation skills; flexibility; an ability to stand back from controlling the discussion and allow group dynamics to emerge.

Bryman (2016) offers further information on the nature of interviews in the following table.

Table 5.6: Interview Types (adapted from Bryman, 2016, p.466)

Type of Interview	Description
Structured	• Structured to maximise reliability and validity of measurement. • Designed to clearly answer a specified set of research questions. • Interview questions reflect the researcher's focus. • Going off on a tangent is discouraged. • Researcher cannot depart from the interview guide because this may be regarded as compromising the interview process. • Objective is to derive information that can be coded and quickly analysed. • Participant is usually only interviewed once.
Qualitative (Semi-structured and unstructured)	• Questions are more open-ended. • Interview questions aim to reflect the participants own views. • Going off on a tangent is encouraged because it provides an insight into what the participant regards as relevant and important. • Researcher may depart significantly from the interview guide to follow up on participant's replies. • Objective is to derive rich detailed information. • Participants may be interviewed on several occasions.

Subsequent to the Initial Study (Chapter 3), as previously discussed in Chapter 4, research conducted within the main Case Study utilised a more structured, standardised interview approach in order to address concerns regarding firstly the reliability and consistency of the data previously collected and secondly to provide a more effective and efficient approach to data gathering. Semi-structured interviews were based on the developed Standard Question Set (Appendix D). The interviews were mostly conducted face-to-face, but telephone and Skype interviews were used particularly in the early stages of the research. Robson (2011) notes that face-to-face interviews offer the following advantages:

- Potential to provide rich & illuminating data.
- Modifying line of enquiry as you proceed.
- Follow-up interesting responses.
- Investigating underlying motives that can't be done in a questionnaire.
- Non-verbal clues may also give messages that help in understanding the verbal response possibly affecting the meaning of the response.

The interview process was standardised as much as possible. All permissions were obtained beforehand, and interviewees were provided with a consent form (Appendix G). The consent form was accompanied by a Research Privacy notice in compliance with GDPR regulations that detailed the purposes of collecting the data and provided details regarding data storage as well as the relevant Data Controller. Where the interviews were conducted by telephone and Skype these documents were emailed in advance.

Face-to-face Interviews took place at Health Care Org.'s head office, either in communal areas such as the canteen and lounge areas, or specific rooms booked through the main contact's administration support resource. The researcher was aware that interviews conducted in communal areas might be overheard by others, so interviewees might be more reticent than if interviewed in private rooms. Non face-to-face interview were conducted from the researcher's home. Interviews generally lasted between 40 to 80 minutes in length. Each interview was audio recording, and recordings were transcribed either by the researcher or by a third-party transcription service approved by the researcher's university.

Approximately 50% of the interviews were transcribed by the third-party service. The main Case Study data collection activity amounted to over 30 hours of recorded

interviews with interview transcriptions averaging around 8000 words. Bazeley & Jackson (2013, p.57) state that transcriptions ought to be done by the researcher. If they are not, then it is important to review and edit transcriptions whilst listening to the recordings. This is to ensure that subtleties and nuances are not missed and that sentence meanings are not unintentionally reversed e.g. by the exclusion of 'n't' at the end of verbs. Bazeley & Jackson (2013, p.57) also caution researchers by quoting Kvale (1996, p.165) who states that "Transcribing involves translating from an oral language, with its own set of rules, to a written language with another set of rules. Transcripts are not copies or representations of some original reality, they are interpretative constructions that are useful tools for given purposes". Once each interview was completed it was immediately transcribed or sent for transcription. The resulting text was reviewed for accuracy and consistency. Choices as to whether the researcher or the external service transcribed the interviews were made on the basis of factors including initial analysis 'in-situ' while the interview was being conducted, the backlog of interviews requiring transcription and the available time. Each transcribed interview was subject to the following process.

1. Transcripts were stripped of headers and footers then all were formatted in exactly the same way.
2. Formatting the transcript involved left-aligning all the text, then ensuring that the interviewer and interviewee identifiers are on a separate line distinct from the spoken text transcripts and separated by a carriage return. This allows all the identifiers to be allocated a heading style to distinguish them from the text to enable for auto-coding within NVivo.
3. Each interviewee is allocated a code of the form 'AB-0305', in which the four numbers are the day and month of the interview.
4. Whilst listening to the recording, the text was checked for accuracy.
5. Any references to individuals were anonymised. Names of other interviewees were replaced by their code.
6. The usual respondent and interviewer identifiers ('R' and 'I') were replaced with the interviewee code.

Once the above process was complete, each transcript was imported into the NVivo v12 qualitative data analysis software. Data was then coded using this software. Most of the

data was collected in 33 semi-structured interviews of 30 individuals with 3 individuals interviewed twice to obtain further clarification and to follow up on identified issues. These interviews were conducted in the period May 2019 to September 2019. Because the programme had ended the previous month, it was intended to interview as broad a range of staff as possible, as quickly as possible, to obtain a wide perspective and to capture as much information as possible.

The process of recruiting interviewees relied heavily on the main contact's (coded as WS-2205 in Table 5.7 below) personal network. Because the main contact was located within the IT function, and had extensive visibility of most of the delivery streams, this person was very useful when identifying and contacting potential interviewees. The main contact suggested many of these, but the researcher identified some independently. All requests for interview were made through the main contact. Because the interview period coincided with many staff taking annual leave some interview requests were forwarded to available colleagues. However, most people who were asked, and were available, readily consented to taking part.

The first interviewees were from the main contact's programme delivery stream, but recruitment then widened to other delivery streams and personnel As the interviews progressed, recruitment altered somewhat to account for the different roles within the D/STP, and to include personnel who belonged to departments that interacted with the D/STP. Table 5.7 below indicates the different programme delivery streams. This table excludes four delivery streams because the researcher could not access relevant interviewees because they had dispersed following programme termination. Table 5.7 also includes the main Architectural Runway stream that is the central co-ordinating group within the IT/IS function. This group was responsible for developing the core infrastructure on which the other programme delivery streams output would be 'landed'. This stream was also responsible for a substantial element of the co-ordinating activities involving the other delivery streams.

The Delivery Manager column within Table 5.7 (and Table 5.8) shows the interviewed managers in charge of each stream. The Delivery Personnel column indicates the interviewed staff involved in the delivery of the stream. One delivery manager was interviewed after leaving the organisation to obtain a further perspective (discussed in Chapters 6 and 7). Another delivery person in the Delivery Personnel group was

interviewed twice following several informal chats and discussions. Finally, the Programme Manager (Table 5.8) was interviewed in the middle of the data collection process and then three months later at the end of the process. This enabled a closer and more detailed investigation of the issues and questions that arose during the data collection process.

Table 5.7: Interviews conducted with personnel within the D/STP delivery streams

D/STP Delivery Stream	Delivery Manager Interviewed	Delivery Personnel Interviewed	Face to Face/ Skype	Comments
Digital Workplace	WN-0407, WN-2607	IY-1207	1/2[13]	Delivery manager - interviewed twice
Digital Engagement Web	TO-0506	0	1/0	
Digital Engagement Social Media	NZU-0706	0	1/0	
Access Governance	WS-2205	KN-2205; IX-2405; HH-2105; NZ-2805	3/2	
Data Science	SS-0407	QW-1906; QW-2808	3/0	Delivery person - interviewed twice.
Strategy and Governance	0	XN-1206 ND-1206	2/0	Delivery personnel were senior staff. Manager was Senior Manager in Table 4.3
Digital Service Delivery	HN-0708	0	1/0	
Central Legal Office	HI-2806	0	1/0	
Architectural Runway	HI-0306	TE-1906 NT-1206	3/0	Delivery personnel were senior individuals
Total	**9**	**10**		

In addition to the interviews conducted with the delivery streams personnel, additional interviews were conducted with heads of Strategic Business Units (SBU), and heads of interfacing department functions such as Finance, HR and Procurement. A member of the Executive Management Team was interviewed. These interviewees are detailed in Table 5.8 below.

[13] Three interviews of which one was face-to-face and the other two Skype based.

Table 5.8: Interviews conducted with personnel out with the D/STP Delivery Streams

D/STP Interface Function	Manager Interviewed	Personnel Interviewed	Face to Face/ Skype	Comments
D/STP Programme Manager	QZ-1306, QZ-0609	0	1/1	Programme Manager. Interviewed twice.
Programme Support (PgMs)	NN-0909	QY-1206, QN-1309	0/3	
Finance	WO-0309	0	1/0	
Human Resources	XN-2009	0	0/1	
Procurement	HN-0508	0	0/1	
Strategic Business Unit (SBU): Practitioner & Counter Fraud Services	NY-1109	0	1/0	
Digital	HX-2806	0	1/0	
Strategic Business Unit (SBU): Public Health & Intelligence	OQ-1908 UI3107	0	2/0	
Executive Management Team (Medical Director)	OI-1206	0	1/0	
Total	**11**	**2**		

Tables 5.7 and 5.8 represent a re-categorisation of personnel and their roles compared to a previous version (Chita et al., 2020). This was a result of separating out the Programme Support (PgMs) function from the D/STP delivery programme. Previously it had been labelled as an 'Agile' delivery stream that delivered 'Agile capability'. In addition, the Programme Manager, Senior Management and the Directors of SBUs have also been separated out in these tables as entities distinct from D/STP delivery streams. Although these two tables represent the initial grouping of interviews, the method of coding and the software analysis tool allowed the interview data to be grouped in a wide variety of combinations to obtain different perspectives such as those belonging to the different delivery streams, the SBUs and the Programme Support Team.

There was a deliberate choice of interviewees from both within and out-with the delivery streams because the latter individuals had wider organisation perspectives, so would be much more able to answer contextual questions contained within the Standard Question Set (Appendix D). This was particularly true of the discussions with Heads of Department out with the D/STP delivery streams. Interviews were conducted satisfactorily apart from an early one (HH-2105) where a technical fault prevented

recording. In this instance, there was heavy reliance on hand-written notes taken during the telephone conversation. The questions were from the Standard Question Set (Appendix D) with some variation when it came to the Heads of Departments (Table 5.8) who had interacted with the D/STP delivery streams. In these instances, the questions were modified (ad-lib) to cater for their non-delivery perspective and to focus on their interaction with the D/STP delivery streams.

5.6.2 Research issues and challenges

There are potentially several issues that impacted on the research activities undertaken and the results obtained.

5.6.2.1 Axiology

The nature of value, and in this context, the researchers' own values (axiology) regarding the research process and the different constituent elements have a significant impact on the research undertaken. Saunders et al. (2015) state that a researcher's own values play a role in all the research stages. They cite Heron (1996) who indicates that researchers can demonstrate their axiological skills by articulating their values as a basis for making judgments about their research topic and their chosen methods. Researchers' perspectives may range from positivist where the researcher is deemed to be independent from the research undertaken (which will be value-free) to interpretivist where the researcher's own values cannot be separated from the research process (Collis & Hussey, 2003, p. 48).

Saunders et al. (2015, p.140) state that critical realists recognise that individuals' versions of reality are a consequence of their social conditioning. Therefore, researchers should attempt to be fully aware of their own socio-cultural background and experiences that would influence their research under consideration, and attempt to minimise such biases. Consequently, researchers should address their own perspectives at key points within their research processes. The constructivist approach of this research assumed that knowledge is gained from the process of interpretation and that the researcher's own views and assumptions were part of this research process.

With a consulting background, the researcher was aware of his problem-solving, solution focussed approach that might influence his research. For example, it is likely that this background influenced the researcher's desire for a repeatable process, and

perhaps his desire to ‘operationalise’ AT which led to the creation of the CATF (Chapter 4).

5.6.2.2 Semi-Concealed Research

Given the scale of the organisation and the range of the interviews, it was possible that there would be issues around the level of information about the research topic that was divulged to the interviewees. Easterby-Smith et al. (2008, p.160) discuss the notion of a semi-concealed research. In this approach, the research agenda is not fully revealed to all of the participants. The purpose of this concealment is to avoid obtaining responses based on what the participants think that the researcher wants, rather than on a more realistic basis.

In this research, it was likely that if the participants had been informed that the researcher was looking for instances of contradictions or collaborative activity, they may have actively paid more attention to these types of interactions in their everyday activities and interactions. This Hawthorne effect (Sarantakos, 2005, p.189) where the participants are aware that they are being studied, may well skew the results casting doubt upon their validity. Easterby-Smith et al. (2008, p.166) state that a key issue whilst undertaking qualitative research is the “relevance that the research has to the respondents”. They indicate that if the participants do not perceive the research as relevant then they may provide false or misleading information. However, if the participants perceive some benefit, such as learning something new from an individual perceived to be independent then they are more likely to cooperate. Easterby-Smith et al. (2008) suggest that researchers “should be able to recognise and capitalise on these situations and offer them as benefits or advantages to interviewees in exchange for participation”.

To address this issue, the research was presented to participants in a general high-level form, in which the research objectives were presented as the examination of the learning processes within organisations as they relate to the adoption and maturity of large-scale Agile methods. There was no coverage of the realms of AT. If asked for, senior management and other contacts within the organisation were provided with a copy of a previous paper (Chita, 2018) that details the use and application of AT within research.

This approach did run the risk that this information may have been disseminated to other participants, but this was regarded as a necessary ethical requirement, and as a risk was to be borne by the researcher.

5.6.2.3 Research Ethics

Easterby-Smith et al. (2008, p.166) emphasise the overriding ethical consideration of not bringing any harm to participants. This relates to sensitivity to different issues, and to not disclosing confidential information. Ethical approval for this research was obtained prior to data collection. The procedures for undertaking research are set out in Edinburgh Napier University's Code of Practice on Research Integrity (Edinburgh Napier University, 2007, p.2). Although data was collected from staff at a health care organisation there was no involvement of clinical staff or patients, and there was no consideration of data relating to patients. The focus was on organisational activities that mostly took place within the head office.

5.7 Data Coding in the main Case Study

Saldana (2015, p.4 citing Vogt, Vogt, Gardner & Haeffele, 2014, p13) defines a code in qualitative inquiry as a "researcher generated construct that symbolizes or 'translates data'". Codes thus attribute interpreted meaning to each individual datum for later processing. According to Robson (2011), thematic coding analysis is a generic approach to qualitative data analysis that can be used in a wide variety of settings. He quotes Fetterman (1998) who says that "analysis is as much a test of the researcher as it is a test of the data". Usefully, Robson (2011) identifies the following phases of Thematic Coding Analysis

1. Data familiarity - through data immersion such as transcribing interviews.
2. Generate initial codes – where coding takes place for as many themes as can be thought of.
3. Identify themes – collate all the codes into groups, revise and re-examine as necessary
4. Construct thematic networks – fit the identified themes into one or more maps or networks.
5. Integration and interpretation – Use tools such as tables and networks to explore, describe and interpret patterns.

Utilising this approach, the following details the thematic analysis process that was adopted. Phase one in the above process had already been achieved by the researcher conducting the interviews and then transcribing some of the recordings. It is also likely this process itself resulted in some level of analysis taking place in situ.

5.7.1 Transcript analysis process

The first step in the coding process was to identify the 'generic' codes that would be used to code all of the interview transcripts. These codes were used throughout the analysis, so care was taken to ensure that they were as comprehensive as possible. While codes may be ignored during the analysis phase it would have been very difficult to introduce new codes half-way through. Hence it was decided to follow the humorous advice "If it moves, code it" (Saldana, 2015, p.16 citing Richards & Morse, 2013). However, a balance must be struck because generating qualitative data is ridiculously easy' (Bazelely & Jackson, 2013 citing Richards, 2009); the challenge lies in making it

useful and manageable. At the highest level, the codes were grouped into the following broad sections depicted in Table 5.9 below.

Table 5.9: NVivo groupings

	Categories	Description
1	Generic Agile Activities	One or more of the six Agile activities
2	Collaborative Activity	Different types of collaborative activity such as collaboration and co-construction.
3	Congruences or Stabilisations	An advanced form of the activity that occurs through congruences or stabilisations
4	Contradictions Classification	Identification of the type of contradiction.
5	Expansive Learning Actions	Further classification of the contradiction into one of the seven expansive learning actions.
6	Artifact Level	If the contradiction involves primary or secondary contradictions as well as the artifact node of the activity triangle then the level of artifact whether, primary, secondary or tertiary is identified.
7	Overarching organisational issues.	A catch all wide variety of organisational wide issues that have been mentioned and discussed before & during interviews.

In referring to such groups, there is a need to be able to refer to them generally. Rather than use a multitude of interchangeable terms such as ‘incidents’, ‘units’, ‘data-bits’ or ‘chunks’ (Robson, 2011, p. 474) it was decided that the most useful term to use was ‘events’. Consequently, from this point forwards this term is used to refer to all the items within these groups e.g. ‘Tertiary Contradiction event’ or a ‘Co-construction Collaborative Activity event’. The following table provides an indication of the breadth and depth of the coding that was undertaken.

Table 5.10: Thematic Coding Breakdown

	Themes	Themes sub-division	Number of Codes
1	Generic Agile Activities	Six main themes with each theme further sub-dived into Tasks, Primary Artifacts, Secondary Artifacts & Tertiary Artifacts. Additional two themes of Delivery Stream and Programme	64
2	Collaborative Activity	Three main themes of Co-ordination, Co-operation and Co-construction.	3
3	Congruences or Stabilisations	Four themes consisting of Primary level Congruences, Secondary level Congruences, Tertiary level Congruences and Quaternary level congruences.	4
4	Contradictions Classification	Four themes divided up according to Contradictions. The Primary contradictions theme was further sub-divided into six themes based on Activity triangle nodes. Secondary contradictions divided into two groups based on Subject and Community. Each group is then sub-divided into three further sub-themes based around Artifacts, Rules & Norms and Division of Labour.	18
5	Expansive Learning Actions	Further allocation of the contradictions into one of the seven expansive learning actions. First Expansive Learning Action is further sub-divided into 3 themes. Second and Third into five themes and Fourth into three themes.	18

In total 107 separate codes were utilised to varying extents. Bazeley & Jackson (2013) refer to Friese (2104) who states that between 50 and 300 codes are recommended. They also point to Lichtman's (2013) projection that most qualitative studies in education will generate 80 to 100 different codes. The codes will be organised into 15 to 20 categories which are eventually synthesised into 5 to 7 major concepts.

Given the extensive number of codes, there was some concern that the coding process could become confused, and lack consistency. Therefore, a coding structure was developed involving a specific sequence of questions that were posed when analysing the transcribed interview text. This sequence is outlined in Table 5.11 below.

Table 5.11: NVivo Coding Sequence

	Question	If answer is Yes	If answer is No
	The first step for all events is to attempt to code it to one of the six generic activities. If that is not possible or there is not enough information, then the event is coded to a delivery stream or to the whole programme. Thereafter coding of the event proceeds as follows.		
1.	Does this event refer to a type of collaborative activity?	Code according to the type of collaborative activity. Move to step 2.	Move to step 2.
2	Does the event refer to a congruence or stabilisation taking place?	Code according to the congruence contradiction level. Move to next event.	Move to step 3.
3.	Does this event refer to a contradiction?	Code according to the type of type of contradiction. Move to step 4.	Move to step 6
4.	Can the contradiction be further deconstructed into one of the seven Expansive Learning Action?	Code the event to an Expansive Learning Action. Move to Step 5.	Move to step 5
5.	Is the contradiction a Primary or Secondary contradiction? If so does it relate to the artifact node of the activity triangle?	Code the event to one of the different levels of artifacts. Move to next event	Move to step 6

These codes were also used for some basic quantitative analysis. This “quantitizing qualitative data” (Saldana, 2015, p.26) is regarded as a useful approach to content-analytic studies and mixed methods studies. Saldana states that such an approach is useful for ‘paradigmatic corroboration’ where the quantitative results correspond with the qualitative analytic results, and provides a ‘reality check’ of the analytical work undertaken.

5.8 Conclusion

After investigating research philosophies and strategies and, given the research domain and the proposed use of the CATF, this research adopted a social constructivist/pragmatic research perspective. Also, a form of mixed methods employing both qualitative and quantitative data gathering approaches was deemed to be beneficial. Further, given the research topic, there was value in a single in-depth case study within a single organisation rather than a series of smaller and inevitably more superficial case studies involving multiple organisations.

The research conducted in Health Care Org., included interviews with thirty individuals (almost a third of the core individuals involved with the D/STP programme), afforded data collection across a wide cross section of individuals relevant to the change programme. The use of the Standard Question Set (Appendix D) provided a structured approach to data collection to overcome some of the issues related to open-ended and unstructured interviews, as highlighted in Chapter 3. The number of interviews also afforded the opportunity to obtain different perspectives on the same issues, enabling 'deep dives' to discover contradictions and congruences that might not ordinarily be apparent. The next chapter discusses the analysis of this collected data.

Chapter 6: Analysis and Findings

6.1 Introduction

This chapter presents the analysis and findings of the application of the consolidated Activity Theory framework (CATF) to the main Case Study of Health Care Org. The CATF was discussed in Chapter 4 and the main elements were summarised in Section 4.9. The analysis relates to thirty-three interviews with thirty individuals involved with the Digital/Service Transformation Programme (D/STP) and is presented according to the following discrete sections. The sections in Chapter 4 where the CATF elements are discussed are indicated in brackets.

6.2 Agile Activities and Artifacts: An overview of the occurrences of the six generic Agile activities within the D/STP programme. This section provides an overview of different levels of artifacts and their distribution which are then considered in each of the following sections with which they are associated (section 4.2.3 and Tables 4.9 & 4.10).

6.3 Contradictions: An analysis of the occurrences of the different levels of contradictions and their distribution across the six generic Agile activities (Section 4.3).

6.4 Expansive Learning Actions: Further sub-division of contradictions into the Expansive Learning Actions that make up the Expansive Learning Cycle. (Section 4.3).

6.5 Collaborative Activity: Identification of the occurrences of collaborative activity within the Digital/Service Transformation Programme. (Section 4.6).

6.6 Congruences and Stabilisations: Analysis of the occurrences of congruences and stabilisations and their relation to the occurrences of contradictions. (Section 4.5).

These sections provide a logical progression starting with a discussion of the generic Agile activities that make up the Digital/Service Transformation Programme (D/STP) including the nature of the artifacts and tasks within the activities (Section 6.2). Contradictions within these activities and the different groups related to the D/STP are then examined (Section 6.3). Where possible these are then further sub-divided into

expansive learning actions (Section 6.4). Subsequently, there is a consideration of those elements that ameliorate the contradictions, frictions and issues with a consideration of collaborative activity within the Agile activities (Section 6.5). Elements within collaborative activity are regarded as precursors to the resolution of contradictions and hence of changed activities. Where there are situations of balance within the activity without precipitating change then these are situations of congruence and stabilisation which are discussed (Section 6.6).

Throughout the analysis of the interview transcripts, the research focus is on the variety and nature of the interviewee's experiences during the D/STP programme, in terms of contradictions, congruences and instances of collaborative activity. All tables follow the same row order as Table 4.6 in Chapter 4 for consistency and ease of comprehension. Table 6.1 below outlines a summary distribution of all references to coded events across all groupings of interviewees. The rationale for the grouping of these interviewees is intended to show the broad range of perspectives and aspects that impact the D/STP. The different groups are as follows.

- Delivery Personnel: Ten individuals engaged in activities to produce delivery stream outputs. These are the individuals who performed the tasks and delivered new capability and functionality.
- Delivery Managers: Nine individuals (including the programme director) responsible for the eight to ten delivery streams (varied over time). They had additional responsibilities for interfacing with other groups within the programme and the organisation.
- External Departments: Four senior managers from departments with which the programme interfaced, such as Finance, HR, Procurement, and the Executive Management Team.
- Strategic Business Units (SBU): Four senior managers who adopted roles such as Product Owner, within the SAFe framework and whose departments were the main clients of the programme delivery streams.
- Programme Support: Three members of the Programme Management Support (PgMs) function who were assigned to assist the D/STP in terms of adopting the SAFe framework and providing support and mentoring in all Agile activities, processes, and techniques.

Table 6.1: Distribution of all events (contradictions, congruences etc)

Generic Agile Activities	Frequency					
	Delivery Personnel (10)[14]	**Delivery Managers** (9)	**External Dept.** (4)	**SBU** (4)	**Prog. Support** (3)	**Total** (30)
Governance and Support (G&S)	16	60	15	15	6	**112**
Requirements Engineering (RE)	7	9	0	5	0	**21**
Building and Coding (B&C)	9	4	0	0	0	**13**
Testing and Quality (T&Q)	0	2	0	0	0	**2**
Release Management (RM)	9	33	1	4	3	**50**
Learning and Development (L&D)	21	35	1	19	6	**82**
All Six Agile Activities	62	143	17	43	15	**280**
Delivery Stream	101	81	0	51	0	**233**
Whole Programme	69	109	27	50	32	**287**
Total	**232**	**333**	**44**	**144**	**47**	**800**

Several initial points emerge from Table 6.1. Firstly, it is clear that the distribution of interviewees across all the different groups is not equal: with the Delivery Personnel and Delivery Managers groups constituting nearly two thirds of the interviewees, with the remaining third spread across three other groups. Therefore, it is not possible to undertake straight-forward numerical comparisons across these five different groups. However, it will be possible to make comparisons within groups for instance to examine the distribution of events across the different Agile activities within for example the Delivery Managers group.

Secondly, most references are to events within the context of the delivery streams and the whole programme, rather than within the context of a single generic Agile activity. Each delivery stream would be made up of more than one generic Agile activity, and the programme consisted of eight to ten delivery streams. During the analysis of the transcripts, it was often difficult to ascribe events to a specific Agile activity. In such cases it was decided to assign the event to either the Delivery Stream or the whole Programme, depending on the context and the elements under consideration. This is

[14] In this table and all subsequent tables, the numbers in brackets refer to the number of interviewees in each group.

indicative of the more wide-ranging and high-level events occurring compared to those specific to discrete generic Agile activities. The generic Agile activity that has most events associated with it is Governance and Support (G&S) followed by Learning and Development (L&D).

Thirdly, it is likely that the reason for the low number of events related to the other generic Agile activities is that the D/STP programme did not involve a typical substantial software development change initiative. Although many aspects did involve software development such as web development, most delivery streams focussed on acquiring IT technology such as off-the-shelf software packages, and preparing facilities and training staff to use them. These activities ranged from implementing a changed network and platform infrastructure to providing and configuring user workspaces, desktops and hardware and software. This explains why there are relatively few events that relate to the Building and Coding (B&C) and Testing and Quality (T&Q) activities.

Fourthly, the distribution of events in Table 6.1 also confirms basic expectations where, for example it is unlikely that SBUs or external departments will be involved in B&C and T&Q activities. Similarly, the distribution also confirms many elements that would be expected such as:

- Greater focus on G&S elements from Delivery Managers compared to Delivery Personnel.
- Across all the groups there is more focus on G&S.
- To a lesser extent this is also true of the focus on L&D.
- Programme Support focus on programme-wide elements rather than delivery stream or individual generic Agile activities.
- The external departments and SBUs have a more Programme wide focus instead of individual Agile activities.

It is important to note that generic Agile activities on their own do not constitute the main focus of this study. They represent the 'containers' or locations where the contradictions, collaborative activity and congruences and stabilisations take place. This is also true of the aggregated delivery streams and the whole D/STP. Also it should be noted that within this chapter, where later analysis identifies much larger numbers of events than those listed in Table 6.1 above, this refers to events that were not possible

to be linked with any specific generic Agile activity, delivery stream or the whole programme.

6.2 Analysis of Agile activities, artifacts and tasks

In addition to the significant events of contradictions, collaborative activity and congruences taking place within Agile activities there is also their interaction with different levels of artifacts within the Agile activities. The general distribution of these artifacts is discussed in the next section. Where contradiction and congruence events etc. interact with Agile activity artifacts these are discussed in sections later in this chapter.

6.2.1 Activity artifacts

This section examines the distribution of references to different levels of artifacts. As a reminder, artifacts are represented by the node at the top of Engeström's (1987) activity triangle. They include all the tools or elements that have a mediating role within the activity. Section 4.2.3 outlined different levels of artifacts. Primary artifacts are tools that are entirely physical. Within an Agile development context, examples include Scrum boards or post-it notes representing story points.

Secondary artifacts are mediating concepts that drive the activity. Examples include user stories and the minimum viable product (MVP) concept. It is likely that primary and secondary level artifacts will be specific to a generic activity. For example, a software regression testing tool (primary artifact) is likely to belong to a T&Q activity rather than an RE activity. However, some artifacts such as a product backlog may be present in several activities such as G&S and RM.

Tertiary artifacts are still broader themes that provide overall guidance and direction. Within the Agile domain, tertiary artifacts differentiate Agile approaches from conventional project management mind-sets such as command-and-control and big design up-front approaches. They are best represented by the Agile manifesto and the Agile principles on which the manifesto is based (Section 4.8.1). Note that these are completely different concepts from those cultural elements that might appear within the Rules & Norms node of the activity triangle which affect the whole organisation. This node represents a much broader organisational culture array, rather than an intermediating set of specific software development values.

Due to their broad themes and concepts based on the Agile manifesto and principles, tertiary level artifacts underpin the whole programme across the different delivery streams. Primary and secondary artifacts are confined to the different generic Agile

activities. Different primary and secondary level artifacts are illustrated in Table 6.2 below. It is also possible that some artifacts span across different levels. For example, a product backlog can be both a conceptual (secondary) artifact as well as a physical list (primary) on a scrum board. Table 6.2 also provides some example tasks that are the endeavours necessary to deliver the activity within each generic Agile activity. These tasks were mentioned by interviewees: their occurrence and distribution are discussed in Section 6.1.2.

Table 6.2: Generic Agile activities & artifact levels & tasks

Generic Agile activities		Description/Examples
Governance and Support (G&S)		
	Primary	Project and sprint backlogs
	Secondary	Sprint, sustainable pace, self-organizing teams monitoring and reporting
	Tasks	Daily stand-up; prioritisation
Requirements Engineering (RE)		
	Primary	User stories and story cards; User personas and profiles
	Secondary	Close customer collaboration; Managing and accepting change
	Tasks	Requirements gathering
Building and Coding (B&C)		
	Primary Artifacts	Development or a building tool
	Secondary Artifacts	Coding/development standards, metaphor, shared code ownership,
	Tasks	Refactoring; solution spiking; architecture configuration
Testing and Quality (T&Q)		
	Primary	Automated test tools
	Secondary	Test driven development, production level delivery
	Tasks	Acceptance testing, regression testing, defect analysis
Release Management (RM)		
	Primary	Poker planning game; story cards
	Secondary	Frequent releases; minimum viable product (MVP), short delivery cycle
	Tasks	Programme and sprint planning;
Learning and Development (L&D)		
	Primary	Training manuals, videos and web courses.
	Secondary	Learning whilst doing, mentoring and advice, knowledge management
	Tasks	Sprint and programme retrospectives, show and tells.

There are several key factors that are likely to substantially affect the distribution of references to artifacts across generic Agile activities and indeed across the whole programme.

The first, as noted earlier with regard to the occurrence of events, is that there was very little software development taking place across all the delivery streams. The activities that individuals were involved in may well incorporate some aspect of building such as installing software, but they are unlikely to follow the conventional software development tasks and operations.

Secondly, the interviewees within the programme were either in charge of the delivery streams or they had senior roles within the delivery streams. Again, this is likely to have led to very few B&C and T&Q activities being mentioned by interviewees because their roles were more managerial rather than development oriented. Thirdly, more than a third of the interviewees were not directly involved in programme delivery but were either from interfacing departments, such as HR and Programme Support, or were from 'client' SBUs who were the recipients of the outputs of the delivery streams. They were senior individuals such as functional heads or senior managers, and were unlikely to be involved in software development activities. An important characteristic of most of the interviewees is that, given their seniority and their managerial roles then the activity that they were likely to be involved in was Governance and Support activities.

Table 6.3 below indicates the distribution of all references to artifacts across all the Agile activities. This includes references associated with contradictions, congruences and examples of collaborative activity, and any associations with any of the expansive learning elements. Tertiary artifacts which relate to the delivery stream or the whole programme are referenced by individuals in these groups and Table 6.3 shows within which generic Agile activity the reference occurred. To avoid clutter, where there are no references to artifacts, the cells have been left blank.

Table 6.3: Distribution of all references to artifacts across all Agile activities

Generic Agile activities		Frequency					
		Delivery Personnel (10)	**Delivery Managers** (9)	**External Dept.** (4)	**SBU** (4)	**Prog. Support** (3)	**Total** (30)
Governance and Support (G&S)							
1	Total Artifacts	**10**	**32**	**6**	**7**	**5**	**60**
	Primary	8	17		1		26
	Secondary	2	14	6	6	3	31
	Tertiary		1			2	3
Requirements Engineering (RE)							
2	Total Artifacts	**6**	**4**		**5**		**15**
	Primary	6	4		4		14
	Secondary				1		1
	Tertiary						
Building and Coding (B&C)							
3	Total Artifacts	**9**	**2**				**11**
	Primary Artifacts						
	Secondary Artifacts		2				2
	Tertiary Artifacts	9					9
Testing and Quality (T&Q)							
4	Total Artifacts		**1**				**1**
	Primary		1				1
	Secondary						
	Tertiary						
Release Management (RM)							
5	Total Artifacts	**2**	**6**				**8**
	Primary	1					1
	Secondary	1	6				7
	Tertiary						
Learning & Development (L&D)							
6	Total Artifacts					**3**	**3**
	Primary						
	Secondary					3	3
	Tertiary						
All Six Agile activities		**27**	**45**	**6**	**12**	**8**	**98**
Total Primary		15	22		5		**42**
Total Secondary		3	22	6	7	6	**44**
Total Tertiary (Affecting Delivery Stream or Whole Programme)		9	1			2	**12**

Table 6.3 confirms the earlier anticipated distribution of references to artifacts within Agile activities with a total of only 98 references. This is a relatively small proportion (98/800) of all events (Table 6.1) indicating that in this analysis, artifacts do not figure prominently in relation to congruences, collaborative activity or congruences and stabilisations. Proportionally, there are relatively few contradictions, collaborative

activity and congruences events related to artifacts. These aspects are considered in more detail in Sections 6.5 and 6.6.

As expected, there are few references to artifacts within the B&C and T&Q activities (11 and 1 respectively). The largest number of references to artifacts (60) is associated with the G&S activities which is understandable given the senior roles of most of the interviewees. More than half of these artifacts came from the Delivery Managers group due to their senior roles and the higher number of such interviews compared to other groups. The distribution of artifact references across primary and secondary artifacts shows slightly more references to secondary rather than primary artifacts. There were very few references to tertiary artifacts across all the groups. The inference therefore is that the overall ethos and principles of Agile approaches create few contradictions. This may then give rise to collaborative activity and subsequent congruences. Further, most of the events relate to primary and secondary artifacts within the G&S activity. This may well be a consequence of the organisation's previous strong emphasis on aspects of governance and control; where the new Agile methods encounter these approaches, they give rise to such events.

Examining these elements in more detail, the correlation of artifacts with the identified events relating to contradictions, collaborative activity and congruences, Table 6.4 provides a distribution of these references to artifacts. Because it only relates to these three types of events there are fewer occurrences than in Table 6.3 which includes all references to all elements. As expansive learning actions are regarded as more detailed aspects of contradictions, it was decided not to include them in this analysis to avoid potential duplication.

Table 6.4: References to artifacts across contradictions, congruences and collaborative activity

Generic Agile Activities		Contradictions		Congruences		Collaborative Activity		Total
		Primary	Second-ary	Primary	Second-ary	Prim-ary	Second-ary	
Governance and Support (G&S)								
1	Total Artifacts	**4**	**31**		**9**	**5**		**49**
	Primary		13		6	2		18
	Secondary	4	14		3	3		24
	Tertiary		4					4
Requirements Engineering (RE)								
2	Total Artifacts		**8**	**2**	**1**			**11**
	Primary		8	2	1			11
	Secondary							
	Tertiary							
Building and Coding (B&C)								
3	Total Artifacts		**3**	**2**	**1**	**1**		**7**
	Primary Artifacts							
	Secondary Artifacts		1					**1**
	Tertiary Artifacts		2	2	1	1		**6**
Testing and Quality (T&Q)								
4	Total Artifacts				**1**			**1**
	Primary				1			1
	Secondary							
	Tertiary							
Release Management (RM)								
5	Total Artifacts		**3**	**1**	**1**			**5**
	Primary							
	Secondary		3	1	1			**5**
	Tertiary							
Learning and Development (L&D)								
6	Total Artifacts		**1**		**2**			**3**
	Primary							
	Secondary		1		2			**3**
	Tertiary							
Total Primary			21	2	7	1		**31**
Total Secondary		4	19	1	6	3		**32**
Total Tertiary			6	2	1	1		**10**
All Six Agile Activities		**4**	**46**	**5**	**14**	**5**		**74**

Table 6.4 shows that most of the references to artifacts were associated with contradictions. This is further discussed in Section 6.2 that presents contradictions analysis. References to artifacts associated with the other events of congruences and collaborative activity are further discussed in Sections 6.6 in this chapter. Due to the very low number of references to artifacts it was not possible to identify and discuss all artifact-related events across all programme groups and generic Agile activities. Instead, analysis was undertaken of selected areas that have significant levels of events, but some explanatory discussion is provided for those areas which have few references. In addition, while the focus is on the occurrence of artifacts within specific generic activities, consideration is also given to their occurrence within delivery streams and across the whole programme in association with contradictions, congruences and collaborative activity.

6.2.2 Activity tasks

In addition to the identification of different levels of artifacts within generic Agile activities, the research also identified references to tasks associated with contradictions, congruences and collaborative activity. Example tasks within Agile activities are displayed in Table 6.5 below and references to tasks are provided in Table 6.6 below.

Table 6.5: Example tasks within generic Agile activities

Example tasks within activities	
Governance & Support (G&S)	Monitoring and reporting, prioritisation
Requirements Engineering (RE)	Developing user stories and epics
Building & Coding (B&C)	Software development, software configuration and installation
Testing and Quality (T&Q)	Acceptance and unit testing, defect analysis
Release Management (RM)	Configuration management, planning and estimation
Learning & Development (L&D)	Retrospectives, training, mentoring

Table 6.6: Distribution of all references to tasks across all Agile activities

Generic Agile activities	Frequency					
	Delivery Personnel (10)	**Delivery Managers** (9)	**External Dept.** (4)	**SBU** (4)	**Prog. Support** (3)	**Total** (30)
Governance and Support (G&S)						
Tasks	6	28	9	8	1	**52**
Requirements Engineering (RE)						
Tasks		5				**5**
Building and Coding (B&C)						
Tasks		1				**1**
Testing and Quality (T&Q)						
Tasks						
Release Management (RM)						
Tasks	7	27	1	4	3	**42**
Learning & Development (L&D)						
Tasks	21	35	1	19	3	**79**
Total Tasks	**34**	**96**	**11**	**31**	**7**	**179**

Table 6.6 shows some similarity of distribution of references to tasks to Table 6.3's distribution of references to artifacts in that B&C and T&Q activities have minimal references and RE only has a few. Both tables show high levels for G&S, but Table 6.6 shows particularly high levels in L&D and RM. This is not true of Table 6.3's distribution of references to artifacts. References to tasks within L&D are high for three of the groups especially the SBU group.

Table 6.7 below shows the distribution of interviewees' references to tasks within Agile activities. For ease, Table 6.7 displays Agile activities headings (abbreviated) horizontally. The difference in the totals between Table 6.7 and Table 6.6 is likely due to some tasks being only allocated to expansive learning actions but not also included in contradictions.

Table 6.7: Distribution of references to tasks within Agile activities

Events		B&C	G&S	RM	T&Q	RE	L&D	Total
Contradictions								
	Primary			3			6	**9**
	Secondary	1	35	23		4	36	**99**
	Tertiary		2	1				**3**
	Quaternary		5					**5**
Congruences								
	Primary		1	1			16	**18**
	Secondary		7	12		1	22	**42**
	Tertiary		1	1			2	**4**
	Quaternary		5			1	1	**7**
Collaborative Activity								
	Co-operation		8	3			9	**20**
	Co-construction		1					**1**
	Total	**1**	**65**	**44**		**6**	**92**	**208**

The discrepancies between the total columns of Table 6.6 and the total row of Table 6.7 merits further analysis because it was expected that they would be approximately the same. On further investigation, it became clear that in a few instances of recording congruences it was not clear at what level these occurred so there was a need to link them to contradictions. This resulted in some events being double counted as belonging to both a contradiction event and a congruence event. These instances were few, and they were regarded as not adversely affecting the overall distribution of task-related events.

Tasks exist within specific Agile activities and, unlike tertiary level artifacts are not shared across multiple activities. Consequently, tasks generally did not extend across the whole programme. However, there were a small number of exceptions to this relating to overall Programme Increment (PI) planning and retrospectives. These tasks usually took place within the RM and L&D activities. They are further discussed in the sections addressing contradictions, congruences and collaborative activity later in this chapter.

Tasks may be involved in multiple levels of contradictions beyond the primary and secondary level contradictions that artifacts are limited to. For example, the task itself, the way it is performed, or its output may well lead to issues with neighbouring artifacts, or to difficulties with a culturally more advanced form of the activity. Similarly, a task may be the focus of collaborative activity or subsequent congruences at multiple levels.

Given the previous discussion of the role of interviewees and their senior positions it is no surprise that the distribution of events related to tasks was highest in the G&S and L&D activities, and least in the B&C, T&Q and RE activities. It is likely that the senior individuals interviewed did not participate in a substantial number of RE tasks such as developing user stories. The larger numbers of events within the RM and L&D activities are likely to relate to individuals' involvements in PI and sprint planning, as well as in sprint and programme retrospectives. By far the most common occurrence of events was related to secondary contradictions across all activities, followed by secondary congruences also across all activities. Further discussion of references to tasks as part of contradictions, congruences and collaborative activity is discussed within sections 6.3.6, 6.5 and 6.6.6 below.

6.3 Contradiction analysis

Following the outline of the events across Agile activities and within the programme, this section examines the distribution of contradiction events according to the different types of contradictions. These events are broadly outlined in Table 6.8 below.

Table 6.8: Distribution of contradictions levels across programme groups

Contradiction Levels	**Frequency**					
	Delivery Personnel (10)	**Delivery Managers** (9)	**External Dept.** (4)	**SBU** (4)	**Prog. Support** (3)	**Total** (30)
Primary contradictions: (within nodes)	22	23	0	12	1	**58**
Secondary contradictions: (between nodes)	131	212	36	96	37	**512**
Tertiary contradictions: (between the activity and a more advanced form)	4	17	6	4	9	**40**
Quaternary contradictions (between the activity and a neighbouring activity)	10	39	7	15	4	**75**
Total	**167**	**291**	**49**	**127**	**51**	**685**

From a high-level perspective, it can be seen from Table 6.8 that most of the contradictions take place at the secondary level, irrespective of the groups involved within the programme. This suggests that there are considerable issues in the practical application of new way of working. Each of these contradiction levels is now further examined in the following sections for more detailed analysis.

6.3.1 Primary Contradictions

The primary contradictions can be further deconstructed as displayed in Table 6.9 below. The subject node represents the Delivery Team, while the Community node represents other groups who have a vested interest in the successful delivery of the activity.

Table 6.9: Distribution of primary contradictions across programme groups

Primary Contradictions (within nodes)	**Frequency**					
	Delivery Personnel (10)	**Delivery Managers** (9)	**External Dept.** (4)	**SBU** (4)	**Prog. Support** (3)	**Total** (30)
Subject	3	10	0	10	1	24
Artifact	1	1	0	1	0	3
Object	1	1	0	1	0	3
Rules & Norms	4	0	0	0	0	4
Community	11	5	0	0	0	16
Division of Labour	2	6	0	0	0	8
Total	**22**	**23**	**0**	**12**	**1**	**58**

From the table most of the primary contradictions (underlined) occur within the delivery personnel, delivery managers and SBU groups. Within these groups the events occurred either within the subject or the community nodes. The SBU group has a disproportionately higher incidence of subject node contradictions. Examining the subject node, there appears to be demographic and learning issues within the team itself as identified by one of the SBU manager.

> *"I've got a population which is older than the average in [Health Care Org.], so the average age of my business unit is 53. I have 36 people over the age of 60, two people over the age of 70. These are not the kind of people who get…they don't get Six Sigma and Lean, let alone…and PRINCE2, let alone Agile methodology, they just don't get it."*
>
> SBU Manager: NY-1109

The lack of understanding is a significant primary contradiction, having immediate implications for the learning that needs to occur when a modified approach to delivery activities takes place. It seems that a more senior age distribution and/or a disinclination to adopt new approaches is likely to have follow-on implications in terms of secondary contradictions (a lack of engagement with a new approach) and perhaps even a possible tertiary contradiction (a reluctance to let go of older established delivery activity processes).

> *"In my part of the organisation, they're just not necessarily as up for change, because they're comfy, I think. Bottom line, even by just…so some of them are uncomfortable even being asked what their opinion is, because it's not what they're used to."*
>
> SBU Manager: NY-1109

It is likely that the Delivery Managers group had similar issues with regards to the existing delivery staff skills sets that were required to undertake the Agile approaches.

> *"There was a couple of key roles that were allocated, in my opinion, that the people were put into the role didn't have the, didn't, weren't anywhere close to having the skills to do the role at the outset, and what happened was they had to either learn on the job, or they crashed and burned in full view of the wider team, which wasn't helpful."*
>
> Delivery Manager: TO-0506

Delivery Personnel mostly identified the same issues regarding age demographics and existing skillsets but, from their perspective, the issues took place within the Community node rather than the Subject node.

> *"So, you've got these sorts of very highly educated people, coming in the bottom end but because these people aren't moving, I think what we'll start to potentially see is a lot more turnover of people. Those people going well I've got as high as I can go here, I'm going to have to go somewhere else, because it's going to be hard to see where the opportunities are."*
>
> Delivery Person: QW-1906

Examining Table 6.9 above and the quotes from the individuals within the different programme groups there are several issues that emerge. At this primary contradiction level there appears to have been little issue with either the Agile methodology and techniques in themselves (Artifacts), with organisational practice (Rules & Norms) or with the ways in which work was allocated and roles were established (Division of Labour). Instead, at this level, the main areas of friction were within the Delivery Team itself (Subject) and with the wider Community that had a vested interest in the outcome of the activity.

The main emphasis from the above is on the existing skill sets of the individuals involved in the programme, and on their propensity or ability to adopt new practices. Contributing elements of this are the demographics of some of the staff involved, their length of service, their proximity to retirement, their ease within the status quo and their perceived rigid skills sets. From the above quotes (Delivery Person: QW-1906) there is also the prognosis that this is unlikely to change because younger qualified individuals are likely to leave because the 'problematic' layer of staff occupies the middle ground suppressing change and opportunities. A 'familial' or paternalistic culture

emanating from senior staff is identified as perhaps one contributing factor and another factor is the lack of sanctions for individuals.

> *"No, no, and I think the reason for that is that there's absolutely no consequences within [Health Care Org.] if you don't. It's not like private sector, if you don't deliver, you're out on your backside, it's, okay, we'll try it a different way."*
>
> Delivery Person: NT-1206

These elements represent significant constraints on new initiatives at the very beginning of the expansive learning cycle. As analysis proceeded, further consequences of these elements were investigated. It was not possible in this study to determine the extent to which these elements and behaviours are restricted to the Health Care Org. organisation, or whether they permeate wider but some of these elements do share some characteristics of public sector culture and approaches (Nuottila et al., 2016). These issues are returned to in later sections of this chapter.

6.3.2 Secondary contradictions

As indicated earlier, secondary contradictions constitute most of the identified events. Table 6.10 below provides a distribution of secondary contradictions. The table follows the approach from Mwanza (2000) structured according to the two actor nodes Subject and Community. The table lists the contradictions between these nodes, the intermediating nodes (Artifacts, Rules & Norms, and Division of Labour) between these two nodes and the Objective of the activity.

Table 6.10: Distribution of secondary contradictions across programme groups

Secondary Contradictions (between nodes)	**Frequency**					
	Delivery Personnel (10)	**Delivery Managers** (9)	**External Dept.** (4)	**SBU** (4)	**Prog. Support** (3)	**Total** (30)
Subject - Artifact - Object	24	60	1	17	11	113
Subject - Rules & Norms - Object	11	4	3	4	0	22
Subject - Div. of Labour - Object	7	11	2	7	1	28
Subject Total:	**42**	**75**	**6**	**28**	**12**	**163**
Comm. - Artifact - Object	5	22	5	0	0	32
Comm. - Rules & Norms - Object	57	91	22	55	16	241
Comm. - Div. of Labour - Object	27?	24	3	13	9	76
Community Total:	**89**	**137**	**30**	**68**	**25**	**349**
Subject + Community Total	**131**	**212**	**36**	**96**	**37**	**512**

From the table it is clear that almost twice as many events involve the Community node compared to the Subject node. The following sections separately analyse the events related to Subject and Community nodes.

6.3.2.1 Secondary contradictions – Subject node

For the Subject node, the focus is very much on the Delivery Managers group and the contradictions in the use of Agile related artifacts (tools). The Delivery Managers appear to have had a wide range of experiences in getting to grips with Agile approaches and there were certain themes that consistently occurred. Initially, the transparent and collaborative nature of Agile approaches posed difficulties for staff not used to this way of working. This may well be a continuation of some of the primary contradictions noted above.

> *"They weren't…some people didn't like the conversation or the dialogue. It was totally new, or they were maybe shy, or they found it difficult to express. A lot of the teams, a lot were pure techy*."

> *"Some of them weren't comfortable with using it, weren't used to speaking and updating things in that format. Especially in this organisation, there's a lot of ageing staff. They weren't comfortable using the Trello board."*

Delivery Manager: WS-2205

The appearance here of these events as secondary contradictions may well be as a result of congruences and stabilisations at the primary contradiction level (discussed in Section 6.6.1). In addition to the difficulties the staff had with the required transparency and the collaborative nature of the Agile tools and techniques, there were also issues that related to understanding Agile approaches. These led to confusion and difficulties with the new way of working.

> *"You'll probably get this answer from everybody, but it felt that the, certainly the product owner role for at least six months, if not a year, was being supported by the rest of the team because they were really struggling. And that caused, everybody was trying to help out, but it did cause quite an interesting dynamic because you were frightened that you were stepping on somebody's toes and you were trying to be supportive but also getting a bit heart sick in the fact that everybody's role was getting confused."*
>
> Delivery Manager: TO-0506

In addition to contradiction events related to openness and transparency and difficulties in understanding and consistently applying Agile approaches, the Programme Manager noted issues around the language and terms associated with Agile approaches.

> *"The risks were partly cultural, I guess. One of the issues that we had was, you know, people felt it was a bit buzz wordy and a bit oblique in terms of its language. It was felt one of these new things that will just peter out. So, that was one risk, was definitely, sort of, cultural/adoption if you like."*
>
> Programme Manager: QZ-1306

These Subject node based events identified by the Delivery Managers group point to some significant issues related to the use of Agile tools and techniques within the delivery activities.

6.3.2.2 Secondary contradictions – Community node

From Table 6.10, most event occurrences are those relating to the Rules & Norms node. The largest group involves the Delivery Managers, followed rather surprisingly by the SBUs and the Delivery Personnel. Whereas the previous Subject node discussion identified that the Delivery Managers had more events associated with artifacts in terms of Agile tools and techniques, this Community node perspective indicates a very large clustering of events around the Rules & Norms node. Indeed, this set of 91 events is the largest single event group in the whole data set.

The Rules & Norms node represents the practices that influence an activity. From a Subject node perspective, the Rules & Norms node refer to specific practices that typically occur within the delivery activity such as software-coding norms or business analysis habits. Consideration of the Rules & Norms node from a Community perspective involves much wider-influencing practices that originate outside the activity, but which will still impact it. Typically, these are wider business practices such as recruitment policies and remuneration packages. To facilitate analysis of this large group of events clustered around the Rules & Norms node, several categories were distinguished, based on work by Nerur et al. (2005, p.76) and Mangalaraj et al. (2009) that identifies key elements in adopting Agile methodologies. These categories are listed below alongside the D/STP elements.

A. Organisational culture – Clinical and public sector culture
B. Management style – Funding, business case and focus on early return on investment (ROI)
   Senior management involvement and approvals
C. Organisational form – Influences of other departments
D. Environmental factors – Another new thing

A: Organisational culture - Clinical and public sector culture

There were several references to the pervading influence of a public sector culture and exceptionally of a 'clinical' culture that adversely impacted on activities. Examining the public sector culture aspects, there were references to the difficulties in changing established processes and procedures as well those who openly cited the public sector effect in terms of bureaucracy, process, and oversight as an impediment to delivery activities.

> *"So, we'd often get the 'that's not how we do things around here' but that wasn't necessarily to do with the fact that we were using Agile it was the fact of what we were aiming at, and we were using Agile to do*
>
> *it. So probably both a double whammy – what the heck is this Agile thing and what are you actually doing?*
>
> Delivery Manager: HS-0407

> *I think, one of the other risks was, the documentation wasn't there, and the [Health Care Org.] lives and breathes by heavy documentation. And I think that, you know, that that was definitely seen as a risk, because people were too used to having lots of documents that they*

could…you're not necessarily saying they did necessarily read, but they went back to long after, if they wanted to look at anything. So, this whole idea of delivering product, not paperwork, was something that was a bit of an anathema."

Programme Manager: QZ-1306

Mention was also made of the disconnect between the Agile delivery approach and the public sector need for governance and control.

"...if you're trying to deliver Agile in the public service where you've got high levels of accountability, sometimes political accountability. What you're effectively saying to the people who are the decision makers at the top of the organisation is, you're going to get something, but I can't tell you what it is yet. I think they will struggle with that and I think you need to be much clearer on what you are going to deliver in terms of business value out of it before you start."

Delivery Manager: HI-0306

In some accounts there was reference to an organisational culture that goes further than the usual elements associated with public sector culture

"So, if you want to look at [Health Care Org.] as an organisation, it is really rigid, it is very bureaucratically driven. It's probably across the top of it all at the high levels, it's got that kind of role-based culture so very difficult to change. Everything's based on somebody's job title person spec, job spec you know, and even the kind of fluidity I've seen in other parts of public sector, you tend not to get here, it's really rigid and difficult to change."

Delivery Manager: HI-0306

"I mean, you know, we were trying to do it in rapid three-month increments, and the [Health Care Org.] wants to…you to submit a lot of paperwork and to go through several layers."

"I mean, somebody I was talking to, they were saying, well maybe, you know, is it because it's a health board and you've got people that are nurses, and nurses generally juggle…they have 20 patients, 40 patients, and they're doing everything to these patients. And they're juggling, juggling all the time. Because what I've seen is, there's a few cultural pieces in the [Health Care Org.], which derive from a very health-oriented culture. Even though they're in a business environment."

Programme Manager: QZ-0609

The Programme Manager also pointed to Health Care Org.'s recruitment practices differing from other public sector organisations: it required high medical qualifications at a senior level irrespective of job role.

"I don't know if you've seen the recruitment process, but it is geared towards clinical and health, so you could be…I was unusual that I became an Associate Director without a Doctorate. And, you know, you were expected, at that level, that you were a doctor. Even if you were in a business to business, professional services organisation."

Programme Manager: QZ-0609

This recruitment preference along with the almost family GP practice culture identified previously in the primary contradictions section is discussed further in Chapter 7.

B: Management style

Funding, business cases and focus on early ROI

Many of the contradictions relate to problems with making finance available, and the challenges of the funding processes. The organisation has a complex procedure for the approval of funding for projects, involving a requirement to submit a full business case for all funds. These must then go through a somewhat complex authorisation process. The duration of this authorisation process is at odds with Agile delivery approaches.

"The other thing that happened on finance was that the formal processes for even getting access to money are that you submit a business case through the budget process, and then you have to update and resubmit that business case when you actually come to draw down the money. And that almost sat alongside what this team was trying to do which was, no just give us a lightweight business case, because it very quickly became give us a lightweight business case but make sure your full business case is written as well."

Delivery Manager: HI-0306

But, because of the way that budgets and the [Health Care Org.] work on their funding cycle, you know, you're talking about a very fixed process. So, trying to align that process with the one that we were trying to do, there was risks involved in, you know, maybe us not spending, or overspending"

Programme Manager: QZ-1306

In addition to obtaining funding, the Delivery Managers also experienced continued demands from senior management to produce quick returns for the funding that had been made available.

"I think they would like to see it move faster; they wanted more bang for their buck. And that was always going to be a challenge because we weren't working on any of the things that would have delivered that."

Delivery Manager: HI-0306

> *"Senior management level, we are putting money into this, isn't working, but we're three months down the line, we're starting to form a programme, six months down the line, this really isn't working, let's try this, change this, change that. So, there was constant trying to change and evolve the programme, but not always for the right reasons."*
>
> Delivery Manager: NZU-0705

B: Management style

Senior management involvement and approvals

This section considers the frequent references to the need to continually obtain senior management participation and approval within the programme. This influenced the Agile delivery activities in terms of practical delivery aspects and the organisation-wide perception of the value of output from the programme.

> *"And I would say that the, probably the biggest challenge was that it felt that senior management, and I would put that right up to EMT*[15] *level, buy-in waivered during the project."*
>
> Delivery Manager: TO-0506

> *"You know, we need to do this bit of work, oh we can't do it without this person's say so. And it was, you know, held up, held up, held up and so it didn't matter that we had the money. It didn't matter that we could procure them quickly, we just couldn't get the senior business owners."*
>
> Programme Manager: QZ-1306

Compared to the Rules & Norms node events, the Division of Labour intermediating node had much fewer events (24) but was significant because a high concentration centred around the same event types that would have had significant influence on the activities. The CATF does not provide any guidance on which types of events occurring across intermediating nodes have the most impact on activities, but one indication might be the frequency with which the event type is cited. In this analysis, these types consist of (a) individuals who are involved in more than one project simultaneously and (b) a high dependency on staff to volunteer to participate in the D/STP programme. Individuals being involved in many projects simultaneously was symptomatic of the diverse workload facing the organisation.

[15] EMT – Executive Management Team

"I was also conscious that, quite often, we started too many things; we're asked to do too much with the resources. If you look at that wall I put up behind where I sit, I think at the moment there's 55 live projects for IT internally. Now, we've probably got capacity of capability to deliver 12, but we've been asked to get involved in 50 odds. Now, that doesn't take into account all the other stuff that's going on across the organisation, which is made up of six SBUs plus what we're supporting PgMs on.

Delivery Manager: WS-2205

From the above quotation, this issue might appear to be amenable to a simple resolution through deployment of a Kanban approach aimed at reducing 'Work in Progress'. However, as indicated in one of the quotes from the Programme Manager, the organisation appears to value people/departments more if 'you have more things on your plate' and so such a resolution might be more difficult than it first appears. The large number of projects to be delivered was combined with individuals being asked to take on multiple projects simultaneously.

"So, if you think about other organisations, specialisms and expertise, if you go into an environment and you look at somebody that's doing business analysis or something, they usually have one or two projects on at the time, max. And yes, you know, you go into [Health Care Org.] and you will find that there's people delivering five, six, seven, eight different things, and they're juggling. And they're not obviously delivering anything, because nobody can when they've got that kind of thing to juggle. But it's what the organisation rewards, is that kind of collection of stuff you do, your, sort of, everyday portfolio. So, you've got people in there that are on about five or six programme boards. You know, like, well how can you actually deliver anything on a programme if you're in five or six?"

"Yeah, almost, well you know, almost impossible because the efficiency was just not there so if you've got 10 percent of somebody's time, 20 percent of time, it's really hard to make that work."

Programme Manager: QZ-1306

In addition to the large number of projects, and the fact that the individuals delivering these projects are undertaking multiple projects simultaneously it appears that the people involved were mostly volunteers for the programme who were participating in addition to their normal roles.

"The whole thing, in my eyes, was done on volunteers. When we were putting these teams together, they asked people to come and join these teams. They weren't freed up from their day job; they still had their day job."

Delivery Manager: NZU-0706

This reliance on volunteers stems from the organisation's well-established approach to project delivery which was not altered to accommodate an Agile method.

> *"It's pretty much the same in the traditional waterfall project management style; you don't get a dedicated team; you get to call on resource as and when, if it doesn't conflict and the stars are aligning, everything is going good."*
>
> Delivery Manager: WS-2205

In addition to the friction caused by established organisational practice, there was an added complication where departments or functions participating in the programme appoint individuals to it who were then subsequently removed.

> *"It's because they've got to be seen to be allowing it to happen, but then after a reasonable amount of time, it's closed down. Which is why we lost all the capability, so trying to run a programme where your key people have been pulled off and put on other work because their line manager has just gone, right you've had your time, we need to go back to the old way now. Thanks very much. So, you're coming off the programme. So, it's, you know, at the beginning it's like, yeah, yeah, yeah of course they can help out, of course they can do this, of course they can be part of it. And then after a certain period of time, it's acceptable for them to be pulling people off it."*
>
> Programme Manager: QZ-1306

This appears to be symptomatic of the organisation's reluctance to share workers across boundaries and maintain traditional methods of operation and hierarchical control. In response to the researcher's follow-up question asking for an indication of the major problems currently facing the organisation, a delivery managers response was,

> *"Huge amounts of individual silo working, a lot of traditional practice, a lot of traditional attitudes to working."*
>
> Delivery Manager: NZU-0706

These issues relating to a large number of concurrent projects, project team members working on many projects simultaneously, the programme being constituted of volunteers, some who were volunteered by their departments but then subsequently withdrawn. These represent significant cultural and organisational behaviours that proved to be highly influential and somewhat detrimental to the Agile methods of delivery.

C: Organisational Form - Influences of Other Departments & SBUs

Throughout the events within the Rules & Norms node there were many references to the influence of other departments. These originated from HR, a trade union and the SBUs who were closely involved in the D/STP programme. The Finance function has already been considered in section A above. There were several issues regards the involvement of the SBUs. These centred around resistance to the Agile delivery method, lack of ownership of the proposed solution as well as a lack of support towards the programme.

> *"There's a lack of participation, a lack of prioritisation, and that's a…generally a lack of support, for the programme across the piece."*

> *"Particularly in the behaviour and norms actually, we got a lot of resistance to the way that we were working from certain areas of the business who were trying to help deliver… refusal to engage around some of it, yeah, and just get it done attitude, just go live even though we know it's not ready to go live."*
>
> Delivery Manager: NZU-0706

The different way of working was also referenced with regard to the trade union.

> *"And they maybe want, you know when we tried to bring the union guys in, but they like to have a straight answer, and Agile doesn't lend itself to straight answers. So, it deals with the unknown and that's not what the, you know, the union guys didn't like the unknown. And I can understand that, but that's the way that unions worked. But again, back to modern ways of working, they're going to have to. Because digital is moving at the speed of light compared to these guys"*
>
> Programme Manager: QZ-1306

D: Environmental factors - Another new initiative

The interviewees frequently referred to the ease with which the organisation previously introduced new initiatives, which then endured for a short time and were subsequently abandoned with little apparent explanation or justification. This has led to the D/STP change programme frequently being labelled as 'another new initiative' and this perception has significant impact on the delivery activities.

> *"Whereas in the [Health Care Org.], my perception was that every year we had to produce something new. And so, it's that kind of short termist. And I don't know if that's driven partly because we're, you know, very aligned to the political machinations as well and that's always pretty short termist. You know, we're looking at election cycles.*

But it's that kind of, there's no expectation that things will get maintained."

Programme Manager: QZ-1306

6.3.3 Secondary Contradictions – local and external nodes

The large grouping of secondary contradictions was worthy of further analysis because an issue came to light during the analysis of the transcripts of the initial three interviews. Within those transcripts it became apparent that the secondary contradictions could be broadly grouped into two types. Firstly, there were those secondary contradictions that took place within the Requirements Engineering (RE) activity related to the Rules & Norms node which were usually associated with determining requirements that would cause friction within the activity. Secondly there were those Rules & Norms related contradictions that extended beyond the Requirements Engineering activity to the wider organisation, that also impacted the Requirements Engineering activity.

This distinction is founded on the earlier more specific definition of the Community node (Section 4.4) that identified a Community as those with a 'specific interest' in the activity. Therefore, the HR function and activity are unlikely to have a specific interest in the Requirements Engineering activity, but their HR policies and initiative may have had an impact. The question therefore arose as to how to cater for this 'external' influence on the activity originating beyond the Community involved with delivering the activity.

The first option that was considered was that this was an example of a quaternary contradiction taking place between the activity and a neighbouring activity. However, an examination of the expansive learning cycle (Engeström, 2001) reveals that quaternary contradictions are likely to occur in a sequence or progression following on from primary, secondary and tertiary contradictions. From this it was reasoned by the researcher, that it is only when the more 'advanced form' of the revised activity has been created to some extent that its interactions will change with neighbouring activities, leading to quaternary contradictions. Therefore, the activity needs to have changed significantly before it can cause a quaternary contradiction with a neighbouring activity. From the expansive learning cycle, this is the last step before the revised activity becomes the new norm.

Analysing the data from the first three interviews it was realised that the impacts of wider organisational elements occurred mostly in the activity mediating nodes of Artifacts, Rules & Norms and Division of Labour. Therefore, it was decided to divide the contradiction events that involved these nodes into two types 'local' for contradiction events that originated from within the activity (involving Subject and Community nodes) representing those with a 'specific interest' in the activity and 'external' for contradictions whose origins were out with the activity. This would allow a more granular analysis of contradictions.

One potential benefit of differentiating the contradictions in this way is that it may afford a view on any power dynamics that may be acting on and between activities. This provision of an additional perspective within the CATF has hitherto not been considered. Such a proposed extension is in keeping with Engeström & Sannino's (2010) welcoming of further developments in AT based on its use and application.

Table 6.11 below provides a more detailed analysis of secondary contradictions with the mediating nodes differentiated according to 'local' or 'external' origins.

Table 6.11: Secondary contradiction events according to 'local' and 'external' sources

Secondary contradictions (between nodes)	**Frequency**					
	Delivery Personnel (10)	**Delivery Managers** (9)	**External Dept.** (4)	**SBU** (4)	**Prog. Support** (3)	**Total** (30)
Subject – Artifact (local) – Object	17	47	1	11	5	**81**
Subject – Artifact (external) – Object	7	13	0	6	6	**32**
Subject – Rules & Norms (local) – Object	11	4	2	4	0	**21**
Subject – Rules & Norms (external) – Object	0	0	1	0	0	**1**
Subject – Division of Labour (local) – Object	7	11	2	7	1	**28**
Subject - Division of Labour (external) - Object	0	0	0	0	0	**0**
Subject Total:	**42**	**75**	**6**	**28**	**12**	**163**
Comm. – Artifact (local) – Object	5	22	5	0	0	**32**
Comm. – Artifact (external) – Object	0	0	0	0	0	**0**
Comm. – Rules & Norms (local) – Object	6	6	4	12	0	**28**
Comm. – Rules & Norms (external) – Object	51	85	18	43	16	**213**
Comm. – Division of Labour (local) – Object	6	2	1	2	0	**11**
Comm. - Division of Labour (external) - Object	21	22	2	11	9	**65**
Community Total:	**89**	**137**	**30**	**68**	**25**	**349**
Total	**131**	**212**	**36**	**96**	**37**	**512**

From Table 6.11 it is apparent that the most common secondary contradiction events are the external ones (underlined). Whilst the external events associated with Subject-based contradictions are relatively few, when it comes to Community node-based events, they are the dominant type. The quotations in section 6.2.2 are almost all external contradictions, relating to the Rules & Norms node. It therefore appears that, where there are inputs into an activity beyond the Subject level, then the most frequent and significant influences are those external to the activity, relating to the Rules & Norms intermediating node. This is primarily from the perspective of the Delivery

Managers but is also generally a significant influence for other groups particularly the SBUs.

6.3.4 Tertiary contradictions

Tertiary contradiction events are given in Table 6.12 below.

Table 6.12: Distribution of tertiary contradiction events across programme groups

Tertiary contradictions (between the activity and its more advanced form)	**Frequency**					
	Delivery Personnel (10)	**Delivery Managers** (9)	**External Dept.** (4)	**SBU** (4)	**Prog. Support** (3)	**Total** (30)
Events	**4**	**17**	**6**	**4**	**9**	**40**

Compared to secondary contradictions there were substantially fewer tertiary contradiction. Again, the largest concentration was with Delivery Managers and proportionally the Programme Support function. The dominant theme here is the difficulty in letting go of previous approaches.

> *"I would say generally an issue with SAFe and Scrum, is if you don't have dedicated resources, it's really hard to make it stick, because people just get pulled back into, you know…if the environment doesn't change, you get pulled back into the same ways of working."*
>
> Programme Manager: QZ-1306

There were several instances of difficulties in pursuing new ways of working that were at odds with the established methods.

> *"So, it felt like at the website for practitioner services provision which was developed in Agile – so there was a lot of bad behaviours that came to fore when it came to adopting certain standards that should be adopted for the website, they wanted to revert to old ways of working."*
>
> Delivery Manager: NZU-0706

Often it was the case that staff found it challenging not to revert to the more established method of delivery due to lack of time or resources.

> *"Yeah, partly the inhibitor is, I suppose that the reality is our day to day jobs...or my day to day job's being a lawyer, it's not being somebody who is doing Agile transformation or Agile working within way to develop our use of software. I think we don't have enough dedicated resource to that to really, truly embrace working that because I think you need to have enough time."*

Delivery Manager : HI-2806

In other instances, reference was made to tertiary contradictions that were attributable to the difficulties in changing individuals behaviour patterns.

> *"It was quite interesting to watch because it quite often became the feature that a lot of delivery actually happened during inspect and adapt because people were still behaving in similar ways to the way they behaved before so that was quite interesting to watch."*
>
> Delivery Manager: HI-2806

> *"I think it's a muscle memory thing for me. It's that kind of, you can bend people out of shape for a while, but they will bounce back…"*
>
> Programme Manager: QZ-1306

From a programme support perspective there was more of a focus on traditional management style that didn't evolve as required by an Agile approach which held back development.

> *"During one of the PI events where we had a team that were working together as a team because they got rid of the hierarchy and everybody was happy and looked as if they had felt as if they were of value and being part of that journey, part of the decision making process. Then the other side of the room the hierarchy was still there and because of that, I don't know whether it was that team, but the dynamics were distinctly different. You could see that there were people less engaged, less enthused and it was that one person who was driving the conversation and wasn't taking a step back to take in other people's views."*
>
> Programme Support: QY-1206

6.3.4.1 Overcoming the 'Cult of Agile'

In some functions within the External Departments group there was a strong awareness of the difficulties the organisation faced in moving on to a form of Agile delivery, and of the kind of cultural issues that were inhibiting change. A significant issue is that the Agile movement was seen by some as a 'cult'.

> *"They all agreed with what we're trying to achieve, they didn't buy in to the cult of Agile as they called it. Genuinely we did a wash up after transformation and somebody said it was this like cult, there was all this terminology that we didn't agree with, Americanisms and blah, blah, blah. So culturally they resisted, you know, rather than embracing it."*
>
> Finance Director: WO-0309

The ‘cult’ impression predominated despite a clear recognition that the Agile mode of delivery is to an extent aligned with some existing Health Care Org. work practices.

> *“…if you’re taught concepts about getting everybody together to work in focused teams and sprints when you’ve got a clear clarity of what you’re going to be doing, you deliver and then you test it and then you change it, that test of change aligns absolutely properly with the way that we do quality improvement in the [Health Care Org.]. And so actually it should be something that everybody gets and embraces, but the trouble is, it was lost in translation, and it was seen as something different.”*
>
> Finance Director: WO-0309

There was a recognition that shifting to a successful Agile mode of delivery requires a receptive culture within the whole organisation, very much alongside those who were actively engaged with the D/STP.

> *“…and so, I am an Agile zealot, if I’m perfectly honest, but not in terms of taking the tool bag and the nomenclature and just applying it out the book. I think that the principles are brilliant, but you need to recognise that it needs to land in the culture of the organisation, and for me I think that’s the biggest barrier we had in this organisation.”*
>
> *“So, for me, you’ve got to be ready for it, and what we created was a huge amount of energy, huge amount of empowered people over here, but they had nowhere to land because all the SBU directors just didn’t embrace it and didn’t say, come in and do it, do it to me.”*
>
> Finance Director: WO-0309

The programme manager also refers to this issue.

> *“it’s harder to control because you’re bringing in business units and they’ve got their old ways of working and they’re not necessarily motivated because they’ve not been in the programme for a year and getting used to ways of Agile and all that kind of thing. And so, you felt that you were having to start again, and then again in the next increment, and again as soon as another service came on.”*
>
> Programme Manager: QZ-1306

6.3.5 Quaternary Contradictions

Quaternary contradiction events are displayed in Table 6.13.

Table 6.13: Distribution of quaternary contradiction events across programme groups

Quaternary contradictions (between the activity and a more advanced form)	**Frequency**					
	Delivery Personnel (10)	**Delivery Managers** (9)	**External Dept.** (4)	**SBU** (4)	**Prog. Support** (3)	**Total** (30)
Events	**10**	**39**	**7**	**15**	**4**	**75**

While the six generic Agile activities could all be regarded as 'neighbouring' activities in themselves, this research regards the term 'neighbouring' as referring to non-delivery functions which have other objectives within the organisation such as Finance, Procurement and HR. There were many references from the Delivery Managers group to quaternary contradiction events. This seems to have been a substantial influence on the delivery activities, with such contradictions being wide-ranging.

> *"We clashed with probably every part of the organization and sometimes…"*
>
> Delivery Manager: WN-0407

Delivery managers responsible for the delivery of programme streams were most likely to encounter quaternary contradictions in terms of their interactions with other elements of the organisation. It is likely that while delivery focused teams and individuals have to change the way they work, no matter whether prompted by D/STP or otherwise, the interfacing organisational infrastructure, which is somewhat removed from the delivery teams, doesn't undergo the same level of change as those involved in delivery.

> *"So, people who are involved with Scrum, they'll tell you that they are used to change management and people who are in frontline healthcare will say nothing ever stays the same. We are changing all the time yet if you really ask people sitting in offices in the [Health Care Org.] whether their job changes day to day the answer is probably no – they'll have been doing the same thing in the same way for a long time."*
>
> Delivery Manager: WN-0407

The organisation also seems to struggle with rapidly evolving health sector changes but at a much slower pace.

"So, if you look at the pace of change, the pace of change in the environment is very quick but the actual pace of change in what they are doing is not very quick."

"That's not how things work so people in delivery situations are looking at having to deliver in different ways but that doesn't mean that the management know that. They're not delivering it… how could they know?"

Delivery Manager: WN-2607

In anticipation of potential friction and issues between the new way of working and other parts of the organisation, senior managers involved in the delivery of the change programme approached these other External Departments. The Programme Manager approached the head of the procurement function with limited success.

"We've been stuck in these large contracts that were in like inflexible and immovable. And so, the whole point in having that conversation was to try and work out where we could shift the process to make it compliment the Agile way of working".

"And we knew when we started the programme that we, in working in Agile, we would need suppliers to work with us in particular sprints or increments in that the way that we procured suppliers was just not going to be in alignment with our way of working in increments and sprints. So, they were very, [Procurement Manager] … was really, really helpful."

"I think the procurement on was difficult. It wasn't impossible, but we worked with procurement with a new…the DPS, which is the new framework which allowed us to get to market quicker. But still the procurement process could be up to, you know, 9 to 12 weeks, which makes it hard to deliver within an increment, if, you know, you take a whole increment to actually go through procurement."

Programme Manager: QZ-0609

Similarly, the Programme Manager also discussed changed modes of interaction with the Finance Director with some initial success.

"We had…a Finance Director was heavily involved, which helped a lot, and she was an advocate, so that really helped."

"So, we, and [Finance Director] understood when we kicked off the programme that the old way of, a similar kind of problem. You need to provide a lot of justification up front, business case, et cetera, which goes through several layers of governance to spend money.

And what we were saying is that if you want flexibility, and you want rapid response, we cannot, we don't have the time to wait. The amount of time it took to go through that process to release spend was not going to allow us to work in Agile. And so initially [Chief Executive and Finance Director] came to an agreement where we were responsible for a pot of money for the programme which we were able to use flexibly. I think they got a stay of execution on that for maybe a year, a year and a half before, you know, the governance was pulled in tighter on that. But while we had it, it was very, very helpful."

Programme Manager: QZ-1306

The programme developed some successful interactions with other parts of the organisation, but there were still outstanding issues that impeded further progress. For example, having developed a new relationship with the Finance Department, there were still other organisational elements that prevented this relationship from working effectively. This subsequently led to the suspension of the new working relationship.

"…because we were in that Agile way of working, we were giving them their governance arrangements, we gave them the money to spend, and they didn't spend it, so it was pulled back and we're doing service transformation now and you have to have a bid and a process. So, I have no sympathy for them frankly. The money was there, there is evidence that IT used it to fill gaps in their budget elsewhere and recharge the cost of people that weren't working on the programme to the programme, there's definitely evidence of that, so that's just taking the piss frankly, and there was a lot of that. So, all of these things conspired to, you've been given this, you've not taken the opportunity, you've mucked it up. So now there was…pulling it back, again there was…we rebadged it to service transformation because there was a whole reaction around, you've spent all this money, what am I getting for it?"

Finance Director: WO-0309

The programme manager acknowledged the amendments that the Finance function had made to facilitate the change programme's new mode of interaction, but pointed to other difficulties that prevented the interaction being effective. In this instance the recruitment process had not changed, adversely affecting the D/STP irrespective of the arrangements that the Finance function had put in place.

"…part of the problem with not being able to spend the money was that HR processes when it was particular skill sets. So, for example, if the programme said that we needed a scrum master or a product owner or A.N. Other person to come in, and it was a single person and we wanted them in on a contract, the HR processes meant that often that could be four, six months to get them in and get them working.

So the, I can feel [Finance Director's] pain because, you know, you can line up the money and line up the model and protect the model, but if you've got other processes running that are not aligned, then you just can't get the pace."

Programme Manager: QZ-0609

6.3.6 Contradictions and Artifacts

Table 6.14 below indicates the distribution of references to artifacts across the Delivery Personnel group and the Delivery Managers group. The distribution of references across the remaining three groups is very small indeed and so they have not been considered.

Table 6.14: Distribution of Artifacts associated with contradictions

Generic Agile activities		**Delivery Personnel**		**Delivery Managers**	
		Primary	**Secondary**	**Primary**	**Secondary**
Governance and Support (G&S)					
	Primary		2		11
	Secondary		1	4	10
Requirements Engineering (RE)					
	Primary		4		3
	Secondary				
Building and Coding (B&C)					
	Primary Artifacts				
	Secondary Artifacts				1
Testing and Quality (T&Q)					
	Primary				
	Secondary				
Release Management (RM)					
	Primary				
	Secondary				3
Learning and Development (L&D)					
	Primary				
	Secondary				
Total: (Primary & Secondary Artifacts)			**7**	**4**	**28**
Tertiary Artifacts:			**2**		**1**

The occurrence of different levels of artifacts involved with contradictions within activities mostly relates to two Programme groups in Table 6.14. Most contradictions involving artifacts took place within the Governance and Support (G&S) activity followed by Requirements Engineering (RE). The high concentration within Governance & Support is again reflective of the senior management role of the individuals interviewed

and it is also entirely expected that the Delivery Managers group has the most occurrences. Almost all of these occurrences related to primary and secondary artifacts.

> *"There was activities being directly injected into team backlogs which were not necessarily aligned with or anticipated by the programme backlog".*
>
> Delivery Manager: HN-0708

> *"And that caused, everybody was trying to help out, but it did cause quite an interesting dynamic because you were frightened that you were stepping on somebody's toes, and you were trying to be supportive but also getting a bit heart sick in the fact that everybody's role was getting confused."*
>
> Delivery manager: TO-0506

The distribution of other events involving levels of artifacts across the different Agile activities was very small, making it difficult to pursue further analysis. In particular, there were very few references to tertiary level artifacts associated with contradictions. This may indicate that individuals had few issues with this level of artifacts, and it is worthwhile comparing this with the level of congruences in section 6.6. below.

6.3.7 Contradictions and Tasks

Table 6.15 is a more specific version of Table 6.6 highlighting the distribution of tasks associated with contradictions.

Table 6.15: Distribution of references to tasks related to contradictions

Events		B&C	G&S	RM	T&Q	RE	L&D	Total
Contradictions								
	Primary			3			6	**8**
	Secondary	1	35	23	4	4	30	**79**
	Tertiary		2	1				**3**
	Quaternary		5					**6**
	Total	1	42	27	4	4	36	**96**

References to tasks associated with contradictions are the most prevalent of all references to tasks. They were mainly focussed on secondary contradictions. As expected there were few occurrences within the B&C and T&Q activities. Most are centred around G&S with instances relating to the need to develop business cases, and to issues related to demonstrating some form of return on projects. Almost all these references originated from the Delivery Managers group.

"There was some difficulty at those meetings because … they were sometimes difficult in that people on that oversight team did not necessarily understand what you were doing and sometimes they would question about funding even although it had been okayed at another meeting somewhere else and that got very overly complicated and a little bit time consuming."

Delivery Manager: WN-2607

"It felt to me that there was priorities being identified, but there was no actual metrics or financial metric set up, set round about them"

Delivery Manager: TO-0506

Notably there was a significant number of references to tasks correlated to contradiction within the RM and L&D activities. As mentioned earlier, these are probably due to the involvement of key individuals within the programme planning (PI) events, as well as programme retrospectives and 'Show and Tells'. There also were issue with the programme planning tasks as indicated by the Delivery Managers.

"…yeah, at programme level, and it was all the programme managers and a few others that got together. The prioritisation that we got out of that, in my opinion, was shambolic and ever changing and completely unrealistic."

Delivery Manager: TO-0506

"…we didn't do as much on the retrospective front as with the access governance team when we got down to four, because I think we were well versed and drilled in what we were doing; but at the very beginning, yeah, it was…because we were trying to teach all these new folks the ceremonies and all the stuff they should be considering"

Delivery Manager: WS-2205

Beyond these specific areas there was little further references to tasks related to contradictions.

6.4 Expansive learning actions

The purpose of this analysis is to provide a more granular decomposition of contradictions in terms of expansive learning actions (Engeström et al., 2013). Table 6.16 shows the relationship between identified contradictions and expansive learning actions. Some discrepancies are present as it was not always clear which expansive learning actions were indicated. Also, it was not always possible to identify the most appropriate specific expansive learning actions. Hence the main heading has been used in such cases.

Table 6.16: Distribution of expansive learning actions across programme groups

Contradiction levels	**Frequency**					
	Delivery Personnel (10)	**Delivery Managers** (9)	**External Dept.** (4)	**SBU** (4)	**Prog. Support** (3)	**Total** (30)
Primary contradictions: (within nodes)	**22**	**23**	**0**	**12**	**1**	**58**
1. Questioning:	22	14	0	12	1	49
Q1. Question current practice	5	2	0	0	1	8
Q2. Critique current practice	10	8	0	3	0	21
Q3. Identify challenges	7	4	0	0	0	11
Secondary contradictions: (between nodes)	**131**	**212**	**36**	**96**	**37**	**512**
2. Analysing:	132[16]	180	25	84	30	451
A1. Articulate needs and ideas	17	11	0	2	1	31
A2. Historical analysis	8	28	4	8	0	48
A3. Articulate problems and challenges	77	108	11	55	13	266
A4. Identify contradictions	12	24	7	10	10	63
A5. Weigh-up alternative solutions	16	9	3	8	6	42
3. Modelling:	0	1	1	4	0	6
M1. Sketch initial model solutions	0	0	0	1	0	1
M2. Exploit existing model	0	0	0	0	0	0
M3. Name and define the model	0	0	0	1	0	1
M4. Fix the model in material or graphic form	0	0	1	0	0	1

[16] One of the expansive learning actions had been accidently selected.

Contradiction levels	Frequency					
	Delivery Personnel (10)	**Delivery Managers** (9)	**External Dept.** (4)	**SBU** (4)	**Prog. Support** (3)	**Total** (30)
M5. Vary and adapt the model	0	1	0	2	0	3
4. Examining:	1	7	1	4	0	13
E1. Discuss the model critically	1	2	1	4	0	8
E2. Enrich the model	0	5	0	0	0	5
Tertiary contradictions: (between the activity and a more advanced form)	**4**	**17**	**6**	**4**	**9**	**40**
5. ***Implementing:*** *(not sub-divided)*	3	16	5	6[17]	10[18]	40
Quaternary contradictions (between the activity and a neighbouring activity)	**10**	**39**	**7**	**15**	**4**	**75**
6. Reflecting:	6	32	3	8	3	52
7. Consolidating:	4	10	2	11	2	29
Total	**167**	**291**	**49**	**127**	**51**	**685**

During the analysis of the interview transcripts, once a contradiction had been identified, it was attempted to identify which of the expansive learning actions was most appropriate. Engeström et al., (2013) identify twenty-one expansive learning actions including 'Consolidating' which comes after the quaternary contradiction. The following sections examine the distribution of expansive learning actions that took place within each level of contradiction. Such a distribution is likely to follow that of the contradictions and this analysis is intended to afford an insight within the contradictions as to the main areas of focus.

6.4.1 Expansive learning action – 1. Questioning

Primary contradictions contain three expansive learning actions. Although it is apparent from Table 6.16 that there are relatively few expansive learning actions occurring in the first place, the most commonly identified 'Questioning' learning action is 'Q2. Critique current practice'. This is especially true of the Delivery Personnel and Delivery Managers groups. The distinction into the three groups of critiquing and questioning current practice, as well as identifying new challenges, was not always clear because an interviewee may be

[17] Two of the expansive learning actions have been accidently selected.
[18] One of the expansive learning actions has been incorrectly assigned.

critiquing some aspect of practice while simultaneously identifying challenges. Hence it is possible to categorise the same text into multiple 'Questioning' expansive learning actions.

> *"I think criticism, if you're somebody who's critical, the organisation can be quite defensive. And instead of actually trying to get underneath it, so you feel like there's a bit of you can be, there can be exclusion if there's a perception of being challenging. Because obviously there's some criticism that's unwarranted or needs dealt with or needs fleshed out, I don't think it's a very open organisation."*
>
> Delivery Person: QW-2808

This raises some doubts as to the value of further sub-division of primary contradictions.

6.4.2 Expansive learning actions – 2. Analysing

The 'Analysing' group of expansive learning actions contains a larger number of actions and a much more diverse set including 'A1. Needs & Ideas', 'A2. Historical Analysis' and 'A5. Weighing up alternative solutions'. The group is by far the most commonly occurring in the whole expansive learning cycle. This was entirely expected because it relates to the most commonly occurring secondary type contradiction, addressing issues and frictions between nodes. Within the secondary contradiction, the most commonly occurring 'Analysing' expansive learning action is 'A3. Articulating problems and challenges'. These problems and challenges were distinguished from the earlier 'Q3. Identify Challenges' in the 'Questioning' group because they took place in the secondary contradiction context rather than in a primary contradiction.

It may well be that it was easier for interviewees to express problems and challenges than it is for them to weigh up alternative solutions or undertake historical analysis. The focus on problems and challenges may also be due to the focus and wording of the Standard Question Set (Appendix D). In catering for these elements, it is interesting to note that there is significant expression of 'A2. Historical Analysis' and 'A4. Identifying Contradictions' although it may well be argued that there is little distinction between 'A4. Identifying contradictions' and 'A3. Articulating Problems and Challenges'.

6.4.3 Expansive learning actions – 3. Modelling and 4. Examining

These two distinct groups take place between the secondary and tertiary contradictions. This research discovered that there very few occurrences of actions within these groups. Both groups relate to appraisal of a new work practice. Again, this may well be a consequence of the questions posed within the Standard Question Set (Appendix D). Alternatively, it may be due to individuals simply getting on with the new initiative, without undertaking much appraisal. As has already been outlined Health Care Org. personnel have become accustomed to the organisation implementing new initiatives almost on an annual basis. Hence the evidence of little appraisal may well be an indicator of the individuals rather long suffering approach of overt compliance coupled with anticipation of the new initiative inevitably dwindling and eventually being terminated.

6.4.4 Expansive learning actions – 5. Implementing and 6. Reflecting

The 'Implementing' expansive learning action is not further sub-divided. Both actions entirely follow the tertiary and quaternary contradictions, exhibiting similar values to those of the contradictions. These contradictions have already been discussed earlier in this chapter (sections 6.3.4 and 6.3.5).

6.4.5 Expansive learning actions – 7. Consolidating

This expansive learning action takes place after the quaternary contradiction. It relates to actions and elements that embed the new practice activities. In this respect, this learning action has parallels with the eighth stage ('Anchoring Change') of Kotter's (1995) classic eight-step change process. There was a significant number of occurrences of this action, with the heads of SBUs and Delivery Managers undertaking most of them. This would be expected given their responsibilities and (in the case of Delivery Managers) their enthusiasm for the Agile approach. Had further analysis had been possible with more interviewees, it would ideally map these consolidating actions to the quaternary contradictions, thereby identifying those elements of areas still in need of 'consolidation'. If these were identified, it would then be possible to focus attention on these specific areas, which would be some value to the organisation.

6.4.6 Expansive learning actions – Conclusion

Before the analysis of the interviews took place, it was anticipated that by attempting to identify Engeström et al. (2013) learning actions in the expansive learning cycle, additional insight might be obtained on the nature of the contradictions, and on whether it would be possible to further identify more informed contradictions. This could only have occurred within the primary and secondary contradictions because these are the ones that are further sub-divided by Engeström et al. (2013). For primary contradictions the difficulty lay in the interchangeable nature of the learning actions, and hence the difficulty in distinguishing between them. The learning actions within the secondary contradictions offered greater diversity, and hence more opportunity for further decomposition, but in this research most of the occurrences were clustered around the 'A3. Articulate Problems and Challenges' action. This was very similar to the actions within the primary contradiction. It may well be that these results are due to the nature of the questions within the Standard Question Set tool, but currently it is difficult to say.

6.5 Collaborative activity

According to Engeström (2001), the process of addressing contradictions will result in a change of behavioural activity leading to the emergence of much more collaborative approaches to work practices. These changes will, in some instances, lead to some questioning of the validity and rationale of the work practice, resulting in either a new way of working (resolved contradiction) or an accommodation leading to a congruence or stabilisation within the work practice. It is likely that the behavioural activity that leads to either the resolution of contradictions (Section 6.4) or the occurrences of congruences and stabilisations (Section 6.6) follows a collaborative activity progression from co-ordination through to co-operation through to co-construction.

It is therefore suggested that the presence of co-operation or co-construction collaborative activity may be regarded as precursors of the progress towards resolution of contradictions or to the development of congruences and stabilisations. These developments enable the organisation to move forwards either with a newer learned work practice or a modified work practice. These collaborative activities will occur at all levels within the expansive learning cycle.

Because co-ordination is simply the normal behavioural work practice, it has specifically been excluded from the analysis. It is deviations from normal work practice leading to contradiction resolution or congruences and stabilisations, that are regarded as indicative of changes in work practice (Engeström et al., 1997). The occurrence of these elements is outlined below in Table 6.17, along with contradiction levels and the identified occurrences of congruences and stabilisations.

Table 6.17: Distribution of collaborative activity across different programme groups

Contradiction levels	Frequency					
	Delivery Personnel (10)	**Delivery Managers** (9)	**External Dept.** (4)	**SBU** (4)	**Prog. Support** (3)	**Total** (30)
Primary contradictions:	**22**	**23**	**0**	**12**	**1**	**58**
Collaborative activity	13	13	0	5	0	31
Co-operation collaboration	5	1	0	0	0	6
Co-construction collaboration	0	0	0	1	0	1
Secondary contradictions	**131**	**212**	**36**	**96**	**37**	**512**
Collaborative activity	66	53	9	18	21	167
Co-operation collaboration	19	13	7	7	5	51
Co-construction collaboration	2	1	1	0	0	4
Tertiary contradictions	**4**	**17**	**6**	**4**	**9**	**40**
Collaborative activity	3	7	3	6	9	28
Co-operation collaboration	0	1	1	2	1	5
Co-construction collaboration	0	0	2	0	0	2
Quaternary contradictions	**10**	**39**	**7**	**15**	**4**	**75**
Collaborative activity	22	26	19	16	3	86
Co-operation collaboration	8	6	7	4	1	26
Co-construction collaboration	4	2	7	3	1	17
Total contradictions	**167**	**291**	**49**	**127**	**51**	**685**
Total collaborative activity	104	99	31	45	33	312
Total mapped co-operation[19]	32	21	15	13	7	89
Total unmapped co-operation[20]	38	25	28	15	7	113
Total mapped co-construction	6	3	10	4	1	24
Total unmapped co-construction	8	4	15	5	1	33

In Table 6.17 there are substantially fewer identified occurrences of collaborative activity than other types of events. This in part reflects difficulties in identifying different types of collaborative activity in the first place. Where it has been possible to identify collaborative activity, their occurrences follow the general distributions of congruences,

[19] Where the analysis has been able to map collaborative activity to congruences & stabilisations at different levels

[20] Where it has not been possible to map collaborative activity to congruences & stabilisations at different levels.

stabilisations and contradictions. It is also notable that the occurrence of co-construction collaborative activity is substantially less than that of co-operation collaborative activity. This is to be expected because co-construction activity can pose serious almost existential issues.

> *"…and you're asking them to come ideas, and I'm asking my people to come up with ideas that will take away their own jobs. I think that's a really difficult…you can empower them as much as you like, that's a difficult…"*
>
> SBU: NY-1109

The following sections examine the distribution of collaborative activity across the different contradiction levels, as well as within the different programme groups, and in relation to the identified congruences and stabilisations.

As with contradictions and congruences, collaborative activity is most prevalent at the secondary contradiction level. This is followed closely by the quaternary level, and it is apparent that it is the co-operation type of collaborative activity that is predominant. The occurrences of this collaborative activity type are mainly within the Delivery Personnel and Delivery Managers groups, particularly at the secondary level. Within the Delivery Personnel group, there was frequent mention of collaboration activity that takes place within the delivery team.

> *"I feel as a team, so we've worked as quite a small team, all coming from different areas and different perspectives. So, things like the sta…it's meant we've been able to collaborate better, so things that… "*
>
> Delivery Person: XN-1206

> *"One of the things that we…I don't know if I've covered it here is the relationships with the customers was built on and we did a really good job there. The internal relationships that we built were really beneficial, so working with other technical teams in IT."*
>
> Delivery Person: NT-1206

The Delivery Managers commented on the cooperation activities that took place across boundaries, disciplines and norms that would not otherwise have happened.

> *"So, the feedback we got was that they really enjoyed the fact that they were talking and working collaboratively with people that they didn't usually deal with."*
>
> Programme Manager: QZ-1305

"it was really quite multidisciplinary teams got together, when it worked it worked really well, social media worked brilliantly because we had a really good mix of people from across the business."

Delivery Manager: NZU-0706

At the quaternary level, there was a significant number of co-construction collaborative activities in relation to co-operation collaborative activities. For all the other levels, co-construction activity was minimal or non-existent, but for quaternary activity the numbers approach that of co-operation activity. There were multiple mentions of an initial receptive attitude to the notion of transformative practices.

"There's a lot of innovation and there's a lot of people that embrace it, but I guess from where I come from is that there's a lot of people who love the theory of change and the theory of transformation and learning new methods…"

External Department: WO-0309

In some instances, this developed into actual re-structuring and significant changes to the way an element of delivery practice was performed.

"They've actually restructured their part of the organisation, so one of their parts is now that service transformation support."

External Department: OI-1206

This extends to the Programme Manager who considered a radical change to the organisation's whole approach to the delivery of change in terms of setting up an independent autonomous entity for a change programme.

"Well, I'd worked, that was one of my clients when, from the beginning, [Finance Company] I worked for. And they just green field it… I think it needs to be a, it's something I spoke to Finance Director about and I do think it's got to be a, some kind of on the table solution."

Programme Manager: QZ-0609

6.6 Congruences and stabilisations

Accompanying the identified contradictions above were instances of congruences and stabilisations (Allen et al., 2013) as the organisation moved towards consolidating the new ways of working. Table 6.18 below provides an indication of the distribution of these congruences and stabilisations across all four contradictions.

Table 6.18: Distribution of congruences and stabilisations across different programme groups

Contradiction Levels	Frequency					
	Delivery Personnel (10)	**Delivery Managers** (9)	**External Dept.** (4)	**SBU** (4)	**Prog. Support** (3)	**Total** (30)
Primary Contradictions:	**22**	**23**	**0**	**12**	**1**	**58**
Congruences and Stabilisations	13	13	0	5	0	31
Secondary Contradictions	**131**	**212**	**36**	**96**	**37**	**512**
Congruences and Stabilisations	66	53	9	18	21	167
Tertiary Contradictions	**4**	**17**	**6**	**4**	**9**	**40**
Congruences and Stabilisations	3	7	3	6	9	28
Quaternary Contradictions	**10**	**39**	**7**	**15**	**4**	**75**
Congruences and Stabilisations	22	26	19	16	3	86
Total Contradictions	**167**	**291**	**49**	**127**	**51**	**685**
Total Congruences and Stabilisations	104	99	31	45	33	312

From Table 6.18 it is apparent that there is a strong association of congruences and stabilisations with the occurrence of contradictions. As with contradictions, congruences and stabilisations occur mostly within the Delivery Personnel and Delivery Manager group. This is consistent with the larger numbers of interviews that took place within these groups. Congruences and stabilisations occur as individuals adopt solutions to the frictions and issues that give rise to contradictions. The more contradictions that exist, the more opportunity for congruences and stabilisations. Unfortunately, due to the nature of the D/STP programme and the wide diversity of issues, as well as the way in which the data was collected after the programme had finished and the nature of the data itself, it was not possible to directly map the identified congruences to the relevant contradictions.

However, some comparison of congruence themes is made in the later sections of this chapter. This comparison is structured according to contradiction levels.

Theoretically, and perhaps on a much smaller scale and at a much more simplistic level, one might expect to see the occurrence of contradictions and associated congruences moving up the different levels of contradictions as a progression from primary through to quaternary. Such data might have been gathered if the researcher had been able to undertake continuous research, collecting data snapshots over the lifetime of the change programme. For example, where a new practice has just been deployed within a team, one might expect to identify contradictions at the primary level. One might then expect to see increasing numbers of congruences and stabilisations at this level, leading to the resolution of contradictions, then the occurrence of contradictions at a secondary level as the team expands its activity. One would then expect to see congruences and contradiction resolutions at the secondary level, and so on up through the different contradiction levels.

In this study where a large-scale initiative was examined, and where the data collection took place after the change programme had finished, it was difficult to obtain a conceptual timeline of a progression because all references to contradictions and congruences were provided in hindsight. The distribution of the wide diversity of references to contradictions and congruences in this analysis is spread across all contradiction levels with the vast majority taking place at the secondary level. The disproportionately low level of congruences and stabilisations within the Delivery Managers Group and the SBU group at the secondary level (underlined in Table 6.18) is perhaps indicative of some of the key problems faced by the programme. It is also plausible that congruences and stabilisations could be occurring between the two separate groups of Delivery Managers and those involved with the SBUs.

Overall, the occurrence of congruences and stabilisations aligned with the distribution of contradictions across all the groups and across all the different levels of contradictions. The number of congruences and stabilisations was approximately one half to one third of the number of contradictions. There are some notable exceptions (underlined in Table 6.18) where the number of congruences drops to a quarter in the Delivery Managers and SBU groups.

In the External Departments group, there is a notable reversal of values, in which the number of congruences at the quaternary contradiction level is more than double the number of contradictions.

This is likely to relate to the accommodations that external departments made to facilitate the D/STP programme, as discussed earlier. The following sections discuss in more depth the occurrences of congruences and stabilisations across the different levels of contradictions.

6.6.1 Congruences and stabilisations at primary contradiction level

Primary contradictions occur within the six nodes of the activity triangle. The number of congruences and stabilisations at this level was relatively small (31). This is around 10% of the total number of congruences and stabilisations. Most of the congruences take place within the Delivery Personnel and Delivery Manager groups (13 each). Almost all of these congruences took place within the Subject node of the activity triangle. At a primary level, one might well have expected at least some congruences to relate to the Artifact node that relates to the Agile tools and techniques themselves. Indeed, this might well have been the case had the change involved the use of new hardware or software. However, the D/STP mostly related to changes in working practices, without reliance on any specific new artifact or tools. The following were the main themes that related to individuals within the Subject node.

- Individual motivation and enthusiasm.
- Individual's potential willingness to embrace new approaches.
- Individual empowerment
- Reliance on volunteers

There was some initial doubt as to whether the last theme – 'Reliance on volunteers' was a congruence at the primary level within the Subject node or whether they were congruences at a secondary level involving the relationship between Subject node, Division of Labour and Object. It was concluded that because they related to the make-up of the subject team itself rather than the allocation of roles and responsibilities then they were congruences within the Subject node at a primary contradiction level. The most common Subject node occurrences involved the delivery team and team members

themselves, and by far the most common references were to the themes around motivation and enthusiasm of the individuals within the delivery team.

> *"I don't know about others, but we had an amazing team. The actual motivation within the team to actually keep the morale high, it's an environment I've never seen before. Very supportive, so when these issues were encountered, you know the scrum master collectively with the development team, all would try and solutionise to a problem, you know."*
>
> Delivery Person: IY-1207

The Delivery Managers made similar references to the enthusiasm of the delivery team members. The key point for the Delivery Managers was just how different the delivery team were in terms of their motivation of enthusiasm compared to the typical and somewhat entrenched approaches of others within the organisation.

> *"You were in an environment where you probably had 200 highly enthusiastic people that got the message, where, when you're trying to communicate to 4,500, whatever number [Health Care Org.]is currently sitting at the moment, that message is lost, it's diluted. Lots of people in the organisation are only interested in doing their wee bit of the cog, and lots of stuff is auto-delete, or they don't read it."*
>
> Delivery Manager: WS-2205

In addition to the motivation and enthusiasm themes that typified the Delivery Personnel, there was an additional theme of individuals who were very open to new approaches. In the two interviews conducted with the Programme Manager, these individuals were referred to as the 'hand raisers'.

> *"I would absolutely want to be going down an Agile way, or put as much Agile into it as I can."*
>
> Delivery Person: KN-2205

Closely related to this willingness to embrace new approaches was the emergent theme of new challenges being posed by the D/STP change programme. Individuals rose to them and benefited from the personal development and experiences obtained. The Delivery Manager pointed out that some previously surplus individuals were redeployed to the programme and were now extending previous work practices.

> *"They've been sitting on redeployment for a long time and HR would be allocating them the same band jobs without looking to their skills that they were now developing within a scrum team because people were being allowed and challenged to do things that had never been done before."*

Delivery Manager: WN-2607

A theme that connects all the above is that of individual empowerment. Empowered teams that can take decisions without needing to continually refer details or obtain approval from senior management, is a key aspect of the Agile approach. Such an approach contrasted strongly with the traditional top-down hierarchical structure that typifies public sector organisation's such as Health Care Org. Many of the individuals involved within the programme readily took to the delegated authority approach of the change programme.

> *"…the sort of management that we'd been under for such a long time has been a very command and control, so we will tell you to do this, and they all come back complaining going, but we want to do this and we want to do that, so this empowered them, it gave them the opportunity to be able to do that, to take that ownership and to move it forward."*
>
> Delivery Person: NT-1206

These individuals appreciated the new empowered work practice, and this substantially fuelled their increased enthusiasm for the change programme. This is in sharp contrast to the contradictions identified earlier where, particularly at the secondary level, bureaucratic procedures often requiring senior management approval were considered to impede progress. It may well be that employee empowerment at the primary level, related to the Subject node could well obviate some of the contradictions that present themselves further downstream[21] at the secondary level.

The most significant theme within the Subject node was the presence of volunteers within the delivery teams. The D/STP programme recruited its delivery teams on a mostly volunteer basis. In many instances the delivery work of the D/STP programme was in addition to volunteer's usual roles taking up any spare capacity they had and often adding to their duties. These 'hand-raisers' formed a very substantial proportion of the delivery teams.

> *"So, I think that probably a lot of people that were involved in this early doors were probably self-selecting so they were all up for it and doing things in a different way. So that that was relatively straightforward"*
>
> Delivery Manager: HS-0407

[21] The term 'downstream' refers to later contradictions within the progression from Primary through to Quaternary.

"I liked the idea…the majority of folk who volunteered put their heart and soul into it, gave it their best shot, they were open to learning."

"The whole thing, in my eyes, was done on volunteers. When we were putting these teams together, they asked people to come and join these teams. They weren't freed up from their day job; they still had their day job."

Deliver Manager: WS-2205

Many reasons were cited for the D/STP to be deployed using volunteers and for individuals to volunteer for the programme. Foremost amongst these was the finite capacity and resources within departments that had no capacity to release resources to the programme. With regard to the motivation of the volunteers there are many references to altruistic motives. There were similar reasons cited as to why these individuals had sought employment within Health Care Org. in the first place.

"…so within the team, most people weren't there under duress, they were there because they want to make a difference and they wanted to transform…"

Delivery Manager: ZU-0706

These emergent themes are closely associated with the primary level contradictions as discussed in Section 6.3.1 because they similarly converge around the Delivery Personnel and Delivery Manager groups. They also represent significant congruences that affect some of the identified contradictions. These include some individuals not being receptive to change. As mentioned in Section 6.3.1, these may well be related to these individuals' limited length of service and proximity to retirement. This may explain the change programme's reliance on volunteers, rather than co-opting disinterested individuals who might be more set in their ways.

There is also the issue of congruence theme of empowerment which is recognised here within the Subject team. Where such congruences are not available then they occur as secondary contradictions where activities are delayed awaiting senior management approvals (see Section 6.3.2.2).

6.6.2 Congruences and stabilisations at secondary contradiction level

Secondary contradictions occur between activity triangle nodes. Table 6.18 shows that references to congruences and stabilisations at this level are by far the most common making up more than half of all such references. Due to the very broad, indeterminate

nature of references to congruences and stabilisations, it was not possible to provide a comprehensive distribution of their occurrences as was provided earlier for contradictions (Table 6.8). Instead, only an overview of themes within congruences at this level can be provided. These are listed below in order of those most cited across all the different groups.

A. Multi-disciplinary collaboration (removal of silos)
B. Embracing the Agile approach
C. Increased transparency and visibility
D. Training, learning, support and mentoring
E. Team structures, roles & responsibilities
F. Work arounds and fixes

A. Multi-disciplinary collaboration (removal of silos)

A major theme emerging particularly from the Delivery Personnel group was the benefits of working in multi-disciplinary teams. Frequent reference was made to the different way of working within an Agile approach, compared to past working practises that had predominantly had little cross functional collaboration and communication.

> *"it was working in a completely different way that we'd never done before I think, working together as a team, because we do work… but we do work in silos, so I lead on risk, somebody leads on resilience, somebody leads on adverse events, but what we're working on just now, adverse events and resilience we're working together, we're working together…"*
>
> Delivery Person: ND-1206

> *"…again, it was more the collaboration, I think that was the biggest bit, is getting everybody in the same room at the same time to talk about what they're doing."*
>
> Delivery Person: NT-1206

The cross functional working practices promoted by the change programme led to several benefits highlighted by the Delivery Personnel group. The individuals were able to learn more about operations than they would normally.

> *"So that was a different way of working, but a really beneficial way of working. We learned more about the businesses as well."*
>
> Delivery Person: ND-1206

The multi-disciplinary approach allowed Delivery Personnel to develop relationships with other functions in a much more informal manner that contributed to effective delivery.

> *"The other thing that I thought really worked well was the way we networked. So, even though we had all this governance, that was superimposed on us. But what really worked well is we networked through that governance, and we found routes eventually through it."*
>
> Delivery Person: NZ-2805

Other benefits of this new way of working identified by the Delivery Personnel was a better understanding of other functions and departments problems and issues as well as access to knowledgeable experts.

> *So, we weren't just talking, we were really sharing. We were really getting to understand each other's bugbears and then finding the commonality about, actually, if we had better connectivity, we had better sharing, then it didn't only help us, but it inevitably helped our customers and our stakeholders."*
>
> Delivery Person: NZ-2805

These sentiments were confirmed and repeated by members of the other groups, in particular by the Delivery Managers group who identified similar benefits to those raised by the Delivery Personnel group.

> *"it is absolutely fantastic to work in cross-functional teams with people that have different skills and there was so much benefit from that. Understanding what other people do and that in itself I can you know remove silos you're working across an organisation that I've never done that before."*
>
> Delivery Manager: WN-0407

B. Embracing the Agile Approach

All groups frequently expressed their support for the Agile approach with reference to many of the tools and techniques such as daily stand-ups and the iterative development approach. These were often contrasted with conventional organisational practices that they had found to be onerous and stifling.

> *"Instead, the use of Agile made it clear what exactly was required and what was not, the key deliverables were identified very quickly (rather ruthlessly) and also, the speed of delivery was very good which is different from the usual."*
>
> Delivery Person: HH-2105

"I love the fact that you have Agile ceremonies which force you to work in a certain way. So, you meet regularly in your scrum teams. You have to keep clearly identifying who is responsible for what. You've got shared and agreed tasks which are again transparent. The show and tells and having to do reports out is really important in terms of engaging the business. The other words I would use is relentless. So, when you're Agile compared to other project methodologies, you literally never get away from it, which is good because it keeps you on focus with delivery."

SBU: HX-2806

A significant theme was the ease with which some individuals took to the Agile approach and the almost 'common sense' way of working that it brought. It appears that individuals were keen to only adopt Agile tools and techniques within the D/STP programme but also to extend their use beyond the programme and employ them within their BAU work practices.

"…we were working in a much more Agile way, like we were having our stand-ups and the guys bought into that and we did deliver some BAU stuff under the SAFe which was great, and again it was more the collaboration, I think that was the biggest bit, is getting everybody in the same room at the same time to talk about what they're doing."

Delivery Person: NT-1206

"…even for the simple things like using Trello boards and that type of thing, we never used them before, we'd never thought of using that type of thing before. And not only do we use them in the project, we used to use them in the department as well for team meetings and things."

Delivery Person: ND-1206

"So, it wasn't a director or a senior person, it was somebody that was involved with it and the product owner being part of the group and facing in and looking after the group has worked really, really well, and scrum masters have worked well as well because actually they kind of chivvy you along in a nice way. We don't have a scrum master now, but we did at the beginning, we learned loads and loads from them."

Delivery Person: ND-1206

C. Increased transparency and visibility

This theme emerged from the use of Agile concepts such as daily stand-ups and online collaboration tools such as Trello and BaseCamp, which provide online repositories of project information. These were used by the delivery streams to identify share and communicate information related to all aspects of the projects and the work in progress.

"I don't think you had to put in a lot of effort to be transparent and visible with things when you're working Agile because you've got your board, because you're meeting daily, I also find it might even get on with your work."

Delivery Person: KN-2205

"And then it made it easier for us and there was more transparency among the core team because everybody knew when people were working and what they were trying to achieve for the different planning stages."

Delivery Person: IX-2405

This view was widely shared within the Delivery Personnel group, but there was some acknowledgement that individuals within the wider organisation may not have had the same enthusiasm for such openness and transparency.

"…all that material was just all sitting on people's emails so all the people in the team just had lots and lots of emails whereas in the Trello, it's just in one place and it means everybody can see it, so that's great. I do think and this is sort of an observation, is that one of the things that's very challenging I think for some managers in my experience, is that transparency."

Delivery Person: QW-1906

The Delivery Managers group and the SBU individuals involved with the change programme were very much in agreement with the Delivery Personnel extolling the benefits of the transparency afforded by the Agile approach. One Delivery Manager commented on the speed with which problems and issues were aired due to the openness and availability of the information.

"So, there's something about the process that gets these things aired and either resolved at least partially so you can carry on. Perhaps it was more the unsaid got said more quickly which I think helped progress and in general as I said the team were pretty committed to doing it and were up for it, so they just kept going."

Delivery Manager: HS-0407

An SBU manager welcomed the increased scrutiny that was facilitated by the openness and transparency afforded by the Agile tools & techniques.

"…the fact that you've got open, we use Trello. So, you've got open boards. Anybody who has got access at an organisational level can just see where you're at, at any point as a team. So that's a really important aspect of delivery because it's a kind of in the background scrutiny, the very live scrutiny that I think helps keep everyone to task. I really like the multidisciplinary team approach."

D. Training, learning, support and mentoring

Many of the congruences and stabilisations related learning and to individuals being supported and encouraged to use and understand Agile concepts, tools and techniques in the delivery of the change programme. There was a general consensus across all groups that there was extensive assistance and support available throughout the programme.

> *"So, even though they were working on different themes and different projects, it allowed people to come in who were novices with Agile methodologies and people that were, shall we say, experts towards that line of experts and the knowledge sharing and being able to learn from your peers was of great value, basically."*
>
> Programme Support: QY-1206

> *"We were writing test scripts for the first time there was loads of learning. Loads of knowledge that was shared and gained, thinking about the user, creating you know personas and profiles and doing user research."*
>
> Delivery Manager: WN-0407

> *"…generally, the product manager, the product owner and the Scrum master had all had a relatively good understanding of the SAFe methodology and how we were going to deliver on each of the themes. There was the Agile theme [delivery stream] who created a lot of learning and development around Agile methodology, principles, the roles, et cetera…"*
>
> Delivery Manager: NZU-0706

The theme of encouraging learning and providing support throughout the programme was commonly expressed, but the extension of this theme in terms of the provision of formal training was much more complex and debatable. There was evidence that, for some individuals, training was readily available and accessible. In one instance, this was attributed to the organisation's historical involvement in epidemiology.

> *"They try and promote learning as much as they can and they're good for funding. Learning, I mean, a lot of people, personal development is a big thing in the organisation and especially with Agile as they're trying to promote that, but the organisation was really good in encouraging me to go as far as I could with it."*
>
> Delivery Person: IX-2405

> *"…learning is a very big thing, it's a wee bit like academia, but the clinicians take that to a new level as well, they have a thirst for*

knowledge, so there's lots of people that understand change theory, all the new…so they will embrace going on courses to learn how to Lean or to learn about Agile or to learn about service design."

External Department: WO-0309

On the other hand, there is some evidence that the organisation was not so forthcoming when it came to the provision of formal, costly training courses delivered by external suppliers. This was particularly the case when individuals were already performing their roles and then sought additional formal training.

"I then went to a manager, not above him, but a training manager who said why do you want this training, you're doing this anyway, this just seems like this is no benefit to the organisation… I don't think you should have the training. And then went to her manager who said I'm not signing it off, and I just thought, at this point I was so frustrated that I just took money out of my savings and went and paid for it."

Delivery Person: QW-2808

From the Programme Support perspective, it appears that support for formal training varied: at the beginning of the programme, training was provided upfront. However, as it progressed there was a view that training would be provided for some, then those that had been trained would then mentor others recruited to the programme.

"I think that helped it as well, because as we moved into year two that was like a prerequisite of joining the programme, was that you had to have gone through a certain training before you joined. Whereas at the beginning there was maybe only a selection of folk that got training and they were expected to kind of support and bring along others in the team"

Programme Support: QN-1309

E. Team structures, roles and responsibilities

The Agile approach adopted within the change programme provided a differently structured work practice that led to delivery teams having much flatter organisational structures. This was a deliberate move away from the conventional hierarchical structures that predominated throughout the organisation.

"…so, everything we did was goal focussed and it wasn't role focussed so we purposely did it like that because that is what's in the scrum guide you know everybody's equal and everybody's so we divvied up the jobs if they weren't specialised and just shared them."

Delivery Manager: WN-0407

One of the main aspects of this was individuals taking on responsibility themselves for the work that was to be delivered. This is a significant theme to emerge from the change programme.

> *"Once we had agreed and identified what we needed to do, and we had it in our backlog, it was easy to see, and people took ownership of something, and it could track their progress and their results."*
>
> Delivery Manager: WS-2205

With the initial successes of the programme, an extension of this approach became more apparent with individuals becoming increasingly open to taking on increased responsibilities and providing greater input and options.

> *"I think people became more confident in that way of working, I think as we worked on different aspects of the march we were taking forward people become more willing to take on...and this doesn't apply to everyone but some people became more willing to take on bigger roles in that and so, therefore, became more confident about taking on things and saying, oh, I'll do that or why don't we do this or why don't we do that?"*
>
> Delivery Manager: HI-0306

One of the reasons for this could be the momentum that was built up through early delivery and the transparent nature of the work success and the work delivered.

> *"Momentum comes from achieving goals and we were setting goals and we were achieving them, and it was obvious, more obvious in Scrum than anything else I've ever done."*
>
> Delivery Manager: WN-0407

F. Work arounds and fixes

With the enthusiasm and positive approach adopted by many individuals involved in the change programme there were many occurrences of individuals finding alternative methods of delivery that deviated from the accepted norm.

> *"Yeah, the legal team, you know, really engaged enthusiastically. They may be not working as pure in Agile, but they were delivering, and they were moving forward which was great."*

> *"I mean you found that everybody went on an adoption curve with the Agile stuff. A lot of them implemented in their own way, you know. How they did stand ups. Whether they did them weekly, daily, whatever. We tried to start with a bit of flexibility and then tried to refine the use and mature people through it."*

> *"And the team itself came up with, what I thought was quite a good idea. I couldn't get anybody, or very few people to be full time on this which I think is the, anything that I have learned that is the ideal, that you have a proper dedicated team. A number of the team, I could only get part-time. So, what they did was they worked a whole week together and then they went back to their day jobs for a whole week and then they worked a whole week together and then they went back to their day jobs."*
>
> SBU: OQ-1908

Many of these congruence themes address somewhat different elements than the contradictions elements discussed earlier in Section 6.3.2. While secondary contradictions and congruences and stabilisations are by far the most commonly occurring throughout the study, there is a divergence when they are examined further. Most of the secondary contradiction occurrences relate to the Community – Rules & Norms sub-triangle whereas the secondary level congruences and stabilisations mostly occur within the Subject – Artifact and Subject - Division of Labour sub-triangles. This may well be due to the empowerment granted to the teams was limited to certain situations.

6.6.3 Congruences and stabilisations at tertiary contradiction level

Contradictions at the tertiary level take place between an activity and the developed or 'culturally more advanced' version. As with contradictions, congruences and stabilisations at this level had the lowest number of occurrences throughout the whole analysis. Congruences and stabilisations at this level involve references to overcoming impediments to the newer way of working, as well as an appreciation of the benefits of the newer practices. Tertiary congruences involve elements of comparative analysis in which individuals examine the benefits of new practices compared to the more entrenched approaches.

> *"…just the sheer Agile approach that you're producing things, you know, every couple of weeks. They really felt that they were moving forward, that they had a sense of achievement when they'd got to the various stages."*

> *"The techniques, the combination of that fortnightly, you know, delivering value sense of things gives you a completely different sense of time, literally we just didn't notice the time."*
>
> SBU: OQ-1908

"I think people are seeing that this has been a good way of working and people are saying, oh, you could do this, and you can do that and do the other. So, we have to prioritise and manage what's coming onboard."

Delivery Person: XN-1206

A consequence of making these comparisons, and of being exposed to a different way of working, led to many Delivery Personnel anticipating how things might change.

"Going forward they will stick with Agile in perhaps a less excellence focussed environment particularly in the Care sector looking at nurses and quality in care."

Delivery Person: HH-2105

"I see it as the way that we're moving forward, that's what it would be used for."

Delivery Person: KN-2205

The Programme Support group, which had proportionately the highest occurrences of congruences, had a perspective that viewed the Agile approach as a vehicle for breaking down long-held beliefs and practices, and for introducing different approaches.

"…the five generations that you've got in the workplace have all got their different ethos of working and different cultures, if that makes sense. Obviously one big barrier that I said before, oh, we've always done it this way so it's the way we're always going to do it, and in many ways, I think the Agile way kind of helped us break some of those barriers down."

"…using Agile methodology has also helped us to change the work environment which is great. So, in some areas we've gone from call centres environment where you're sitting there in blocks with computer screens to more collaboration spaces which is a lot brighter, a lot more energetic in the room sort of stuff to create that collaboration work."

Programme Support: QY-1206

"So, that's what SAFe delivered for us. And in terms of the Agile, at a team level, it was a definite enabler for behaviour change. Because the way that people ran projects was very waterfall and very focused on the paperwork and the process, rather than the outcomes, which wasn't taking us anywhere particularly fast."

Programme Manager: QZ-0609

The Programme Support group also noted a shift in the prevailing organisational culture, and beliefs amongst those involved in the change programme that would facilitate future changes in work practices.

> *"It's the blame culture but in this instance when [Delivery Manager – A] stood up and said, this has not worked, she got unreserved support and assistance and she was actually quite taken aback because she was expecting to told, oh, well, you didn't do that job good enough. Really it was a culture change, and you could see it was quite a distinct culture change where everybody was giving her support and saying, right, so it didn't work, it's fine. We've not spent two million on it. We would have if we hadn't done it this Agile way, so we know it's not going to work quicker."*
>
> Programme Support: QN-1309

These congruences directly address some of the contradictions at the tertiary level that were identified earlier such as the reluctance to let go of old practices. It is significant that most congruences at the tertiary level originated from the Programme Support group rather than the Delivery Personnel or Delivery Managers groups.

6.6.4 Congruences and stabilisations at quaternary contradiction level

Quaternary contradictions take place between an activity and a neighbouring activity. The number of quaternary congruences and stabilisations was double those at primary and tertiary levels but less than half at secondary levels (Table 6.18). Notably congruences within the Delivery Managers and External Departments group were double the number of contradictions, whereas the other groups' congruences are much fewer. It is likely that this high number of congruences reflects the early attempts by the senior managers within the D/STP to discuss different work practices with the external departments (outlined earlier in Section 6.3.5). This is apparent from the references to congruences by both the Delivery Managers (including the programme manager) and the External Departments

> *"It allowed us to have, you know, much more quick discussions about things and kind of get to a point of thinking, right, we understand this now, we know what it is, we're going ahead to work on and I think it just brought that much more of a kind of sharing collaborative approach to work as well"*
>
> External Department: OI-1206

> *"I think they felt…one is that they felt they were connected much better. So, the feedback we got was that they really enjoyed the fact*

that they were talking and working collaboratively with people that they didn't usually deal with. And a broad mix of skill sets, so there was an awful lot of cross learning going on. I think they enjoyed the ability to try and knock issues, problems, barriers, blockages, on the head pretty quickly."

Programme Manager: QZ-1306

In addition to these congruences between the Delivery Managers and External Departments, there were others in the form of connections and cooperation taking place at all levels within the organisation.

"There's things that just wouldn't have happened, friction between the teams would have got bigger and bigger, at least now people are aware of what everybody does which has been really beneficial, just some of the stuff that has been delivered would never have happened."

Delivery Person: NT-1206

"They were encouraging and supportive I would say, the broader organisation, where we've needed them to be, so… Yeah."

Delivery Person: XN-1206

Consistent with Engeström's notion of Reflection as an expansive learning action at the quaternary (Section 6.4.4), there was a significant level of reflection on what developments had been achieved and might be consolidated.

"I certainly don't think we would have got to where we got in the time period. I don't think that the outputs from the different work streams would have had as wide an exposure and therefore the level in the organisation that we had got to in the time period"

External Department: OI-1206

"I think we set out to do something really ambitious, we weren't ready for it, but it was absolutely the right thing to do, and I think that all the work we've done, we'll start to reap reward from it, so I think that for me is the message that needs to come out in that."

External Department: WO-0309

The notion of consolidation was elaborated on further, with frequent references to Agile practices becoming more widely disseminated amongst the whole organisation and, to some extent, being adopted in conventional Business as Usual (BAU) operations.

"So, in terms of roles and responsibilities, people who worked within the programme had taken that skill and started using these tools and concepts to deliver business as usual."

Delivery Manager: NZU-0706

"I think the greatly reduced silo mentality. People previously would've kind of said that piece of work's about technology, so the IT department will deliver that. Whereas now I think people are kind of saying...much more recognising the need to engage users, do your experience, do the... So, I think that that has changed quite a lot and people are definitely bringing in colleagues from other parts of the organisation more than they used to."

External Department: OI-1206

"So, we're still running a web transformation work stream, its running under separate governance now and it is running pretty much to the Agile principles that everybody picked up during the programme. There's a real appetite to use it elsewhere as well so we kicked off completely separately, an API and containerisation work stream."

Delivery Manager: HI0306

"Because this is now in Business as Usual it is in our five year strategy. There is a plan that we will progress and deliver the digital transformation, service transformation across all parts of the organisation, all service areas. It's now part of the core way that they'll support that transformation across the organisation."

External Department: OI-1206

This strong sense of incorporating Agile tools and techniques within the organisation led to the congruence that both Agile and non-Agile approaches were regarded as important developments for the organisation. There was an appreciation of the need to adopt a contingent approach for delivery methodologies dependent upon need and circumstances.

"Yes, I'd be willing to use Agile again but again I think there was a danger for a while that we were going down the route that everything had to be done in an Agile way. I don't think Agile naturally fits with everything, but it certainly does go with a lot of the stuff that we do so I would definitely use it."

Delivery Manager: HS-0407

"I suppose through the programme we matured in our thinking about how and when we use different methodologies. So, it's not let's stop doing PRINCE and let's start doing Agile. It's very much about learning which approach is the right thing for which type of piece of work you're doing. And how do you sometimes have a blend of different things going on within a broader programme of work. So that's something that I think by the end of it we had kind of begun to get our head around that."

External Department: OI-1206

"I think the PGMS role now is not just to promote and put out Agile, but it's to promote and to make sure that we use the best and most

appropriate methodology for the programmes and piece of work that we haven't had."

Programme Support: NN-0909

The last quote from the head of the Programme Support function confirmed a modified perspective for the group charged with assisting others in the selection of the most appropriate approach. To this end there is a reference to the need to develop an assessment tool that would assist in this process.

"There's no doubt about it at all, but it is a different way of working, and not all of the pieces of work that we have will lend themselves to that, which is why I say we need to actually have some methodology or some assessment tool that actually says Agile is the best way to approach this piece of work and to approach the solution to this issue that has been identified."

Programme Support: NN-0909

The programme manager referred to a similar tool that was developed during the programme to aid other functions with their state of readiness to adopt Agile approaches. This may well have an influence on the desired assessment tool.

"So, we developed a readiness piece which, you know, you could argue didn't have to be restricted to a SAFe environment, it could be used in any kind of programme implementation, where you were like, well, you know, is the team ready? Does it have…are they trained, are they supported appropriately? And so, there were lots…definitely lots of assets and lots of knowledge that we were then able to take beyond [Health Care Org.]."

Programme Manager: QZ-0609

Finally, although the programme had technically finished there were references to its approach and methodology as having morphed into different forms. This represents congruences and stabilisations that allow the organisation to proceed with some form of Agile work practices.

"I don't think the programme is finished. I think the programme was effectively revised and re-factored. I think the discipline is still there. I think the Agile discipline is still being brought into play. I think there's an increasing awareness of the acute importance of demand management and prioritisation and informing an organisational level backlog. I think that's something that is there."

Delivery Manager: HN-0708

"…there is still plenty of people that were involved in that programme that are still implementing things that they have learned, the

methodology, so there is small pockets of it still around despite kind of what happened."

Programme Support: QN-1309

"It did not come to an end. That's the first thing. But there was a change and the handover responsibility for the web transformation work went to digital on the 1st of June this year and so the chains were divided in that regard. The programmes or the piece projects that were being taken forward in the initiative were to keep on the go. Were to keep going, and that service transformation change within PGMS continues to coral and continues to use all of that. The programme did not end, it moved into something different to try to make it a more sustainable piece of work and to make sure that the solutions that were being devised at for the problems that were identified were appropriate for users and indeed for the staff who had to deliver them."

Programme Support: QN-1309

6.6.5 Congruences and Artifacts

There were very few references to artifacts associated with congruences, as shown in Table 6.19 which displays the two groups where these references occurred. With regards artifacts within specific Agile activities, the External Departments group had only two references and the SBU group had none while Programme Support had only four. Given the few occurrences, there is little facility to distinguish between the different levels of artifacts and their distribution across the different groups of the programme.

Table 6.19: Distribution of Artifacts associated with congruences

Generic Agile Activities		Delivery Personnel		Delivery Managers	
		Primary	Secondary	Primary	Secondary
Governance and Support (G&S)					
	Primary		2		4
	Secondary			1	
Requirements Engineering (RE)					
	Primary	2			1
	Secondary				
Building and Coding (B&C)					
	Primary Artifacts				
	Secondary Artifacts				
Testing and Quality (T&Q)					
	Primary				1
	Secondary				
Release Management (RM)					
	Primary				
	Secondary		1	1	1
Learning and Development (L&D)					

Generic Agile Activities		Delivery Personnel		Delivery Managers	
		Primary	**Secondary**	**Primary**	**Secondary**
	Primary				
	Secondary				
Total: (Primary & Secondary)		**2**	**3**	**2**	**7**
Total Tertiary:		**2**	**1**		

6.6.6 Congruences and tasks

The picture is slightly different when examining references to tasks associated with congruences. This is displayed in Table 6.20 below.

Table 6.20: Distribution of references to tasks related to congruences

Events	**G&S**	**RE**	**B&C**	**T&Q**	**RM**	**L&D**	**Total**
Congruences							
Primary	1				1	16	**18**
Secondary	7	1			12	22	**42**
Tertiary	1				1	2	**4**
Quaternary	5	1				1	**7**
Total	**15**	**2**			**14**	**41**	**71**

Tasks related to congruences within the L&D activity make up more than half of all the congruences. There are a variety of tasks that were identified within this activity, ranging from training and mentoring to knowledge management.

Whereas the earlier relatively high incidence of L&D tasks references associated with contradictions indicated frictions and tensions, the large number of references regarding congruences indicates an achievement in some areas of a level of balance and stabilisation.

> *"We were learning all the time and very experienced Agile coaches coming into us and saying right what have you done today and let's share that knowledge and let's talk about scrum and Agile development and the difficulties you had."*

> *"All of the Scrum event planning, retros, reviews and Scrum they help support the team. We knew we had to go to those we did go to those, they supported us, they allowed openness so the events themselves worked very well for us. Helped knowledge management and sharing."*
>
> Delivery Manager: WN-2607

This is not the case for the G&S activity where the number of congruences related to tasks such as prioritisation, business case and risk management is less than half the number of contradictions. This is particularly true at the secondary contradiction level, where the number of congruences is a fifth of the number of contradictions (see Table 6.18 for the comparison), indicating difficulties in this area.

> *"I think that was the belief but the difficulty with that is, I think I said, so, 1. we weren't working on the right things and 2. to me, that's not how you go about transformation in your organisation."*
>
> Delivery Manager: HI-0306

> *"There were certain business cases that went for things, but the business case process that we've got for the organisation and how that's managed didn't fit in with the Agile model that we were trying to deliver against."*
>
> Delivery Manager: NZU-0706

The RM activity also had substantially less congruence events related to tasks, and many of these issues related to planning tasks.

> *"It made the agreement of priorities very, very difficult. So, at PI planning we committed to priorities, and it felt during the subsequent PI, there was a lot of chat and push back on the priorities from individual directors and the whole different, IT business partners, et cetera."*
>
> Delivery Manager: GL-0506

6.7 Conclusion

This chapter has examined the distribution of events across generic Agile activities within the D/STP programme in Health Care Org. The analysis takes the form of different perspectives that, when combined, provide an integrated, complex picture of the learning and development issues facing the organisation.

The overarching initial perspective that examines the distribution of all events indicates that the G&S activity is the most active whether contradictions, congruences or collaborative activities are concerned. However, because it was often not possible to locate events within a single Agile activity, broader categories of delivery stream and programme were utilised. These broader categories turned out to have the most common events, with events across the programme being most frequent, followed by the discrete delivery streams. This indicates that most events took place at a level that transcended individual activities, being common across all activities.

These events were analysed in a logical progression that first focussed on contradiction events relating to frictions or tensions within the activity, delivery stream or programme. These were followed by events that related to collaborative activity, which is the precursor to the resolution of contradictions, and represents attempts to resolve contradictions. The last point in the progression was the identification of congruences (temporary stabilisations) within the activity that enable the activity to proceed but which do not lead to any change.

The analysis shows that secondary contradictions were the most frequent. Within this grouping a more detailed perspective revealed that although the Delivery teams had some tensions with using the Agile artifacts, the largest number of contradictions involved the wider Community participation within the activity as related to organisational Rules & Norms. These related to five distinct groupings consisting of Funding and production of business cases; Undue influences of other departments; Influence of clinical and public sector cultures; Organisational proclivity for new initiatives and the Need for senior management approvals.

The main tertiary contradiction holding back change was the difficulty other functions had in overcoming their view of Agile as a ‘cult’. There were few references to collaborative activity. Where they did occur, they followed the general distribution

pattern of contradictions, with very few occurrences of co-construction activity. This may reflect the freedom or ability of individuals to re-conceptualise their roles and activities.

The occurrence of congruences and stabilisations strongly matched the distribution of contradictions, indicating that individuals were able to cooperate to evolve the activity to a point allowing them to work well enough together without undergoing radical change. Again, there was a strong concentration of congruence events taking place at the secondary contradiction level. This was evidence of balance and stabilisation taking place in areas such as the removal of silos; increased transparency and visibility, take-up of different roles and responsibilities and provision of training, mentoring and support,

The different elements of the consolidated CATF have been combined to provide an insight into the complex nature of implementing an Agile based change programme. This has provided a wide-ranging, integrated and multi-faceted analysis tool that has identified areas for further improvement within Health Care Org. The next Chapter further discusses these findings in some depth.

Chapter 7: Discussion

7.1 Introduction

This chapter discusses the findings presented in Chapter 6 and its structure is determined by the three Research Questions.

RQ1: What insights and understanding can a Practice Theory based organisational learning approach provide when adopting a large-scale Agile method?

RQ2: How can a consolidated Activity Theory framework (CATF) provide a contextual and relational understanding of the cultural and behavioural obstacles when adopting large-scale Agile delivery methods?

RQ3: To what extent can a consolidated Activity Theory framework (CATF) contribute towards the assessment of obstacles to learning involved in developing an organisation's large-scale Agile capability?

The first research question addresses the wider issue as to whether the Practice Theory perspective such as Activity Theory (AT) can provide useful insight into the organisational learning aspects of large-scale Agile methods. The application of AT to the Digital/Service Transformation Programme (D/STP) is evaluated according to the five dimensions of Practice Theory (Section 2.5.5).

Having considered that the Practice Theory based approach does provide novel insights, the second research question develops this issue further by evaluating the findings from the D/STP Programme in comparison with other author's approaches (Section 2.2.5).

The third research question then examines whether the CATF can be deployed as a capability assessment model for large-scale Agile projects and whether it can be used as a progressive, relational and repeatable framework. This could then be used in particular to identify issues (rooted in historical, social, and cultural contexts) that may impede or present obstacles to organisational learning intending to pursue large-scale Agile delivery methods. The construction of the CATF and its application to the D/STP programme is evaluated according to Maier et al.'s (2012) guidelines on developing maturity grids. This chapter evaluates the findings against each research question in turn.

7.2 RQ1: What insights and understanding can a Practice Theory based organisational learning approach provide when adopting a large-scale Agile method

7.2.1 Introduction: A Practice Theory based approach

In the last twenty years, the project management domain has experienced substantial re-appraisal of its approaches, with much of the analysis driven by academics (Section 2.2.1). The main causes were the need to review the theoretical bases for project management that were founded on a plan-driven and operational research approach. Responses have included a reconsideration of projects as temporary organisations rooted in different social contexts, the development of newer approaches such as large-scale Agile delivery methods and adoption of the 'practice turn' (Schatzki et al, 2001) from the social sciences to examine what practitioners do when delivering projects.

As discussed earlier, this study adopts the suggestion by Floricel et al.'s (2014) of a practice-based approach (Section 2.5.5). This provides a theoretical lens to better understand the challenges facing modern project management. In this research, the object is the adoption of a large-scale Agile method based transformation programme (D/STP) in a large public sector organisation (Health Care Org.) as described in Section 5.5. The following discussion of the analysis related to RQ1, is structured according to five dimensions of practice, adapted from Nicolini (2013) and Floricel et al.'s (2014, p.1102) table outlining these five dimensions of practice (Table 7.1) which provides an overview of the Practice Theory (in this case Activity Theory) perspectives. This table provides the literature context that underpins the assessment of findings and analysis provided in Chapter 6.

Table 7.1: Five dimensions of Practice Theory – adapted from Nicolini (2013) & Floricel et al. (2014)

Dimension		Practice Theory Perspective (AT)	Project Management Context	References
1	Revealing work and efforts	Practice theories foreground the importance of activity, performance and work. Underpinning routine social structures are practices, activities and the work and effort of individuals. Practice theories see the social world as consisting of a related collection or nexus of practices.	Uncovering the work and efforts involved in this dimension helps to dispel the illusion of 'rational' project management decisions such as plans and contracts etc. This dimension helps to highlight the difficulties that are involved in the wide diversity of project practices.	Nicolini (2013) Floricel et al. (2014)
2	Role of materiality	Practices are mediated by material resources such as tools, objects and artifacts which provide both possibilities and constraints for action. They also introduce into the practice the output from other practices such as specialist tools.	Project activities and practices are intertwined with a rich array of tools & artifacts which bring their own influences to bear in the practice. This explains why project activities often don't follow expected progressions.	Davies et al. (2009)
3	Agency and creativity	As opposed to rational decision-making, within Practice Theory, the individual carries out social practices that incorporate creativity, intuition and individuality of thought and action in adapting to new circumstances.	This perspective assists in exploring the occurrence of more innovative and entrepreneurial approaches in project activities rather than rational and abstract decision-making.	Floricel et al. (2011) Lampel (2001)
4	View of knowledge	Knowledge is regarded as a form of mastery in carrying out social and material activity which is shared with others. It is part of an existing practice that involves learning how to act, feel, speak and interpret. Knowing what to do does not reside within individuals but in practices.	Represents a shift in the understanding of knowledge from that which is centralised, maintainable and transferable to that which is shared with others, embedded in artifacts and where practical methods are acquired through learning and are inscribed in objects. This represents a much wider array of knowledge practices.	Prencipe and Tell (2001) Reckwitz (2002, p.254)

Dimension		Practice Theory Perspective (AT)	Project Management Context	References
5	Interests and power	Practice Theory surfaces the reality of the diverse nature of interests and power as opposed to the assumption of stable hierarchical authority. Consequently, certain interests are served at the expense of others. Much of this is rooted within historical and material considerations.	Highlights the emergent and diverse nature of interests and power and illustrates the shifts in authority and dependencies in temporary project structures.	Floricel et al. (2014) Hällgren and Wilson (2008)

In this study the CATF framework, developed in Chapter Four, has been applied, with an assessment to determine the insights that have been afforded by each of these Practice Theory dimensions. These practice dimensions are likely to have been overlooked in previous approaches to examining the Agile project management domain (Section 2.5.5). The practice approach is used to illuminate the problems that are encountered within large-scale agile project delivery in modern practice. (Floricel et al., 2014, p. 1093).

7.2.2 Revealing actual work and efforts

The practice-based approach is likely to illuminate many of the difficulties involved within large-scale Agile project delivery activities such as building a project concept, maintaining consensus and cultivating attitudes (Section 2.5). Much of this insight is revealed through the identification of contradictions and subsequent activity development over time. Such analysis can help to reveal the illusion of rationality that tends to be associated with the delivery of projects (Floricel et al., 2014). Large-scale Agile delivery activities evolve and develop through the resolution of these contradictions, so activity is in constant flux.

Instead of collapsing the four levels of contradictions into one, typical of organisational scholars (Groleau et al., 2012), this approach utilises the full potential of all four levels of contradiction to provide a broader perspective linking cultural, situational, social and historical contexts. This section is therefore structured according to the four types of contradictions.

7.2.2.1 Primary contradiction

Primary contradictions start the cycle of activity transformation. Table 6.9 shows the distribution of primary contradictions occurring with the D/STP, within the six nodes of the activity triangle, across the different programme groups. Predominantly, the primary contradictions centre on the Subject and Community nodes, with a sharp contrast between the Delivery Managers group (where the primary contradictions relate to the Subject node) and the Delivery Personnel (primary contradictions occur within the Community node). Primary contradictions indicate the 'inner conflicts' within each of these nodes (Vakkayil, 2010). It is tempting to view this, as Bonneau (2013) suggests, as an opposition between 'managerial logic' and 'professional logic' regarded as the "authority/autonomy paradox". However, the interview transcripts reveal Delivery Managers' concerns relating to skill-sets within relevant teams, and the Delivery Personnel also express similar concerns but related to individuals out with such teams (Section 6.3.1).

This insight indicates that, at a fundamental level, concerns do not always relate to artifacts and objectives (Kaptelinin, 1996; Nardi 2005; Turner, 2016). Instead, they relate to existing competencies within and beyond delivery teams. That is, they extend into the wider community that has a vested interest in delivering the objectives of these activities. A similar issue was identified by the SBU group, who had a proportionately higher level of Subject-node contradictions, and raise issues related to the demographics of their teams and to their apprehension about the adoption of the new approach. This is in marked contrast to those charged with delivery (Delivery Managers and Delivery Personnel) who, although having concerns about skill-sets, were much more accepting of change.

Primary contradictions have a latent or hidden form which means that they are not directly accessible and so have to be approached through participant discourse or actions (Bonneau, 2013). In this study, primary contradictions were identified through the interviews with individuals (Section 5.6.1) belonging to the separate groups. There are very few primary contradictions relating to the Artifact and Object nodes and few relating to Rules & Norms and the Division of Labour. This indicates that individuals within the programme had few difficulties with the large-scale Agile artifacts (tools and techniques) and that they were happy with many of the other elements. It may well be

the case that the new approaches represented by these nodes did not differ markedly from the organisations existing practices.

7.2.2.2 Secondary contradictions

It is the secondary contradictions that form the greater part of this analysis. This correlates with Engeström's Developmental Work Research (DWR) which also focuses on secondary contradictions (Avis, 2007).

Avis (2007) also quotes Engeström (2005, p.180), noting that resolving secondary contradictions will lead to reorganised activities. Similarly, Groleau et al. (2012) state that the identification of secondary contradictions is the first step in the transformation process.

From Table 6.8, the overwhelming proportion (75%) of all references to contradictions relate to secondary contradictions. As expected most (66%) originate from the two main groups of interviewees - Delivery Personnel and Delivery Managers. As a reminder it should be noted that the figures in these tables do not represent references to unique occurrences of contradictions. Instead, multiple individuals referred to multiple contradictions, leading to the large numbers recorded in the tables.

Table 6.10 further deconstructs references to secondary contradictions following Mwanza's (2000) 'Sub-Activity triangles'. This approach was adopted here to help simplify the complexity involved in secondary contradictions (Section 4.7). The analysis shows that at a Subject/team delivery level, the Delivery Managers group had the most significant issues, and that most of these related to artifacts. In addition to the main IT tools of Trello and Basecamp, the main artifacts deployed in the D/STP programme were Scrum boards, two large, shared collaboration spaces and the 'Red Room' (a room with audio-visual facilities). These were the main primary artifacts deployed, but the analysis also included secondary (conceptual) and tertiary (cultural) Artifacts as discussed in Section 7.2.4 below.

The analysis revealed that it is mostly the primary level IT tool artifacts (Trello and Basecamp) that feature in the references to secondary contradictions. At the primary contradictions level, there were no issues with the tools themselves in that they were simple and intuitive to use. The secondary contradiction references relate to the increased level of organisational transparency afforded by these tools. Delivery Managers had some concerns about the affordances, public visibility, openness, and

transparency that these tools provided. This issue has also been identified by Edison et al (2021) who state that the increased transparency that reveals work and efforts requires courage and a change of mindset of the participants. This seems to have been particularly worrisome for Delivery Managers who oversaw delivery streams, and who may not have been used to organisation-wide scrutiny and would have been wary of potential criticisms. This transparency and subsequent fear of criticism is similarly reported by Edison et al (2021) as a downside of implementing activities within SAFe. Also, Kalenda et al., (2018) reported that increased transparency and being observed was a reason why individuals did not want to adopt large-scale Agile methods.

From the Community node perspective, many references to secondary contradictions centre around the Rules & Norms node across the two main programme delivery groups. However, the SBU group was also significant because it had a much higher incidence here.

As discussed in Section 6.3.2.2, the Rules & Norms node from a Community perspective relates to practices of individuals that have a vested interest in the delivery of the outcomes of the activity, but which are not directly charged with delivery. In the analysis provided in Section 6.3.2.2, there were four key categories of secondary contradictions around the Rules & Norms node. Bonneau (2015) emphasises the key role of the identification of secondary contradictions because they may be used as an intervention tool, or as a mechanism for finding new ways of organising work. So, it is possible that a future interventionist approach may examine each of these four categories to identify mechanisms to resolve such contradictions by transforming work and practices, leading to an evolution of the activity.

A secondary contradiction may originate in a primary contradiction, then be resolved by the incorporation of new elements (Bonneau, 2103). This then results in a reconfigured activity which may then subsequently give rise to a tertiary and finally a quaternary contradiction. In this research, the Funding and Business Case category identified in Section 6.3.2.2 consists of secondary contradictions related to the requirement to submit and have approved business cases. The origins of this contradiction lie in the budgetary restrictions within the public health sector, leading to resourcing issues being a primary contradiction.

This contradiction was resolved by the Finance Director agreeing to make available programme funds in advance of the programme starting. This led to several secondary contradictions. Firstly, the unusual funding model led to pressure to rapidly deliver highly visible outcomes in attempts to provide observable return on investment. This brought additional scrutiny and accountability requirements from senior management activities. Secondly, the presence of 'extra' funds within the D/STP programme led to some managers attempting to insert more of their projects into the D/STP programme to utilise such funding. Thirdly the changed funding arrangements were not communicated across all personnel and delivery streams, so some Delivery Managers were unaware and submitted funding applications in the conventional manner. These pressures caused secondary contradictions, particularly within the G&S activities within the programme as is evident from Table 6.3.

As is evident from the analysis in Section 6.3.2.2, this secondary contradiction remained unresolved. Indeed, the Director of Finance withdrew the upfront funding for the second year of the programme. Many of the secondary contradictions relate to business case approval processes within this half of the programme. Such tensions were reported by Dikert et al., (2016) where other parts of the organisation were exposed to the large-scale Agile way of working and those functions that were distanced from development were resistant to change. It is likely that more delegated powers to the G&S activities within the programme could have helped resolve the contradiction and provided a more beneficial input to other activities. This resolution of the secondary contradiction would then have led to potential tertiary contradictions, although in this case it is unlikely this would be problematic. It is far more likely that a quaternary contradiction would have been more difficult to resolve in the case of D/STP activities and their modified funding model interfacing with organisation-wide activities.

7.2.2.3 Tertiary contradictions

As new elements are introduced within an activity and secondary contradictions are resolved, then tertiary contradictions can arise between the old and the new reformed elements of the activity. The latter can be seen as the 'culturally more advanced form' of the activity. They can appear as tensions between the practices within the activity and the older institutionalised variants (Bonneau, 2013).

Table 6.12 shows that few tertiary contradictions were identified and most originated within the Delivery Managers group. This could be interpreted as this group was perhaps the most reluctant to 'let go' of more established ways of working. However, this is not necessarily the case because, on closer examination of the transcripts, it is apparent that although most of these references to contradictions originate from the Delivery Managers, they essentially describe other individuals who were either part of the delivery team or individuals within the SBUs. Delivery Managers are well placed to identify these types of contradictions in others because a large part of their practice involved forming links between the D/STP and the rest of the organisation.

The analysis in Section 6.3.4 revealed that what resistance there was to the 'culturally more advanced form' of the programme activities related more to the perception that these new forms of activities that were large-scale Agile based were seen as something of a 'cult' (Section 6.3.4.1). The new form was associated with negative perspectives such as 'geeky', 'techie' and full of 'Americanisms'. The origins of this tertiary contradiction may well lie in the 'clinical and public sector culture' category of secondary contradictions (Section 6.3.2.2 – part A). This details how changes in established processes and procedures are held back from implementation. This is confirmed by Dikert et al., (2016), who state that scepticism and distrust in large-scale Agile developments in general were common problems.

In addition, there is the important disconnect between the large-scale Agile delivery culture and approaches, and the bureaucratic oversight associated with public sector requirements for governance and compliance. This ultimately leads to tertiary contradictions preventing the introduction of more evolved forms of activities. Similar restricting practices are identified in the literature with Dikert et al., (2016) reporting dual operation of old and new methods side by side as causing tensions on all organisational levels and Conboy & Carroll (2019) report a SAFe implementation where senior management still require the production of reports and plans that SAFe was intended to eliminate. Dikert et al (2016) also report continuing engagement in old commitments resulted in the ignoring of new Agile practices leading to the breakdown of the large-scale Agile method. Although the origins of this issue, in this research, lay partially with secondary contradictions of 'Senior management involvement & approvals' (Section 6.3.2.2 – part B), they ultimately lead to activities being unable to

'break free' from traditional institutionalised approaches (Bonneau, 2013), leading to activities reverting back to older approaches.

7.2.2.4 Quaternary contradictions

While secondary contradictions are the main trigger for organisational change, tertiary and quaternary contradictions can be conceptualised as a realignment of the activity following on from attempts to resolve the secondary contradiction (Groleau et al., 2012). From Table 6.13, it is apparent that the total number of quaternary contradictions is nearly double that of tertiary ones. Quaternary contradictions relate to neighbouring activities, such as those belonging to the External Departments group. Nearly half of these contradictions were identified by the Delivery Managers group. As explained by the Programme Manager, these contradictions were anticipated to some extent before D/STP had started. Accordingly, the Programme Manger had contacted External Departments of Finance and Procurement, to agree new processes to be deployed whilst the Programme was running. This met with mixed success with some procedures (e.g. advanced procurement process) subsequently becoming incorporated into Business as Usual but others (e.g. the funding arrangements discussed above) lasted for only half of the programme's duration. Other External Departments were not so amenable to changed protocols and as one Delivery Manager noted it did not help to have budget available much faster from Finance if the HR processes continued to be extremely slow. For example, it took more than a programme increment (3 months) to recruit contract staff.

The Programme Manager had some successes in anticipating quaternary contradictions agreeing changed interface protocols with External Departments. Where this was not possible the key unaltered interfaces hampered those activities that had already benefited from the changed interfaces. The lesson from this analysis is that a full consideration of all neighbouring activities and likely quaternary contradictions is needed. Dikert et al (2016) verify this perspective identifying the difficulty that large-scale Agile development teams have when interacting with other organizational units that are often non-agile in nature. Conversely Kalenda et al (2018) identify the situation where non-agile teams were reluctant to rely on large-scale Agile teams not knowing whether work would be delivered on time.

Finally, the focus in this section of revealing actual work and efforts has drawn on secondary contradictions. As the analysis in Section 6.3 showed, many cultural, social and organisational activities and practices have been revealed. It is not clear which resolutions of primary contradictions gave rise to the substantial number of secondary contradictions. A longitudinal analysis would enable an examination of the progression of contradiction resolution across the whole expansive learning cycle.

The identification here of all four types of contradiction formation and resolution helps to explain how actual work and activities are constantly transforming themselves. In at least one respect, the inherent contradictions between the need to rapidly deliver outcomes versus the need to learn from and embed good practice will continue to drive these constant transformations, and to illuminate the difficulties in delivering projects. Additionally, Groleau et al. (2012) have stated that, even if secondary contradictions are resolved, the primary contradictions will remain because they transcend all other levels of contradictions and will eventually materialise into a series of contradictions that will generate innovation for a new solution.

7.2.3 Role of materiality

Practices are mediated by material resources such as artifacts (tools and objects) which provide both possibilities and constraints for action (Davies et al., 2009). Activity Theory stresses the mediating role of artifacts in the performance of practices (Engeström, 1987). This aspect has been particularly utilised by many authors examining human computer interactions (Kaptelinin, 1996; Kaptelinin & Nardi, 2006). The analysis in Section 6.3.5 revealed that there were many more non-artifact related contradictions and issues than ones directly related to artifacts. The distribution of contradictions in this study is very much at the bottom half of Engeström's triangle rather than the top (Artifact node). This is because there are proportionally very few references to artifacts in terms of the overall references to events within the analysis (98 of 800 = 12%). This analysis reveals that in the activities involved within the D/STP there was relatively little influencing input from artifacts.

It may be argued that if the introduction of a large-scale Agile approach method had involved the use of new tools, then there would probably have been far more events related to artifacts than the 12% actually found. The D/STP was accompanied by the use

of new communication tools such as Trello and BaseCamp. A brief search for these terms within the Delivery Managers group revealed some references (Trello:23; Basecamp:9). However, few of them were associated with any specific events. A possible explanation is that these off-the-shelf tools represent little significant change in practice, have few inherent user-difficulties, are intuitive, easy to use and fit well with existing organisational practices. These results relating to the use of artifacts in activities differs from much of the AT literature where the focus is very much on the strong influence and importance of artifacts on activities (Kaptelinin et al., 1999; Turner et al., 1999; Bodker, 1990).

The above analysis relates to the primary and secondary levels of artifacts (Section 4.2.3). Examining the occurrence of tertiary levels of artifacts reveals few references to the cultural artifacts that encompass large-scale Agile principles and the Agile manifesto (Table 6.5). The low number of references to tertiary level artifacts may well be indicative of individuals' acceptance of these artifacts, taking them 'in their stride' with very little discord or dispute. This may also relate to the organisation's proclivity for embracing new initiatives, and the consequential tendency for individuals to develop an indifference or apathy towards them (discussed further in Section 7.3.5.3 below).

Overall, at a tertiary Artifact level, there appears to be indifferent acceptance. At the primary and secondary Artifact levels, there is active acceptance and incorporation of these new artifacts (whether physical or conceptual) into work practices. There are few examples of tokenism or of individuals simply 'going through the motions'. If the new artifacts had involved changes to procedures or practice, such as a new reporting tool requiring more frequent work and updates, then the situation may have been otherwise. Additionally, if the new digital artifacts had incorporated additional generative elements (leading to new structures or unanticipated behaviours) or agency elements (behaviour manipulation) or automation elements as identified by Karanasios et al (2021) then it is likely that additional consequences would have been highlighted by the CATF. In this case, the new digital artifacts represented little more than an additional transparent data-repository used to store project information.

Artifacts help to accomplish practices (activities) as well as making them durable over time. They also bring in the output of other activities such as specialist tools. In this case, Artifacts would include all large-scale Agile tools and objects used (Nicolini, 2013, p.4).

The practice approach emphasises the non-trivial role of objects: because objects are intertwined with, and mediate project activities, they can set the possibilities, constraints and influences on individuals. This in turn helps to explain why failures and issues arise within projects (Floricel et al., 2014). In this study, the introduction of large-scale Agile related artifacts (at any level), such as Scrum, Kanban boards (electronic or physical), sprints and retrospectives, does not appear to have given rise to contradictions that would have indicated problems, issues and friction within the practices. This is also identified by Edison et al., (2021) in their systematic literature review of large-scale Agile methods. They identify nine categories of large-scale Agile implementation challenges which are then sub-divided into thirty-one sub-categories. Of these, only two – "Formulating viable and measurable stories" and "Too many agile roles, events and artifacts", relate to the creation and application of artifacts.

Overall, one might have expected this study to identify many contradictions related to the use of artifacts within the project activities and practices with which they are intertwined. However, this was not the case and there was little evidence from the D/STP case study that supported Floricel et al.'s (2014) notion of artifacts (at whatever level) as having a major contribution to failures and issues within projects/programmes.

7.2.4 Agency and creativity

Within projects or temporary organisations, different groups with different goals or objectives of activities mediate human agency. This could lead to inconsistent behaviour and tensions which can explain why problems occur within projects (Floricel et al.,2014). Flexible collaborative efforts initiated by individuals can help to resolve these problems with the creation of improvised collaborations or 'knotworking' (Engeström, 2008). Such relationships are not centrally co-ordinated but arise from within activities by individuals deciding to orient their efforts towards a shared objective (Floricel et al., 2014). This study has adopted the concept of collaboration events within activities as being indicative of individuals demonstrating flexibility and initiative. Its examination of the occurrences of collaborative events (Table 6.17) found that they associated with the occurrences of contradictions, indicative of situations where individuals have attempted to resolve issues. These occurrences can also be considered as evidence of congruences (Section 4.5), as well as examples of co-operation and co-construction (Section 4.6).

At the primary contradiction level, there were significant proportions of collaborative activity compared to the total number of primary contradictions (Table 6.17). These activities were concentrated within the Delivery Personnel and Delivery Managers groups, and follow the same distribution as the primary contradictions. There are insignificant numbers of co-operation and co-construction occurrences. This pattern is followed by collaborative activity at both the secondary and tertiary contradiction levels: the proportion of occurrences similarly maps to the number of contradictions, with the same groups (Delivery Managers and Delivery Personnel) accounting for the bulk of the events.

Table 6.17 shows a significant departure from the pattern at the quaternary contradiction level. Here, the number of collaborative events exceeds the number of contradiction events. Additionally, whereas most of the collaborative activity remains within the Delivery Personnel and Delivery Managers groups, there are significant occurrences within the External Departments and SBU groups.

It is highly likely, given that quaternary contradictions focus on neighbouring activities, that these occurrences relate to the other participants of the collaborative events involving the Delivery Personnel and Delivery Managers groups. This is especially true of the Delivery Personnel group, which has more than twice as many collaborative events as contradiction events.

This increased collaboration continues with co-operation events and, more significantly, with co-construction events. At the quaternary contradiction level, the latter constitute 20% of the number of contradictions. For other types of contradictions, this varied from less than 1% to just over 4%. Co-construction events represent the most innovative and pioneering forms of agency and creativity. In these, new forms of practices are developed following resolution of contradictions. In the D/STP, this took place at the interface between delivery teams and other Business as Usual (BAU) functions. In some instances, this related to those departments such as Finance and HR that found new ways to accommodate the programme; in others it represented closer working relationships between delivery teams and customers.

The flexible, creative, and entrepreneurial co-construction capabilities and working practices are considered by many Agile domain authors (Section 2.2.3). They make

similar points when describing the need for flexibility and innovation within the practice of delivering projects.

Dikert et al., (2016) also stated that flexibility and the ability to customise the Agile approach was one of the most important success factors in the adoption of large-scale Agile methods. This study sees a form of confluence of these two perspectives, in which the identification of 'collaborative' events is regarded as the first step towards flexible and improvised working practices. The process of addressing contradictions results in a change of behavioural activity, i.e. the emergence of collaborative approaches to practice activity (Engeström et al., 1997). According to Nicolini (2013), the agency and creativity dimension of practice theories enables the identification of initiative, agency and individual performance, going beyond conventional rational decision-making or automatically following established norms and performing set roles. The use of the CATF elements that produced the data in Chapter 6 helps to identify such practices and show where they might occur.

7.2.5 View of knowledge

Activity Theorists (Engeström, 1987; Sannino et al., 2009) present a view of knowledge from the perspective of change and organisational knowledge. This focuses on de-centralised sharing aspects emphasising the embedded nature of both practices and the artifacts utilised. Practices embody a shared way of knowing that is expressed in the ability to carry out a practice. That is, engaging in a practice involves learning how to act and to accept 'norms of correctness' (Nicolini, 2013). Both Nicolini (2013) and Floricel et al. (2014) emphasize the role within practices of artifacts as 'sociocultural reservoirs of knowledge' that have developed over time as a consequence of human actions becoming 'reified', i.e. inscribed into the artifacts through learning.

These artifacts, whether at a physical, conceptual or cultural level, incorporate past experiences, from both organisational and newly introduced large-scale Agile perspectives. As discussed in Section 7.2.2, artifacts, from both established organisational practice and from the newly introduced large-scale Agile approach, did not appear to cause any observable difficulties or issues. Indeed, as indicated in Section 7.1.2, this study observed minimal involvement of artifacts in much of the analysis. As can be seen in Table 6.14, there were very few occurrences of artifacts associated with

contradictions involving the largest groups (Delivery Personnel and Delivery Managers) across the six Agile activities.

From the perspective of knowledge being embedded within practices, it is suggested that the six Agile activities constitute broad groupings of such practices. The occurrence of secondary contradictions is most likely to represent issues with knowledge in practice, and is most likely to relate to secondary (conceptual) and tertiary (cultural) level artifacts. At secondary and tertiary Artifact levels, the artifacts are not the reified tools discussed by Engeström (1987) and Nicolini (2013), and addressed in section 7.2.2, but are more likely to reflect practices, tasks and activities. Table 6.3 shows the distribution of events relating to all levels of artifacts across all six generic Agile activities. This data shows that there are very few occurrences at secondary and tertiary level, apart from the secondary level artifacts within the G&S activity. This is perhaps indicative of the issues with regard to the perceived lack of compliance and governance that individuals may have been used to. These may well be missing within large-scale Agile delivery environments.

With so few occurrences within Table 6.3, there are limits on the ability to examine the distribution of contradictions across the different generic Agile activities. Had the study focussed more on software development, the data could have been more informative about large-scale Agile delivery activities and practices. Table 6.4 shows a loose association between contradictions involving secondary and tertiary level artifacts and congruences and collaborative activity, but is based on very little data. This follows previous trends where higher levels of contradictions have concomitant higher levels of congruences and collaborative activity.

Although artifacts within practices have the potential to influence and constrain individual behaviour, the data does not reveal any significant issues about either existing organisational artifacts or newer Agile-related artifacts. The likely explanation is that the environment, typical of a public sector organisation, uses standard office tools with little that differentiates such tools or makes them unique to the organisation. It could be argued that, although the Agile tools such as Trello and Basecamp brought with them unfamiliar elements, requiring a particular mode of behaviour such tools simply opened up more possibilities. This was also discussed in section 7.2.2 where artifacts were regarded as reservoirs of organisational knowledge. It may well be the case that, in this

study, organisational knowledge resides less in the IT tools themselves and more in the documents they contain.

This practice view of knowledge is somewhat intermingled with a previous section (7.2.2) on the role of materiality of objects. This view has the potential to examine changes in knowledge and practice in all the generic Agile activities. In this case, the only activity that has featured to any extent is G&S. If the D/STP Programme had involved significant delivery of software, then it is likely that many more issues related to knowledge-in-practice and developments would have been highlighted in activities such as B&C, T&Q and RM. Within the large-scale Agile literature, the perspective that most closely aligns with the view of knowledge in practice, is that which addresses knowledge management (Almeida et al., 2019) where the focus is on knowledge sharing across the organisation and within teams. Almeida et al., (2019) state that new models have been proposed to foster knowledge sharing and management within a large-scale agile environment and the Practice Theory perspective identified in this research may well cater for an additional complementary perspective.

7.2.6 Interests and power

Practices organise individuals and artifacts within certain configurations, and reproduce differences and inequalities advancing the interests of some to the detriment of others (Nicolini, 2013). In a project delivery and temporary organisation context, understanding practices should help to cast some light on shifts in authority, on legitimate practices and on unusual responses to unanticipated events (Floricel et al., 2014).

This study examines the concept of understanding the socio-historical origins of conflicting interests and tensions by identifying large groupings of secondary contradictions. This was also the focus of Engeström's Change Laboratory based work (Kerosuo et al, 2010). The origins of this focus stemmed from the realisation that secondary contradictions could be grouped into two broad categories - those where the contradiction originated from within the delivering activity itself and those that originated out with the delivery activity. These two categories were labelled 'local' and 'external' contradictions respectively. These definitions and their rationale were explained in Chapter 6 (Section 6.3.3). An example of an external contradiction would be where the Finance department imposed budgetary restrictions impacting many

activities. This relates to the Artifacts node where finance is regarded as a tool used within the activity. Another example is when an external public sector organisation, in this case the Office of National Statistics, imposed additional requirements on Data Science delivery stream activities. A third example is where senior management-imposed reporting and approval requirements on programme delivery activities. This involved the Rules & Norms node.

These external contradictions form a mechanism for identifying external management influences on activities. For example, an activity with many external secondary contradictions could be regarded as an activity subject to significant senior management influence, perhaps resulting from an historical 'Command and Control' culture. Typical issues that beset project delivery activities that may be described as external secondary contradictions are:

- Scope-creep from stakeholders.
- Budget cuts and reduction in resources.
- Silo thinking and working.
- Delays in senior management approvals.
- Lack of employee authority and empowerment.

The ability to differentiate between 'local' and 'external' contradictions suggests an additional mechanism to illustrate the diversity of power relationships and interests that occur within practices and activities. The identification of external contradictions points to the unexpected influence of elements that directly impact on the practices and tasks within activities, whereas 'local' contradiction might well be anticipated and could be expected to take place within activities. Consequently, the identified external contradictions may be the result of unexpected shifts in authority and dependencies (Floricel et al., 2014).

In relation to the D/STP Programme, the data in Table 6.11 shows that there are few external secondary contradictions concerning the Subject/delivery team and the mediating nodes. Instead, most of the external contradictions involve the Community node and the Rules & Norms mediating node, and (to a much lesser extent) the Division of Labour mediating node. As expanded on previously (Section 4.4), the Community node represents stakeholders outside the Subject/delivery team who have a vested interest in the delivery of the activity. The high number of external contradictions in

Table 6.11 shows that the stakeholders, and their interaction with the delivery activity, are subject to significant outside influences.

Most of the external contradictions, by a large margin, were identified within the Delivery Managers group (Table 6.11). However, the data is not detailed enough to be able to identify which specific Agile activities were involved, because it was not possible to distribute these events across the different Agile activities. The aggregate figures show that the Delivery Managers had the most external contradictions to contend with in terms of unanticipated external influences and power interests. This is not surprising given their pivotal role in delivery and their need to interface with External Departments and SBUs. Other groups, such as the SBUs, also experienced relatively high occurrences of external contradictions. These could relate to frictions and impediments to a modified way of working, given the D/STP's pursuit of a large-scale Agile approach. Multiple examples are provided by Edison et al., (2021) who report a lack of autonomy, stakeholder engagement and communication difficulties as potentially undermining the changed approach. These highlighted areas represent focussed elements for further socio-historical analysis, now that they have been identified as potential sites of conflicting power interests and tensions (Floricel et al., 2014). The identification and use of external contradictions provide a supplement to AT that offers a useful perspective on interests and power dimensions that exist in practices (Floricel et al. 2014; Blackler, 1995).

7.2.7 Section conclusion

Following the suggestion of Floricel et al (2014),the CATF (practice-based approach) has been applied to the examination of the D/STP to provide more nuanced perspectives on the adoption of a large-scale Agile method. These perspectives differ from traditional, linear, plan-driven, decision-making approaches that focus on operational planning and the logical allocation of resources and roles. Instead, the practice-based approach utilising the CATF aims for a deeper level of understanding that focusses more on social relationships and cultural elements. These usually elude conventional analysis, but ultimately have an influence on project successes and failures. (Floricel at al., 2014).

This study explores multiple levels of understanding according to the five dimensions identified by Nicolini (2013). Firstly, uncovering work and efforts using four levels of

contradictions revealed concerns with skill-sets and abilities, transparency issues and budgetary restrictions. Additionally, the approach uncovered negative perceptions of large-scale Agile work and practices, in that they were labelled as something of a 'cult'. The second dimension examined the intertwined nature of Artifacts with practices and work, finding few instances of issues with regard to the use of the Artifacts introduced by the D/STP. This was unexpected, and indicated a much less problematic adoption of the tools than other studies have previously suggested (Turner et al., 1999; Bodker, 1990).

Thirdly, in terms of the entrepreneurial and creative approaches, the practice approach (CATF) identified significant activity at the interface between the delivery groups and the Business as Usual functions, indicating significant collaborative activity and attempts to modify existing work practices to cope with the large-scale Agile approach. The fourth dimension of shared knowledge embedded in practice was somewhat intermingled with the materiality and artifacts approach of the second dimension. The D/STP did not have a sufficient software delivery component for this to be examined in depth. The examination of the final dimension was facilitated by splitting secondary contradictions into 'local' and 'external' enabling the identification of influences that particularly impacted on the Delivery Managers group.

Nicolini (2013) suggests that the practice-based approach offers a 'Copernican revolution' in the examination of social and organisational phenomena providing a paradigm shift that moves away from the examination of roles such as managers, leaders and entrepreneurs to examining managerial, leadership and entrepreneurial practices. Nicolini is enthusiastic about this approach.

> *"Adopting a practice-based view thus opens a Pandora's Box that holds a potential treasure trove for scholars".*
>
> (Nicolini, 2013, p.7)

In terms of applying Practice Theory to the project management domain, Floricel et al (2014) quote Blomquist et al., (2010) who state that examining project participants' actions within their individual, social, material and historical contexts as well as their shared and linked practices, can lead to practical and theoretical advances. These approaches help to identify further areas of analysis that will help to understand why projects experience problems, and why they stray from those expectations and norms based on traditional rational decision-making approaches. The five specific areas of

Revealing Work and Efforts, Agency and Creativity, Materiality, View of Knowledge and Interests and Power (Nicolini, 2013; Floricel et al., 2014) have not been previously explored. As Floricel et al. (2014) indicate, practice-based approaches do not explain all aspects of project management phenomena, but they do open up a new perspective.

7.3 RQ2: How can a consolidated Activity Theory framework (CATF) provide a contextual and relational understanding of the cultural and behavioural obstacles when adopting large-scale Agile delivery methods?

7.3.1 Introduction: A consolidated Activity Theory framework (CATF)

The first Research Question addressed a broad query as to whether the Practice Theory perspective can provide a useful insight, through the five areas, into large-scale agile project management issues, as suggested by Floricel et al (2014). The second Research Question takes this approach further by examining how a consolidated Activity Theory framework (CATF) (established in Chapter 4) provides a contextual and relational understanding of the cultural, behavioural, and learning aspects around adopting a large-scale Agile approach. This is examined by comparing the information and issues identified by the CATF with current literature that addresses this topic. Such an examination intends to understand whether there is scope to move beyond the current anecdotal and list-based approaches that are dominant within the literature that addresses large-scale Agile methods (Dikert et al., 2016; Edison et al., 2021; Kalenda et al., 2018).

The large-scale Agile project management literature contains many 'Success Factors' and 'Key Issues' contributions (Section 2.2.5) that provide a varied and extensive, albeit anecdotal, list of matters to be considered when organisations migrate to large-scale Agile methods. This section builds on the work of authors discussed in Section 2.2.5 and is presented under four broad headings – Management and Organisational; People; Process and Technology, within which further elements are highlighted.

As discussed in Section 2.2.5, these sources were selected for their generic and widely applicable criteria that made them relevant to this study. Had some of the more extensive, list-based sources (Conboy et al., 2011; Chan & Thong, 2009) been selected, the analysis could have either become more complex or led to the adoption of a more specialised focus (examining ability, motivation or opportunity related challenges). This would have made the study much less widely applicable. Table 7.2 below provides a structure within which the findings of this research are evaluated.

Table 7.2 summarises literature derived influencing factors, mapping them to the identifying elements of the CATF. These are then grouped according to three main

aspects of the CATF, namely the Contradiction Level involved, the relevant Initial Node of the activity triangle and a subsequent Mediating Node (or Artifact type if involved). Collaborative activity and congruences and stabilisations can occur at every point in the table. Table 7.2 provides a framework for relating the findings to the work of others who have examined the cultural, behavioural, and learning factors that influence the adoption of Agile methods.

Table 7.2: Key issues and influencing factors when adopting large-scale Agile methods (consolidated from section 2.2.5)

Topic	**Attributes and characteristics of the CATF that addresses these elements.**		
	Contradiction	**Initial Node**	**Mediating Node**
Process			
• From process to feature and people centric. • Short iterations, TDD adaptability. • Managing large scalable projects. • Selecting appropriate Agile method. <u>Task Factors</u>: • Project type, size and scale	Primary	Artifact – S.	N/A
		Subject	Artifact – S, T.
Technology (tools and techniques)			
• Appropriateness of existing technology and tools. • New skill sets – refactoring, configuration management. <u>Environmental Factors:</u> • Available Technology	Primary	Artifact – P, S.	N/A
	Secondary	Subject	Artifact – P, S.
		Community	Artifact – P, S.
People:			
• Working effectively in a team • High level of competence • Customer relationships – commitment, knowledge, proximity, trust and respect <u>Individual Factors</u>: • Usability, usefulness, attitude, technical knowledge, tenure and job insecurity. <u>Team Factors</u>: • HIPPO • Conflicts within the group • Group majority opinion	Primary	Subject	N/A
	Secondary	Subject	Rules & Norms Division of Labour – L., E.
Management and organisational aspects:			
		Community	

<table>
<tr><th rowspan="2">Topic</th><th colspan="3">Attributes and characteristics of the CATF that addresses these elements.</th></tr>
<tr><th>Contradiction</th><th>Initial Node</th><th>Mediating Node</th></tr>
<tr><td rowspan="5">• Organisational Culture
• Management Style
• Organisational Form
• Management of software development knowledge
• Reward Systems
<u>Environmental Factors</u>:
• Customers
• Competitors</td><td rowspan="2">Primary</td><td>Rules & Norms</td><td rowspan="2">N/A</td></tr>
<tr><td>Division of Labour</td></tr>
<tr><td rowspan="2">Secondary</td><td rowspan="2">Community</td><td>Rules & Norms – L, E</td></tr>
<tr><td>Division of Labour – L, E.</td></tr>
<tr><td>Tertiary</td><td colspan="2" rowspan="2">N/A</td></tr>
<tr><td>Quaternary</td></tr>
</table>

L, E – Local and external secondary contradictions
P, S, T – Primary, secondary and tertiary level Artifacts

7.3.2 Process

The adoption of the large-scale Agile approach within the D/STP programme involved a major shift in project delivery. Barlow et al., (2011) confirm that large, complex projects are more problematic due to many interdependencies and co-ordination requirements and Fuchs & Hess (2018) state that this is not a trivial matter and entails key managerial challenges as well as consequences for the whole organisation. The D/STP programme was aimed at moving away from a process-centric approach, aimed at removing the causes of variation, to an approach based around people and the project features to be delivered. Consequently, there was a shift away from process-driven practices, to ones involving more collaboration and acceptance of uncertainty, reflection, and incorporation of feedback. This in turn implies increased transparency and reliance on individuals who would be expected to learn and adopt practices incrementally (Nerur et al., 2005; Jacobson, 2007).

Within the CATF, the Process aspects are principally addressed by the events relating to primary and secondary contradictions, because tertiary and quaternary contradictions involve the whole activity and relationships with other activities. Primary and secondary contradictions are also likely to involve the Artifacts node, either within the node itself at a primary contradiction level, or as a result of its use by the Subject or Community nodes at the secondary contradiction level.

Within the Artifacts node, secondary level artifacts, which relate to concepts and theories, are most relevant when considering processes. The analysis found relatively few occurrences of artifacts (at any level) within the whole programme, but secondary level artifacts events were most evident within the G&S activity (Table 6.3). The Delivery Managers group was most closely associated with artifact-related events. This group experienced most contradiction events related to artifacts at both primary and secondary artifact levels (Table 6.3). These occurred when the Delivery Managers were engaged in the G&S activity (Table 6.4).

From a Process perspective of all the delivery groups, it is the Delivery Managers who experienced the most obstacles and impediments, accompanied only by a limited number of congruences and collaborative activity (Table 6.4). Consequently, the conceptual aspects of large-scale Agile methods (secondary level artifacts), as well as the physical tools and techniques of large-scale Agile methods (primary level artifacts - discussed below), posed some challenges. These challenges affected only the Delivery Managers group, mostly during their involvement with G&S activity.

The logical interpretation of this is that Delivery Managers were at the meeting-point of two key interfaces: one between the delivery team and the host organisation; the other between the old G&S regime and the newer large-scale Agile approaches. This is reinforced by the figures presented in Tables 6.10 and Table 6.14. These show that specifically the Delivery Managers' application of artifacts generated a high number of events. Many of these events are related to Tools and Techniques (Section 7.3.3) which are primary level artifacts. However, from a secondary artifact level and process point of view, the main issues related to the Agile concepts of transparency and collaboration which were necessary elements of participation in the D/STP.

These aspects are mostly limited to the delivery team level (Subject node) and are not significant at the broader organisational level (Community node). This indicates that the delivery team (in this case the Delivery Managers) have had most difficulty with those aspects associated with the shift from a process-centric view to the more people, creative and adaptability perspective. This is evident in difficulties in understanding large-scale Agile approaches and methods, leading to confusion about the new ways of doing things.

> *"I felt the whole approach got confused and there was no consistency and when you, when the programme got together, you seen the, you seen the Agile approach was being, […] but it just seemed that everybody was doing things in a slightly different way. It seemed incredibly messy."*
>
> Delivery Manager: TO-0506

These are typical difficulties highlighted elsewhere with multiple issues ranging from lack of available guidance in the literature and misunderstanding agile concepts (Dikert et al., 2016), to the misalignment of organisational structures (Kalenda et al., 2018).

With regards to the consistency of approach with the introduction of Agile approaches, this issue was addressed in research such as Cao et al (2009), They state that it is up to senior management to recognise the need to balance the conventional view of organisational processes with the Agile approach of 'people over process'. They further state that this is hampered by senior management's view of development as a routine activity. This in turn leads to significant differences where practices have not been 'effectively appropriated'. Edison et al., (2021) highlight the importance of strong leadership support needed in adopting SAFe. The CATF can provide an indicator to these barriers of practice adoption. In addition, the CATF also highlights the gap between processes as formally prescribed, and processes as actually applied (Korsaa et al., 2013; Jacobsen et al., 2007).

A major impact on the D/STP came from the involvement of staff in multiple projects. Dikert et al. (2016) and Kalenda et al. (2018) have drawn attention to the problems and tensions posed by teams experiencing high pressure and workloads and overcommitment. Events related to this issue involved the Division of Labour intermediating node from both the Subject and Community perspectives. Such issues occurred so frequently that they had a major impact on the delivery of the D/STP. The analysis revealed what appeared to be additional cultural imperatives within the organisation: individuals pursued many opportunities to be observed undertaking multiple roles. At times this contributed to slow project completion rates. This was discussed earlier (Section 6.3.2.2 - Part B), alongside the role of volunteers. Apart from Edison et al., (2021) who identify the importance of having a dedicated full-time team for success in adopting SAFE, there are few studies that specifically address the consequences of team members participating in multiple large-scale Agile delivery teams simultaneously (Nuottila et al.,2016).

Although not explicitly forbidden by large-scale Agile methods and the manifesto, such an arrangement does make it more difficult to comply with Agile principles. If the D/STP had incorporated large elements of software development activity, then it is unlikely that such an arrangement would have been attempted. Nuottila et al. (2016) identify the existence of multiple and overlapping roles as one of seven challenges related to adopting Agile methods within a public sector organisation. Other research (e.g. Conforto et al. 2011) confirms the viability of adopting Agile methods in non-software development industries. However there has been no past consideration of such individual team member configurations.

7.3.3 Technology (tools and techniques)

There has already been extensive research focussed on technology acceptance perspectives, such as the Technology Acceptance Model (TAM & TAM2) (Chan & Thong, 2009). The CATF provides an alternative perspective and Table 7.2 identifies the elements of CATF that address the technology, tools and techniques aspects of an organisation migrating to large-scale Agile methods. Events related to technology and tools occurred at the primary and secondary contradiction levels involving the Artifact node. They will either involve the Subject (teams) or Community perspectives. It is apparent from Table 6.9 that most of the events at primary contradiction level relate to the Community and Subject nodes. At the Subject node level this relates to demographic and learning issues.

The Subject-Artifact-Object sub-triangle (Section 7.2.2 above) identifies the process and use aspects that the delivery team (Subject node) had difficulty with (Table 6.9). These difficulties relate mostly to the Artifacts node at the secondary contradiction level. Issues relating to artifacts involving large-scale Agile technology and tools in themselves occur at the primary contradiction level, at the Artifacts node. It appears that there were few occurrences of these difficulties (Table 6.9). This means that none of the delivery groups had any significant difficulties or problems with the artifacts in themselves that are involved in large-scale Agile delivery.

A substantial distinction occurs when the artifacts are used or applied within the delivery context, where complications and impediments arise within the activity context. This occurs as a secondary contradiction, in that (as identified in Section 6.3.2 and above),

the Delivery Managers had difficulties with some of the Agile concepts (e.g. transparency and collaborative activity) which at some points challenged conventional organisational practice.

> *"I had reservations about BaseCamp. I wasn't comfortable going to a public facing, public hosted facility. So we were very conscious from the outset as to what we were putting there and the sensitivity of it was something that was commercial and in confidence in which case we kept that offline amongst ourselves as opposed to putting it to Base Camp where it may have went somewhere unnecessarily at a later point. So, I was very conscious of the use of these tools."*
>
> Delivery Manager: HN-0708

From Table 6.10, widening the analysis beyond the delivery team (Subject node) to include the whole organisation (Community node), reveals far fewer issues and deployment difficulties using the artifacts. The explanation is that the wider community are much less likely to use the artifacts, being more likely to be the recipients of information within the tools rather than being responsible for generating information, reporting, and using the tools.

The above provides evidence that problems are more likely to be generated by technology and tools elements that address sharing and collaborative work, rather than by specific tools embedded within large-scale Agile methods.

This is consistent with past research that has indicated that the focus should move away from technology to non-technology factors, as stated by (Chan & Thong, 2009) and those who stress a knowledge management perspective (Mangalaraj et al.,2009).

7.3.4 People

The literature review identified that implementing Agile represents a challenge to accustomed everyday behaviour, and that it can lead to a resistance to change (Gandomani & Nafchi, 2016). Putta et al., (2018) state that resistance to change is one of the frequently cited challenges when adopting the SAFe framework and Kalenda et al (2018) state that resistance to change and attachment to previous processes are very common challenges. In this research, this is mostly due to actors' concerns about losing their jobs or roles. People-related aspects occur at the primary and secondary contradiction levels involving the Subject node. At the primary contradiction level, Table 6.9, shows that subject node events are significant within the Delivery Managers group

and SBU groups. Within the SBU group the main issues relate to the group's older demographic. This factor was identified as underlying the issues related to understanding and using the new large-scale Agile techniques, as well as issues around coping with change and a lack of engagement.

The Delivery Managers group identified similar demographic issues as well as out-dated staff skill-sets. These issues relate to the findings of Nerur et al. (2005) who identified people-issues such as competence and knowledge, as well as those of Mangalaraj et al. (2009), who identified issues of attitude, job insecurity and tenure. The identification of the demographic aspect as a key factor, is an interesting finding because perhaps most Agile-related studies focus on software development cases that have younger demographic profiles.

In contrast to Mangalaraj et al. (2009), this study did not reveal any significant levels of conflicts within groups. This may well have to do with the corresponding 'reverse' side of the older demographic profile within the groups, with more mature staff being less likely to engage in open hostility and friction-generating activities. Similarly, there were no major team-related factors found. This may also be related to the older demographic as well as to longstanding acquaintanceships and friendships within teams, thus avoiding the 'forming and storming' issues identified in the widely-accepted group-development theory that addresses the formation and operation of newly-formed teams (Tuckman, 1965). Had such issues and contradictions occurred they would have manifested themselves within the Subject node at typically the primary contradiction level, but would also have been evident at the secondary contradiction level.

In Section 6.3.2.2, the fundamental dependency on staff volunteering to participate within the D/STP was highlighted. This reliance on volunteers was reflected in the large number of events occurring at a Community perspective at the secondary contradiction level, and reflects a long-standing aspect of the organisation's approach to project management. This was not altered with the introduction of the D/STP, which also relied heavily on staff volunteers. It is arguable that the deployment of enthusiastic volunteers would benefit the programme. In the case of staff needing to undertake multiple projects, this was undoubtedly the case. This reflects Mangalaraj et al.'s (2009) findings that a positive attitude to the Agile method, and to practices that empower teams, will facilitate acceptance of such methods. However, it should be noted that within the

D/STP there were two types of volunteers: those who were 'volunteered' by their line managers, which has implications for staff motivation and commitment; and those who were actual volunteers. A complicating issue then arose when those who were 'volunteered' began to be recalled by their departments, leaving the delivery burden to the genuine volunteers which created pressure and a high workload for these volunteers. Kalenda et al (2018) also identify too high a workload and high pressures as causing many problems such as a lack of communication and increased tensions.

This recall of the 'volunteers' is indicative of another organisational trait of 'silo working', in which staff are reluctant to work across departmental boundaries. Such boundary crossing is advocated by large-scale Agile approaches and problems are caused when internal silos are kept by the organisation (Dikert et al., 2016). This has been identified from events at the secondary contradictions level, from both the Subject and the Community perspectives involving the Division of Labour intermediating node (Sections 6.3.3 and 6.6.1). Cao et al. (2009) report that product managers are often used as surrogates for customers. Chan & Thong (2009) review these factors, stating that much of Agile's success depends on actively participating customers.

Section 6.6.2 discussed the organisation's approach to providing learning and support throughout the D/STP, leading to examples of congruences and stabilisations at the secondary contradiction level. These indicate a positive reception. In contrast, the provision of formal training was more problematic, as represented by contradictions at secondary level. Formal training was provided for a select few, with the expectation that it would then be disseminated widely. The lack of widely-available training led to frustrations within the D/STP.

> *"I then went to a manager, not above him, but a training manager who said why do you want this training, you're doing this anyway, this just seems like this is no benefit to the organisation… I don't think you should have the training. And then went to her manager who said I'm not signing it off, and I just thought, at this point I was so frustrated that I just took money out of my savings and went and paid for it."*
>
> Delivery Person: QW-1906

Issues with training have been considered in past research. Dikert et al., (2016) state that training and coaching are direct investments in transformation and their lack is an evident problem. Specifically, not providing sufficient funding for training can create difficulties for the adoption of large-scale Agile transformations (Dikert et al., 2016).

Edison et al (2021) state that training and coaching is essential for the adoption of SAFe and has a high pay-off in terms of team productivity.

Gandomani et al. (2015) found that partial training, inappropriate content and non-practical training, lack of time commitment, time boxed [rather than continuous] training and human aspects [unhappy people] all contribute to inadequate and dysfunctional training. The authors go further in identifying a lack of knowledge as an impediment to Agile adoption (Gandomani & Nafchi, 2016). This is not only related to delivery staff but also to managers and customers. (the latter, in the case of the D/STP, includes the SBUs). Mangalaraj et al. (2009) also view a lack of knowledge about a new methodology as a significant hindrance, and suggest that adopters are likely to fall back on their old work habits in the absence of adequate knowledge. This requires constant reinforcement of core principles, as well as suitable reward structures. Whilst the D/STP did involve significant reinforcement through support and mentoring, as indicated by the congruences and stabilisations, there was no evidence of a revised reward structure.

7.3.5 Management and organisational

The management and organisational aspects are perhaps the most complex elements. They are addressed by multiple aspects of the CATF, including events at all contradiction levels with the primary and secondary level contradictions involving the Community node. At the primary contradiction level, the Delivery Personnel identified the same demographic issues and skill sets that the Delivery Managers did from the Subject node perspective (Table 6.9). Interviewing multiple groups provides opportunities to obtain different perspectives and to triangulate different issues. In this case, this identified issues related to the older demographic profiles, different skill-sets and abilities of different individuals in different groups.

The secondary contradictions involving the Community node generated by far the greatest number of events within the whole analysis. Most of these events related to the Rules and Norms mediating node (Table 6.10). These events originated primarily from three of the groups: Delivery Personnel, Delivery Managers and Strategic Business Unit groups. In analysing the events based on secondary contradictions, Chapter 6 previously organised them into four distinct categories (section 6.3.2.2) based on work by Nerur et al. (2005, p.76) and Mangalaraj et al. (2009). This section follows these

categories which are also present in the Management and organisational aspects segment in Table 7.2 above.

A. Organisational culture - Clinical and public sector culture
B. Management style - Funding, business case and focus on early return on investment (ROI)
   - Senior management involvement and approvals
C. Organisational forms - Influences of other departments
D. Environmental factors - Another new thing

7.3.5.1 Organisational culture – Clinical and public sector culture

The discussion of organisational culture aspects (Section 6.3.2.2 – Part A) outlined the influences of the public sector and the clinical culture. The public sector culture focussed on aspects such as an emphasis on bureaucracy, with a focus on the need to follow due process with rigorous oversight. These cultural aspects are almost diametrically opposed to the Agile approach which relies on minimal documentation and encourages employee empowerment and self-organisation. The utilisation of a large-scale Agile approach by the D/STP within an unreceptive organisational culture gave rise to large numbers of events related to contradictions as well as congruences. This is apparent from Table 6.10, where the Community and intermediating Rules & Norms node events far exceeds all other Community events. This focus is summarised by the Programme Manager.

> *"…the fact that you've delivered a plan and that you've covered every, you've ticked every box is celebrated more than delivery of a thing."*

> *"…the culture in the public sector is that you are valued more if you have more things on your plate. So, the more governance meetings that you can go to, the more programmes that you're involved in, the more oversight groups that you can be a part of."*
>
> Programme Manager: QZ-0609

This is consistent with Nuottila et al. (2016), who identify several challenges relating to the adoption of Agile methods within the public sector, including a heavy reliance on formal documentation as an expected way of working. The above quote relating to the perception of being valued more if you have a greater workload is not something that is apparent in the literature on both the public and private sectors. It was not possible to determine the impact that adopting large-scale Agile had on this cultural perspective.

Although a services organisation, Health Care Org. is sited within a health-oriented culture where some interviewees observed an almost paternalistic 'family GP' based approach.

> *"So, the organisation has this very, in a way that operates like family and everybody…you know people saw you in your teens in twenties and thirties and forties, so that is a huge…you as a person change so much in that time. I'm reminded of that very Scottish phrase of like I knew your faither you know, it's a bit of that, they've seen you all through your whatever time…"*
>
> Delivery Person: QW-2808

This is perhaps a somewhat more intense form of the usual risk and uncertainty management perspective that would normally be expected within a public sector organisation adopting an Agile method (Nuottila et al. (2016). It may well be reflective of some of the demographic issues discussed earlier, with many staff having extended records of service and consequently the existence of long-term relationships between individuals at all levels.

7.3.5.2 Management style:

Funding , business case and focus on early return on investment

Senior management involvement and approvals

As might be expected, and as discussed above, funding issues are strong factors within the public sector. Making finance available through various authorisation procedures was at the core of many secondary contradiction events because it hampered the large-scale Agile approach to delivery. Most of these authorisation processes were derived from the organisation wide business case approval processes.

> *"There wasn't a lot of thought given to what this programme was and how that was going to be managed and funded, so trying to fit the two models together really didn't work because you're trying to write a business case which in the end, we went for business cases for absolutely everything, so I'm trying to write a business case for something for something like £10k. Which then goes up to an executive – yeah, management level and takes three months to come through, and I've already committed to deliver this in my PI planning at the beginning."*
>
> Delivery Manager: NZU-0706

This correlates with Nerur et al. (2005), who pointed out that senior management are reluctant to forego their previous 'Command and Control' project management approaches.

Dikert et al., (2016) also confirm examples of management enforcement of the bureaucracy of previous procedures producing excessive documentation and the need for large-scale agile teams to pass through approval gates.

The continued requirement for senior management to approve not only funding but also project direction and functionality was a significant source of events at the secondary contradiction level involving the Community perspective and the Rules & Norms intermediating node.

These tensions were further extended to rigorous demands from senior management to show conclusively that the D/STP was delivering quick returns.

> *"I think the difficulty was because the amount of money that they were sinking into it, the executive team started looking for return on that investment much earlier. So, in effect, despite the fact that they had been told what the profile was going to look like, it's like, well we've just sunk this amount of money in you, and we've got nothing back for it. And that just became a constant play out as we went through."*
>
> Delivery Manager: HI-0306

Similarly, Cao et al. (2009) also identified an issue where senior management insisted that future projects had to have much more clearly defined costs and benefits.

7.3.5.3 Organisational Forms – Influences of other departments

The interfaces with other departments and functions were varied and significant, as would be expected within an organisation of this size. At the behest of the D/STP Programme Manager, the main external department functions (including HR and Finance) had undertaken initiatives to accommodate the new ways of working posed by the D/STP (Collaborative activity within Table 6.17). There were many references to the SBUs and their role as customers of the D/STP. Predominantly, the issues centred around lack of support, participation in and ownership of the programme. These seem to have caused major problems for some Delivery Managers.

> *"The business should have been owning it at that point I think, and there was a lack of ownership, but nothing would have got done if the ownership had sat in the business at that point."*
>
> Delivery Manager: NZU-0706

Past research has found similar issues with lack of involvement from the wider business. Van Waardenburg & Vliet (2013) found that insufficient business involvement and increased complexity pose problems for Agile implementation, and Vijayasarathy & Turk

(2012) report that the lack of business involvement is one of the most difficult elements that Agile teams must cope with. It is known that lack of effective collaboration is also a factor or impediment to Agile adoption (Gandomani & Nafchi, 2016) and Dikert et al., (2016) report there were challenges when exposing other parts of the organisation to the large-scale agile way of working. Because effective collaboration is one of the founding principles of an Agile approach, an absence of such a capability makes the transition much more difficult. This is also addressed by Hoda et al. (2011) who found that lack of customer involvement was a big challenge because it did not occur as Agile approaches demanded. Hoda et al. (2011) state that this led to further difficulties such as pressures to over-commit, loss of productivity and subsequent business loss. Dikert et al., (2016) found evidence that the full benefits of transformation could not be achieved unless the entire organisation was set to work along the same large-scale agile paradigm.

7.3.5.4 Environmental factors – Another new thing

Health Care Org. has had many experiences in the past with new initiatives that were subsequently abandoned with little justification or accountability. It is pertinent to ask why the D/STP should be any different. Many interviewees were of the view that the D/STP was 'yet another new initiative' and, even whilst the programme was under way, had expressed the opinion that it would be short-lived. This proved to be prescient because its intended duration was cut short in April 2019.

> *"But yeah, the perception in [Health Care Org.] is, well we've done a bit of Lean, tick, done a bit of Agile, tick. So, it's interesting. I think it's cultural, it's, I think it's to do with the funding cycle. I think it's to do with voices round the table that are, been there a long time and are a bit cynical about anything new".*
>
> Programme Manager: QZ-0609

Many reasons have been suggested for the organisation engaging in multiple organisational improvement initiatives. These have varied from budgeting phases to political cycles to the latest consultancy trends. Conboy & Carroll (2019) identify a similar feature where implementations originating from senior management were met with mixed success as individuals felt this was yet another framework imposed by those who didn't understand it, and the implications or the problems that were intended to be solved.

Within the AT context, environmental factors occur at secondary, tertiary and quaternary levels. These are discussed in turn. At secondary contradiction levels, environmental factors involve customers and other collaborators from the Community node perspective. As discussed within Section 6.3.3, this study divides secondary contradictions into two types local and external. The environmental factors may be identified with the external secondary contradictions whose origins are out with the activity and involve the mediating nodes of Artifacts, Rules & Norms and Division of Labour.

As shown in Table 6.11 external contradictions form nearly 70% of all secondary level contradictions. Over 60% of these involve the Rules & Norms intermediating node. The secondary contradiction level mostly involves the application and use of new methods and approaches, so the most significant issues originate from the environment outside the activity, but usually from within the overall organisation. This level relates to how organisation-wide procedures, policies, rules and norms impact attempts to change the Community. This is significant because these events are much greater than events associated with the use of the artifacts themselves or than how the work and roles were allocated. Indeed, Gandomani & Nafchi (2015) point to many other sources (Iivari & Iivari, 2011; Nerur et al., 2005; Tolfo et al., 2011) that identify organisational culture as an impediment to Agile adoption.

At the tertiary level, contradictions impede the progress or evolution of the activity itself. Here environmental factors are present in the form of events that inhibit change (Table 6.12). Many of these items relate to traditional organisational practices that impede the uptake of large-scale Agile approaches.

> *"When you had…one of the team that was very, the old fashioned hierarchical leadership, you will do what I tell you, you could see they weren't getting on faster, so they were kind of lagging behind in some of their, you know, working through the Trello boards."*
>
> Programme Support: QY-1206

Additionally, there was the perception in some areas of senior management that the large-scale Agile approach was a 'cult' that would have limited impact and would not be sustainable.

This view is also addressed by Gandomani & Nafchi (2016), who state that the 'wrong mindset' is another challenge arising from beliefs about the development process,

required roles and responsibilities and fear of change. These authors found that this issue was more critical in association with managers who hold higher authority. Similarly, Nerur et al. (2005) had previously identified traditional mindsets as a barrier to Agile adoption because people holding such mindsets show negative reactions to the required changes. Dikert et al., (2016) quoting Misra et al., (2010) go further stating that adopting agile often requires change of the entire organisational culture.

At a quaternary contradiction level, an evolved activity interfaces with other neighbouring activities. As seen in Table 6.13, there are many events at the quaternary contradiction level. It would be expected that many environmental factors would occur here.

These events are heavily focussed around the interactions of the D/STP activities with the other departments and functions within the organisation, rather than around the neighbouring activities within the D/STP itself.

Within the D/STP, many of these issues involving interactions with other departmental functions were anticipated. Senior management put in place arrangements to facilitate the changed working practices that would be caused by the D/STP. Many of these attempts are visible in Tables 6.17 and 6.18, where there is a high number of collaborative activities related to quaternary contradictions. These lead onto significant numbers of co-operation and co-construction events at the quaternary level. There are far more of these than at any other contradiction level (Table 6.17). Within the D/STP, the Programme Manager, in conjunction with the heads of Finance and Procurement, addressed the interface between the large-scale Agile implementation and other organisational functions, developing strategies for their synchronisation and dependencies and organisational level implementation. This itself is a research area identified by Abrahamsson et al. (2009).

On the other hand, Table 6.13 shows that there are many events reflecting a quaternary contradiction with a neighbouring activity. This is consistent with the view of Mangalaraj et al. (2009), who found that after initial successes at team level (i.e. the Subject node perspective within the CATF), many issues and challenges arose beyond the Agile team's own boundaries. Large-scale Agile implementations are consequently constrained by many of the organisational functions that the Agile team depends on. Mangalaraj et al.'s (2009) implication of a progression of issues in Agile implementations maps onto the

expansive learning progression through different contradiction levels in the CATF. Although the D/STP was a 'top-down' rather than a 'bottom-up' implementation (after Mangalaraj et al., 2009), the expansive learning sequence is likely to follow a similar pattern where problems and issues arise within teams first before extending to beyond team boundaries. This is outlined in Tables 6.15 and 6.16. The CATF suggests an additional perspective on these elements, highlighting not only areas where collaboration took place but also where new approaches and procedures were developed. This is represented by the presence of co-construction events (Table 6.17).

7.3.6 Section conclusion

The focus of this section has been on contradictions, with the understanding that collaboration activity is a pre-cursor to the resolution of contradictions. Collaboration is a changed way of working that is demanded by Agile methods, and is a significant factor behind the lack of uptake of large-scale Agile methods. For example, Gandomani & Nafchi (2016, p.258) state "people collaboration is a serious requirement of Agile software development,"

This section has explored evidence of how collaboration is an unplanned, informal response to a specific, but unanticipated, problem. Such unanticipated problems can be contradictions at any level. The resulting collaboration activity may lead onto co-operation activity, in turn leading to a congruence or stabilisation. In addition, the collaboration activity can go beyond co-operation, giving rise to co-construction and then resolution of a contradiction. In Table 7.2, the areas of contradiction and subsequent collaboration and co-construction have been mapped to the elements identified by researchers in this field, indicating how the CATF addresses these issues, providing a relational context for their analysis. Nerur et al. (2005) state that the adoption of Agile methods is likely to create a considerable burden on organisations. Gandomani & Nafchi (2016, p.257) go further in considering Agile transformation as an "organisational mutation, mainly because of the scope of the required changes covers all the organisational behaviours as well as involved people's roles and responsibilities". Transformation to large-scale Agile is difficult, needing time and effort. This leads to many human-related challenges and barriers. Edison et al., (2021) point to several studies that indicate that a lack of the right mindset and culture prohibit organisations

from benefiting from the whole potential of SAFe and it is perhaps drawing attention to these aspects that the CATF provides the most useful perspective.

In the last few years there have been reviews of the literature on Agile project management addressing the success factors and challenges that organisations face when transitioning to large-scale Agile methods. These vary from academic contributions with large lists of personnel and human resource success factors (Conboy et al., 2011; Dikert et al., 2016) to industry surveys of the 'State of Agile' (Version One, 2019). These authors identify a wide range of cultural, organisational and 'people' factors as key elements of the transition process. It is precisely these challenges and barriers that CATF identifies above. In response to Research Question two, this section considers, firstly, that elements of the CATF could address and signpost the organisational, management, people, process, technology/tools and environmental factors that may arise as organisations transition to large-scale Agile methods and, secondly, that the CATF suggests a structure that moves beyond list-based or anecdotal approaches. This is a useful next step as illustrated by the example identified by Kalenda et al., (2018) relating to the difficulties arising from a lack of training in large-scale Agile methods. They identify multiple sources (also identified in this research) as the main causes of poor training such as difficulties in large-scale Agile transformation, financial constraints and also lack of management support. Additionally, Mangalaraj et al. (2009) state that a lack of knowledge and training means that adopters are likely to fall back on their old work habits (discussed above in section 7.2.2). It appears that these multiple factors are complex, multi-faceted and closely inter-related, which indicates that the analysis of large-scale Agile adoption success factors and challenges may benefit from an additional analytical framework such as the CATF to complement anecdotal and list based approaches. The existence of a form of a progression within this framework is addressed by Research Question three.

7.4 RQ3: To what extent can a consolidated Activity Theory framework (CATF) contribute towards the assessment of the obstacles to learning in developing an organisation's large-scale Agile capability?

7.4.1 Introduction: a 'meta' large-scale Agile maturity model

This section addresses whether the CATF can contribute to a large-scale Agile capability assessment. The stimulus for undertaking this exercise came from the statement that decision-makers within organisations would benefit from measuring agility before, during and after the transition to an Agile method (Gren et al., 2015). Although it is not suggested that the CATF assesses Agility itself, it does seek to explore important impediments to organisations intending to develop a large-scale Agile delivery capability. To this extent, the CATF focuses on aspects of organisational learning involved in adopting large-scale Agile methods, rather than on the prescription of practices typical of maturity models. The specific focus on the impediments to organisational learning rather than on large-scale Agile practices, indicates that the CATF could be viewed as a 'meta' maturity model.

This section discusses the finding of the application of the CATF to the D/STP, as well as the difficulties involved in developing a large-scale Agile capability assessment tool. The application of the CATF to the D/STP is used to evaluate its effectiveness and its features that may be characterised as a form of maturity model. The section starts by examining the key 'leverage points' that the CATF addresses. This is then compared to Maier et al.'s (2012) maturity grid guidelines (Table 7.3). This assesses the extent to which the CATF complies with maturity grid criteria. Maier et al. (2012) identify different elements making organisational capabilities mature. These include adherence to structured processes, emphasis on people and emphasis on learning. The third of these is the element relating to this study. The CATF does not concentrate on learning itself, but on the obstacles and impediments to learning, and hence represents a 'meta' perspective.

There are two different aspects of organisational maturity (Maier et al., 2012). The first is the notion of being complete. The second refers to the process of bringing something to maturity and stresses a process towards an objective. The second aspect is considered here. Process towards an objective is typically represented as a series of stages (usually up to five), in which subsequent stages build on the requirements and capabilities of

lower stages. Representations are characterised by varying views about how stages differ. Maier et al. (2012) identified four criteria that have been used to differentiate stages as detailed in the Table 7.3 below. These criteria are regarded as the 'best leverage points' for an organisation to concentrate on in order to improve performance towards an objective.

7.4.2 Maturity Grid Components

After reviewing 24 existing maturity grids[22], Maier et al. (2012) produced guidance on the development of maturity grids. Their guide is used as a benchmark to evaluate the CATF. The key elements of the four phases are reproduced below in Table 7.3 below.

Table 7.3: Phases of developing a maturity assessment grid (after Maier et al., 2012)

Phase	Elements	CATF Approach
Planning	1. Specify audience	Project, programme and change managers
	2. Define aim (purpose)	Identify problem and impediments to learning. These may have historical, cultural and social origins.
	3. Clarify scope	Organisation change when implementing large-scale Agile approaches.
	4. Define success criteria	Focus is on the high level requirements of usability and usefulness
Development	1. Select the process areas	Defined according to published Agile maturity literature in addition to consultation with domain experts.
	2. Select maturity levels	Based on Engeström's Activity Theory contradiction levels
	3. Formulate cell text	Generic Agile activities only.
	4. Define administration mechanism	Initial mix of interview and questionnaire
Evaluation	1. Validate	Correlation between CATF purpose (aim) and actual result.
	2. Verify	Correlation with the requirements (usability and usefulness) and actual results.
Maintenance	1. Check benchmark and adjust cell descriptions	Not immediately applicable
	2. Maintain results database	Not immediately applicable
	3. Document and communicate	Information is provided to the stakeholders.

[22] Maier et al (2012) distinguish between capability maturity models and maturity grids according to the three criteria of work orientation, mode of assessment and intent.

Table 7.3 is used to structure this discussion of the application of the CATF to the D/STP. Conformance or otherwise with these guidelines is regarded as indicative of the CATF's value as a large-scale Agile capability assessment tool. It should be noted that not all the theoretical elements of the above guidelines can be explicitly identified and appraised in this analysis. Where this has not been possible it is clearly indicated. Also, for ease of relating the discussion to Table 7.3, elements under discussion are identified by underlining.

7.4.2.1 Planning

The Planning phase sets the scene for the maturity grid in terms of identifying the audience, aims, scope and success criteria. This section examines these planning criteria in relation to the CATF as applied to the D/STP. The audience and domain of the CATF is expected to be delivery practitioners i.e. project, programme and change managers implementing a large-scale Agile method or undertaking significant changes to a large-scale Agile approach. Using the CATF, there would be no need to differentiate between different sets of audiences because the objectives and aims would largely be the same for all stakeholders.

The aim of the CATF is problem diagnosis to assist in identifying areas of concern that are historical, social, cultural, or behavioural in origin, and that manifest as impediments to the organisational learning when adopting a large-scale Agile approach. The CATF relates to organisational change, and is domain-specific in that it relates to the adoption of large-scale Agile initiatives including the six generic Agile activities. Extending the scope to other domains should be relatively straight forward, requiring the careful definition and analysis of generic activities representing the chosen domain. In contrast to other frameworks for adopting Agile approaches (Chan & Thong, 2009; Ganesh & Thangasamy, 2012; Gandomani & Nafchi, 2015), the CATF offers a structured analytical approach that is oriented around problem-identification and issue-detection. These elements assist with the identification of culturally deep-seated and organisationally engrained obstacles to the adoption of large-scale Agile methods. Section 7.2 above undertook a comparison of the CATF to these approaches.

In terms of success criteria, Maier et al. (2012) identify high-level requirements of usability and usefulness. The usability of CATF has not been fully explored. To date, it has relied on time consuming interviews. When evaluating another Agile maturity model

(Sidky et al., 2007) that also used interview data, Gren et al. (2015) state that it would have been advantageous if the data could have been collected by a survey instead. Other aspects of usability, such as understanding of concepts and language, do not appear to have been problematic in that no such issues arose during interviews.

In terms of usefulness, Maier et al. (2012) point to the extent to which the maturity grid stimulates learning effects or gives rise to effective plans for improvement. Because the CATF is based on expansive learning, and on identifying obstacles to learning and development, organisational learning and attendant obstacles are its central focus. Consequently, these are its most relevant aspect.

A key useful feature of the CATF is the focus on contradictions and congruences. This aligns to some extent with Vijayasarathy & Turk's (2012) stress on the interplay between perceived benefits and hindrances as a driver of Agile development. These authors definition of hindrances (the perception of elements adversely affecting software development outcomes) closely relates to the contradictions concept with the CATF. Vijayasarathy & Turk (2012) define benefits as perceptions of improved software development outcomes. While the congruences concept within the CATF is regarded as an accommodation and stabilisation, it is a necessary pre-requisite for organisational benefits to occur. Table 6.18 shows a strong association between contradictions and congruences, particularly for secondary-level contradictions (the most commonly occurring type), but the trend continues across all levels of contradiction levels and all participating groups.

As previously discussed, most of these associations occurred within the Delivery Personnel and Delivery Managers groups but the other groups had similar levels of associations. The most instructive perspective is to examine the proportion of congruence events to contradiction events (Table 6.18). Congruence events vary from nearly half the number of contradiction events to less than a fifth. There are instances where there are more congruences than contradictions, but these are few and involve low numbers of events (mostly at the quaternary contradiction level). For the Delivery Personnel group, it is suggested that this is due to the facilitated communication and collaboration across departmental and functional boundaries. This is seen as a benefit derived from the adoption of large-scale Agile methods. This perspective is corroborated by the even greater ratio of congruences to contradictions exhibited by the External

Department group. This group would be most closely involved in a changed communications practice.

There were few occurrences at the primary and tertiary contradictions levels; most of the events took place at the secondary contradiction level, revealing an interesting dynamic across the Delivery Personnel, Delivery Managers and SBU groups.

While the Delivery Personnel group's number of congruences is nearly half its number of contradictions, the Delivery Managers group's ratio is only a quarter, and the SBU group's only a fifth. These figures suggest that the Delivery Personnel group were more successful at identifying congruences and stabilisations likely to lead to future benefits, while the Delivery Managers and SBUs have been much less successful. It is likely that, because the Delivery Managers will have been communicating with and collaborating with the SBUs, the SBU figures reflect the same issues but from their own perspective.

With the CATF's primary focus on contradictions, and subsequently on congruences and stabilisations, the CATF differs from the focus of Vijayasarathy & Turk's (2012) perspectives on benefits and hindrances. Nevertheless, as an analytical tool, the CATF results displayed in Table 6.18 draw attention to significant issues relating to the communication and collaboration between the Delivery Managers and the SBUs. This provides the basis for more analysis, and perhaps a focus for intervention. Subsequent facilitation may well focus on the large-scale Agile training and issues around influential individuals, as highlighted by Vijayasarathy & Turk (2012). These were addressed earlier in Section 7.2.

The CATF is layered, in that at the highest level there are four main levels of contradictions. Within the first two contradictions there are sub-divisions related to the triangle nodes. Secondary contradictions were then further sub-divided into local and external contradictions, providing another layer of analysis. This represents opportunities for organisations to implement more detailed improvement initiatives. This is detailed in Table 6.11, which shows the large number of events related to external secondary level contradictions. These relate to the Community - Rules & Norms - Object relationship involving Delivery Personnel and Managers. In this sense, the CATF is irregular in terms of the degree of analysis at each level compared to the symmetry of traditional maturity grids. This is illustrated by Table 6.8 and the different levels of depth of analysis are depicted in Tables 6.9 to 6.13, addressing other aspects of the CATF.

Overall, in terms of Planning, the CATF has a ready audience, and its aims and scope are well defined. Given only one initial case study, the usability of the approach has yet to be fully explored. In terms of the success criteria of usefulness, the previous two sections of this chapter have already explored various elements. In this section, the CATF's value in terms of identifying the association between benefits and hindrances has been identified, building on the work by Vijayasarathy & Turk (2012).

7.4.2.2 Development

Maier et al. (2012) state that the development phase addresses the architecture of the maturity grid. This defines the process areas to be assessed, as well as the maturity levels to be assigned. These definitions will have a significant impact on the use of the maturity grid. Conventionally identifying processes areas that are key such as Benefits Management or Risk Management within a project management context is a complex mix of prior experience and reference to established knowledge. It is perhaps the most difficult aspect of developing a maturity grid (Maier et al., 2012).

With the CATF the process areas were identified by re-visiting the Agile Manifesto and the Agile principles, and to examine their consistency and coherence. Other Agile maturity models (Sidky et al., 2007; Patel & Ramachandran (2009) have a similar orientation regarding the basic principles of the Agile method. With reference to work by Meyer (2014) and an examination of 14 journal articles addressing Agile maturity models, six generic Agile activities were identified (Section 4.8). These six Agile activities have been kept deliberately broad, generic, and universal to cater for all possible large-scale Agile methods given the wide variety (and immaturity) of large-scale Agile delivery environments.

This approach avoids disputes and entanglements over specific practices, yet provides relevance and applicability to all large-scale Agile delivery environments. Further decomposition of these six Agile activities is entirely possible. However, this would lead to more effort in allocating practices and tasks to the increased number of Agile activities, so the benefits of this must be carefully considered. The CATF's aim is to identify original historical, cultural, social and behavioural factors giving rise to organisational learning impediments. These are likely to be deep rooted within the organisational environment, and are likely to occur across several tasks, work practices

and activities. This would make it less useful to engage in further partitioning Agile activities.

As can be seen in Table 6.1, the data was easily distributed across the six generic activities, without raising any confusing questions over which of the activities held the different tasks or events. In addition, during the interview process, interviewees were asked in which of the six generic activities their work were practices located. All interviewees were easily able to identify one or more activities, and did not require any other activities, or even the creation of a holdall 'miscellaneous' activity.

Table 6.1 also shows the distribution of events (contradictions, collaborative activity and congruences). This distribution was anticipated given the nature of the D/STP and the roles and responsibilities of the interviewees (Chapter 6). Table 6.1 is similar to Fontana et al.'s (2015, p.22) table presenting "No. of pieces of information from interviews showing development teams pursuing each outcome" and provides a general overview perspective of the events that were identified within the study.

Maier et al.'s (2012) maturity levels are based on an adaptation of the three learning types (single-loop, double-loop and deutero learning) plus an additional initial stage where there is no consideration of learning. Analogous to these learning types, the CATF incorporates the four types of contradictions as the main maturity levels or stages of the expansive learning cycle progression. The absence of contradictions could also be added as the most developed level or stage. This is illustrated in Table 7.4 below.

Table 7.4: Matching Maturity Levels with Contradictions

Stage/ maturity level	Contradiction	Identifies obstacles and impediments
1	Primary	Within activity nodes
2	Secondary	Between activity nodes
3	Tertiary	Between an established activity and a newer more culturally advanced form of it.
4	Quaternary	Between linked adjacent activities.
5	None identified	Within or related to the activity

The maturity levels in Table 7.4 represent progressions on the expansive learning cycle. Each level indicates a particular type, location (within the activity) and relationship of an impediment or obstacle to learning and development. Using the CATF as a large-scale Agile capability assessment framework, practitioners or change managers can

subsequently determine the most appropriate corrective approach when an Agile activity has an accumulation of events at a specific level. As Maier et al. (2012) state, the chosen levels should trigger internal processes to initiate change. This will result in a modification of practices and changes to activity norms or procedures that will facilitate the activity's potential to modify and align with changes in the environment.

The factors that influence the practices at each level need to be defined. In the CATF, these elements relate to the existence of contradictions, occurrences of collaborative activity, and congruences and stabilisations.

The CATF focuses on these key elements for each maturity level. They are identified in Tables 6.8 to 6.13. Each of the generic activities will progress through the expansive learning cycle. Table 6.17 displays the range of collaborative activity across the different contradiction levels including the specific events relating to co-operation activity as well as co-construction activity. This is distributed across the different programme groups and is divided into two main categories.

The first category consists of broad collaborative activity, where there is general evidence of accord and agreement. It can be difficult to map collaborative activity events directly to contradiction events, although where there is a general focus on events of any type, it would be natural to expect a concomitant higher incidence of collaborative activity events. The second category (mapped: where the analysis has been able to directly map collaborative activity to congruences and stabilisations – Table 6.17) relates to specific mentions of either co-operation activity or co-construction activity. Overall, the first category has less than half as many collaborative events as contradiction events. The first category of collaborative events follows the pattern of contradiction events, except for those at the quaternary contradiction level. Here, unusually, there are more collaborative events than contradiction events. These events occur across the programme groups, and are regarded as indicative of attempts to accommodate the changed activities. Because they occur from the perspectives of groups involved in delivering the D/STP (Delivery Managers and Delivery Personnel) and those groups with which the programme interfaces (External Departments and SBUs), they represent co-ordinated efforts to accommodate the new way of working introduced by the programme. These were most probably a result of the initial efforts of the Programme Manager and the Directors of the External Departments.

It may have been expected that the number of events (either contradictions or collaborative activity) would follow a pyramidical structure, with most events occurring at the primary contradiction level, then becoming increasingly fewer in number as progress is made along the expansive learning cycle (Figure 4.7). The results show that this is not the case: that events may occur within the different activities at different points. Some activities may not display contradiction events at primary or secondary level, only experiencing them at tertiary or quaternary levels. Consequently, there is no obligatory sequence of decreasing number of events following progression along the expansive learning cycle. The anomalous high number of collaborative events identified at the quaternary level exceeding the number of contradiction events is indicative of a facilitated organisational arrangement that is perhaps not available at other levels within the organisation. These aspects were discussed in Section 7.1 and 7.2.

The second category has less than one sixth of the number of contradiction events, and follows a similar pattern to the first category in terms of the number of contradiction events at different levels, including the higher numbers at the quaternary level. This category is made up of co-operation and co-construction events that have been specifically triggered by contradiction events. It is suggested that co-construction events enable the resolution of contradictions, allowing the activity to progress and evolve, but that co-operation events do not lead directly to contradiction resolution. Instead, they may lead to a form of accommodation with the current activity situation.

From Table 6.17, it is apparent that there were very few co-construction events overall. As with the collaboration events, the higher number of co-construction events at the quaternary contradiction level is indicative of an organisation-wide questioning and open mindset where some senior management, were willing to re-consider conventional practice. This was facilitated by the extensive collaborative activity taking place at this level, as well as by the high level of co-operation taking place.

The analysis provides a further layer of granularity and analysis, by dividing the four contradiction levels into the eighteen expansive learning actions (Table 6.16). This was particularly relevant for the primary and secondary contradictions, where three and five expansive learning actions respectively were clearly identified (Section 4.3). As initially outlined in Section 6.4, there were various difficulties caused by the ambiguous terminology. At the primary contradiction level there were three expansive learning

actions and the results in Table 6.16 did not reveal any particular distinctions between the actions. A similar situation occurred with the five expansive learning actions at the secondary contradiction level. Here, it was problematic in determining which expansive learning action an event was an example of.

Nevertheless, an attempt was made. Given that secondary contradiction based events were the focus of the analysis, most of the expansive learning actions occurred at this level, and were deemed to be 'A3: Articulate problems and challenges'. Unlike the primary contradictions there was a clear preference for this specific expansive learning action. Interestingly, Engeström et al. (2013) provide little guidance on why 'A3: Articulate problems and challenges' should be a secondary level expansive learning action, or on why 'Q3: Identify challenges' should be a primary contradiction expansive learning action. Because there is little to distinguish between them, they could be deployed at either level.

At the tertiary contradiction level, there are two groups (Modelling and Examining) made up of seven expansive learning actions that take place between the secondary and tertiary contradiction levels. These actions address the transitional phase of where a 'new improved and culturally more advanced' form of the activity becomes consolidated prior to the occurrence of tertiary contradictions. Although the learning actions of the Modelling and Examining groups are much more unambiguous, there were very few events that could be categorised as examples of these actions. This may well be an issue related to 'progression' of the adoption of large-scale Agile methods. With the very high numbers identified within secondary contradictions, there has been little resolution of such issues that would have facilitated transition to the tertiary contradiction level. Had there been many events relating to the Modelling and Examining groups, then it would have been deduced that significant progress had been made at the secondary contradiction level.

Given that there are very few events here, it seems that progress has stalled at the secondary contradiction level. Although this is in accord with Engeström's (2005) focus, it may well be that a different case study might have revealed many more useful attributes of the CATF, and of its incorporation of expansive learning actions, than has been possible in this case study. This is particularly true of the Modelling and Examining groups between the secondary and tertiary contradiction levels.

Engeström et al. (2013) have not sub-divided the three remaining expansive learning groups which straddle the quaternary contradictions level. 'Consolidating' is reminiscent of Kurt Lewin's (1947) last stage 'Re-Freezing' of his three-stage Change Management Model.

From Table 6.16 there are sizeable numbers of events categorised within the Implementing, Reflecting and Consolidating learning action groups. This indicates that significant learning actions are present. Apart from that, there is little further that may be extrapolated from these values, apart from that there is some scope to further develop these expansive learning actions into more indicative groupings. This would complement the existing rather broad contradiction levels, which although they map well to existing maturity model stage structures, could be significantly augmented by more nuanced and informative expansive learning actions. Such an objective is beyond the scope of this study.

Having identified maturity levels and the progression between them, Maier et al. (2102) state that the next step is to formulate the cell text (in the cells of the maturity grid) that describes the practices that would be expected. Rather than following other Agile maturity models' attempts to closely define all Agile practices in order to make them amenable to measurement, ranking or aggregation to form levels of maturity (Sidky et al., 2007; Fontana et al 2015), the CATF adopts an alternative perspective. In this, the selection of practices at greater or lower numbers is not indicative of maturity (Gren et al., 2015). Consequently, this aspect of Maier et al.'s (2012) guidelines does not apply, so detailed practices for each Agile activity are not closely defined.

In terms of the administration mechanism, Maier et al. (2012) utilised thirty-minute interviews combined with a two-hour workshop, but they provide little indication of the roles and responsibilities of the interviewees. The CATF was administered using thirty-three hour-long interviews including those directly involved with the D/STP and interviews with individuals within interfacing business units and the programme support office. For consistency, the CATF utilised the Standard Question Set (Appendix D) and diagrams (Appendix E) that were used to guide interviews.

In terms of the Development Phase, the CATF has been able to specify processes areas in a similar manner to Maier et al.'s (2012) approach by reference to literature and by

utilising expert knowledge. The selection of maturity levels has broadly followed AT's four levels of contradictions based on expansive learning.

Each of these levels has applied to the D/STP, showing the value of identifying contradictions, collaborative activity and congruences and stabilisations at different levels. Because the contradiction levels were very broad and all-encompassing, an additional level of granularity was provided by sub-dividing each contradiction level into its constituent expansive learning actions. Because the CATF can be regarded as a 'meta' maturity model that addresses obstacles to learning and development rather than the presence or absence of practices, then there is no requirement to specify prescriptive or descriptive practices. Finally, in terms of administration, several alternatives such as surveys and focus groups could be used in the future. For now, analysis in this study is based entirely on the interviews.

7.4.2.3 Evaluation

Maturity grids evolve over time through continued use and feedback resulting in iterative improvements (Maier et al., 2012). This approach chimes with Engeström's statement that his version of AT should be amended and updated through use and application (Sannino, 2011). The developed grid needs to be tested for validity and relevance. This will involve an assessment or comparison of its intended benefits with actual outcomes. In this respect, elements of the CATF have had some validation in its construction, in that certain constituent element have already been independently validated. The six defined generic Agile activities were validated through consultation with domain experts and with reference to the Agile maturity model literature. In the Change Laboratory initiatives, Kerosuo et al. (2010) demonstrated the successful application of AT. The CATF modification, in terms of the Activity->Task->Action aspect has already been applied by Cash et al. (2105).

The Standard Question List was drawn from several sources that have applied AT (Section 4.7). It represents a distillation of key aspects from different sources. Mwanza's (2000) sub-triangles have already been applied within a case study scenario and other authors have used the same approach (Yamagata-Lynch, 2012). Other authors have successfully applied AT based approach within the IS domain at an organisational and management level (Mursu et al., 2007). However, the combination of all these elements into one framework is unique. Their application to the D/STP has surfaced large-scale

Agile adoption issues which otherwise may have remained unexplored. In particular, the combination of contradictions, collaboration, congruences and stabilisations (Sections 7.1 and 7.2) is especially informative showing issues relating to secondary contradictions predominate in this case study.

Maier et al. (2012, p.152) state that results from the maturity grid should be "correct, accurate and repeatable". A key aspect of the development of the CATF was that it should be repeatable. All the elements have been closely defined, and are open and accessible. This makes the framework eminently repeatable.

With regard to whether the CATF is 'correct and accurate' it is a broad generic framework that is applicable across all large-scale Agile domains. CATF does not prescribe any measures of output or practice, but presents a contextual framework within which key learning and development relationships, and connections relating to teams, communities and activities, are queried as described in Section 7.4.2. The responses to these queries present insights into the problems that the organisation faced when adopting a large-scale Agile method. The extent to which this intent of the CATF corresponds with the results and "understandings of participants" (Maier et al., 2012, p.152) is a view that will have to wait for further evaluation.

7.4.2.4 Maintenance

Maintenance is a continual process as understanding and domain knowledge increases (Maier et al., 2012). This is especially important if detailed and prescriptive activities have been specified for the practices. In the case of the CATF, this is less of a consideration because no detailed practices are specified. Therefore, CATF maintenance would be far less onerous than of a conventional maturity grid.

A significant element of maintenance is to cater for additional linkages and connections that are identified as the CATF is applied. Within the D/STP case study, there were very few indications of delivery activities that were interlinked with other such activities. For example, the B&C activity may experience problems and issues due to internal difficulties with the RE activity. Normally these would be categorised as quaternary contradictions (friction or difficulties between neighbouring activities). There were a substantial number of quaternary contradictions identified within the D/STP, but these occurred between the Programme delivery activities and other supporting activities within the organisation. A case study of more typical software development activity

might have highlighted more events involving large-scale Agile delivery activities. This is a facility that practitioners would expect from a maturity model (Nurdiani et al., 2019). Such events would also have provided an indication whether there were issues regarding the 'correct order' of Agile practices. Agile maturity models have found difficulty in agreeing common practice. (Nurdiani et al. 2019). Overall, given the early stages of development of CATF benchmarking, maintaining a results database can only come from further work.

7.4.3 Mapping the CATF to maturity model dimensions

In addition to Maier et al.'s (2012) maturity grid guidelines, Leppanen (2013) suggests that maturity models can be classified as descriptive, prescriptive, or comparative models (after de Bruin 2005); on the basis of their domains (process, object and people after Mettler & Rohner, 2009) or on the level at which the model operates e.g. organisational, team or personal.

From the results in Chapter 6, the CATF does not easily map to these classifications. This is reflective of its 'meta' perspective. The CATF is not a prescriptive model, because it does not specify an ideal set of practices or processes. It may well provide a comparative component in that, given enough applications, it may facilitate comparative analysis. Organisations could then use this as points of reference. The CATF's most useful application is as an analytical or diagnostic tool, perhaps in combination with other models, to highlight problems with progression and development through levels in other maturity model.

In terms of domains (Mettler & Rohner, 2009), the CATF addresses two of the three domains, by providing insights into objects such as artifacts and tools deployed within each of the activities (Table 6.2). These artifacts are categorised as physical, conceptual and cultural (Hasan et al., 2017). Table 6.3 shows that most artifact-related events occurred within the G&S activity. They related to physical and conceptual artifacts issue by the delivery managers and personnel, indicating potential problems related to compliance and conformance.

In terms of processes the CATF also differentiates between the different processes represented by the practices and tasks that take place within each of the Large-scale activities. From Table 6.6 it is apparent that the Agile activities of G&S, L&D and RM have

a large concentration of process, practice and task events. While the high number of occurrences within the first of these activities might have been expected, the identification of issues within the RM activity is indicative of difficulties with practices such as estimation, planning and integration. This highlights the analytical role of the CATF in that its consideration of these object and process elements was helpful in locating difficulties requiring attention.

The CATF addresses both organisational and team level issues, through the Subject and Community nodes of the activity triangle and through 'local and 'external' contradictions. Because expansive learning is based on collaborative activity, the CATF is unlikely to address issues at personal or individual levels. The Subject node identifies issues relating to artifacts, roles and responsibilities, and rules and norms as they affect the team. Extending the analysis beyond the delivery team elements, to accommodate wider organisational-level influences and effects is addressed by the Community node. This also identifies issues relating to artifacts, roles and responsibilities, and rules and norms.

From Table 6.10, it is apparent that at a team level, the CATF highlighted that Delivery Managers had significant issues with artifacts such as user stories, frequent releases and self-organising teams within their activities. While this would be expected with the introduction of a new method, it is perhaps surprising that this was not also similarly accompanied by Artifact node-related issues involving Delivery Personnel. The explanation for this is that, had the programme involved sizable levels of software development activity, it is likely that these issues would have registered significant numbers of events within the B&C and T&Q activities. It is perhaps in this way that the CATF performs an additional analytical role, by drawing attention to elements where there are certain expectations of occurrences, and verifying their presence or absence.

At an organisational level, Table 6.10 shows that there were major issues in terms of the impact that organisation-wide rules and norms had on the activity for three distinct groups: Delivery Personnel, Delivery Managers and the SBUs. It is at this level that the CATF is uniquely positioned to draw attention to the wider organisational cultural, behavioural, and social obstacles to the implementation of the Large-scale method. Section 6.3.2.2 discusses four categories of impediments, identified by the CATF-based analysis, that have affected the D/STP. These ranged from problems relating to the

existing clinical and public sector culture to the roles of senior management and the approvals process (Section 7.3.5).

In addition, the CATF further differentiated the nature of these issues at an organisational level, by distinguishing between those that arise from the Community that has a 'specific interest' within the activity (local secondary contradiction) and those which originate from the wider organisation that do not have such an interest ('external' contradictions). Examples of the latter include rules and norms originating from the Finance or HR functions. Hence the CATF provides a further layer of granular analysis. While not addressing every aspect of Leppanen's (2013) dimensions of maturity grids, the CATF does incorporate a significant number. It provides a different perspective in terms of the 'meta' elements which would not normally be considered.

7.4.4 Section Conclusion

This section has compared the CATF with guidelines for maturity grid development (Maier et al., 2012), to determine whether the CATF is able to provide insight or indications of an organisation's uptake of large-scale Agile approaches. The CATF offers clear and accessible indicators of 'maturity' in a progression that can assist organisations in implementing plans for change. This is a major success criterion for a maturity grid (Maier et al., 2012). In a domain that is characterised by a large variety of alternative interpretations of large-scale Agile maturity, the CATF suggests a transparent, open approach, facilitated by providing an alternative option to closely defining and measuring large-scale Agile practices. These can be ambiguous constructs, making defining maturity extremely difficult (Gren et al., 2015). Use of the CATF, as demonstrated offers insights and awareness into hitherto unknown issues, complying with Maier et al.'s (2012) notions that process-improvement frameworks will influence organisational performance, leading to initiatives to improve capabilities or even pursue competitive advantage.

There is a consistent theme within the Agile project management literature regarding challenges that face organisations pursuing large-scale Agile methods (Dikert et al., 2016; Kalenda et. al., 2018). There is a wide range of cultural, organisational and 'people' factors, with several contributions stressing the importance of an organisation's ability to promote individual and team learning, empowerment and self-organisation (Nerur &

Balijepally, 2007; Sheffield & Lemetayer, 2013). The CATF advances an outlook that is entirely focussed on all of these perspectives. Gren et al. (2015) have expressed concern with other Agile maturity models (Sidky et al., 2007), due to a lack of validation. They highlight other endeavours such as So and Scholl (2009) which have been validated using a large data set. Creating a similar large data set has not yet been possible, but the constituent elements of the CATF have all previously been applied and validated independently. Their consolidation, in assembling the CATF and then applying it to the D/STP, represents an initial attempt to holistically validate the framework.

7.5 Chapter conclusion

The shift away from the more technical, sequential and operational approaches to project delivery to a large-scale Agile approach that focuses on iteration, collaboration and partnerships, perhaps requires a different analytical perspective. In Section 7.2, analysis showed that the practice-based approach using AT offers an in-depth understanding of the social and cultural elements that are likely to be foregrounded by a shift to large-scale Agile delivery methods, because this promotes responsibility, empowerment and self-organisation elements. The CATF provides an insight into the five dimensions (Nicolini, 2013) of work practices such as 'Revealing actual work' and 'Efforts and interests and power'. Analysis along these dimensions revealed multiple issues, such as concerns with skills-sets and competences within the delivery team, and the perception of Agile activities as something of a 'cult'. Conversely, the analysis found little evidence that the large-scale Agile tools themselves posed particular difficulties.

These insights achieved by the Practice Theory approach were not at the expense of conventional approaches to the identification of issues that usually focus on Process, People, Tools and Organisational and Management aspects. In section 7.3, the analysis showed that the CATF was also able to address some of these elements, identifying the key role of Delivery Managers and the problem posed by individuals charged with the delivery of multiple projects simultaneously. Clinical cultural aspects were identified as a key factor, as were organisational structures and the significant influence of functions outside the D/STP (e.g. Finance and HR). Many of the issues identified in Section 7.2 were reinforced in Section 7.3.

Whether the CATF can make a contribution towards a generic assessment of an organisation's capability to adopt a large-scale Agile method was discussed in Section 7.4. This was considered in relation to established guidelines for maturity grids. The analysis revealed that many elements of maturity grids were present within the CATF. However, unlike conventional maturity models, there was uneven emphasis across the progression, with analysis of secondary contradictions being particularly prominent. This is reflective of the literature on which the CATF is based, which itself is reflective of the focus of AT (Kerosuo et al., 2010). The focus on collaboration and congruences is particularly helpful when understanding elements that might require remedy.

Chapter 8: Conclusion

8.1 Research findings

This research's aim was to examine the issues related to organisational learning and development in the adoption of a large-scale Agile delivery approach. It started with an evaluation of possible theoretical approaches. The practice based approach as represented by Engeström's version of Activity Theory (1987) was selected (Chapter 2). This was based in part on its recommendation as an appropriate analytical tool (Floricel et al., 2014). Application of AT utilising a mixed research approach in a small Initial Study resulted in a re-appraisal of the approach (Chapter 3). This in turn led to the creation of the consolidated Activity Theory framework (CATF) by combining several perspectives of AT which hitherto had mostly remained separate (Chapter 4). This unique approach was applied in the main Case Study of a large-scale Agile implementation within a large public sector organisation (Chapter 5). This approach provided a large amount of data relating to contradictions, collaborative activity and congruences which highlighted a number of specific issues relating to learning organisation when adopting a large-scale Agile method (Chapter 6). An evaluation of the data collected, provided insights and understanding of some key organisational learning issues (Chapter 7) that are aggregated and discussed further in this Chapter.

To assist with the research's aims, the following three research questions were introduced in Chapters One and Four. The following section presents the conclusions to these research questions.

RQ1: What insights and understanding can a Practice Theory based organisational learning approach provide when adopting a large-scale Agile method?

The Practice Theory approach, as implemented in the CATF, can provide insights into where work and efforts take place, and highlights areas of agency and creativity. The Practice Theory approach assists in surfacing deeply ingrained historical, cultural and social factors that affect organisational learning when adopting large-scale Agile delivery methods.

RQ2: How can a consolidated Activity Theory framework (CATF) provide a contextual and relational understanding of the cultural, and behavioural obstacles when adopting large-scale Agile delivery methods?

The CATF contributes to further understanding of the cultural, managerial and organisational learning factors that impact the adoption of large-scale Agile delivery methods. It provides useful perspectives that supplement other approaches and provides a basis for promoting analysis beyond anecdotal and list based approaches.

RQ3: To what extent can a consolidated Activity Theory framework (CATF) contribute towards the assessment of obstacles to learning involved in developing an organisation's large-scale Agile capability?

The CATF proposes a structured, layered perspective of Agile maturity that is analogous to a form of a 'meta' maturity model. It does so by focussing on impediments and enablers to the necessary organisational learning that must occur to move between different levels of large-scale Agile practices. The CATF assists in identifying the learning and development issues related to practices, rather than proposing new or different practices or their re-arrangement in a particular order. The CATF is not prescriptive, and its potential contribution could be as a diagnostic and analytical tool that is granular, scalable, and progressive.

8.2 Domain implications and contribution to knowledge

This section discusses how the research aims to extend knowledge within the wider domains of activity theory, large-scale Agile methods and maturity assessment and organisational learning in relation to the adoption of large-scale Agile practices. The section considers these elements using the following structure.

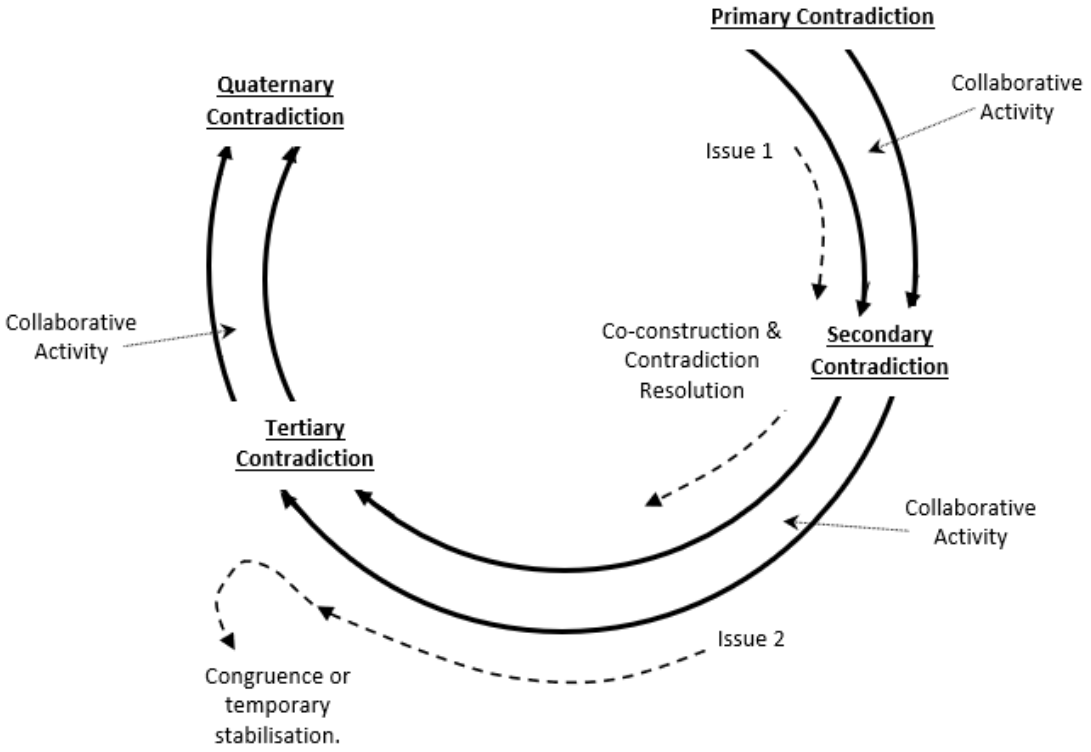
1. Activity Theory as captured by the CATF as an analytical tool.
2. Implications for Agile maturity assessment.
3. Implications for organisational learning.

8.2.1 Activity Theory as captured by the CATF as an analytical tool

The CATF can provide a structured approach that is granular and multi-layered. This helps identify and locate issues that organisations encounter when adopting large-scale Agile methods. Addressing this capability involves several significant developments involving the construction and application of the CATF.

The first point of development is to augment the focus on impediments and hindrances to organisational learning of large-scale Agile practices. The contribution of the CATF consists of providing a further level of analysis by including the identification of collaborative activity as well as congruences and stabilisations. This approach provides an added level of analysis, identifying where events that may challenge practices are likely to result in the resolution of contradictions and also areas of compromise and ‘make do’, resulting in congruences and stabilisations. The definition of these elements facilitates a multi-layered analysis of the progression through the expansive learning cycle as illustrated by Figure 8.1 below.

Figure 8.1: Expansive Learning Cycle Progression

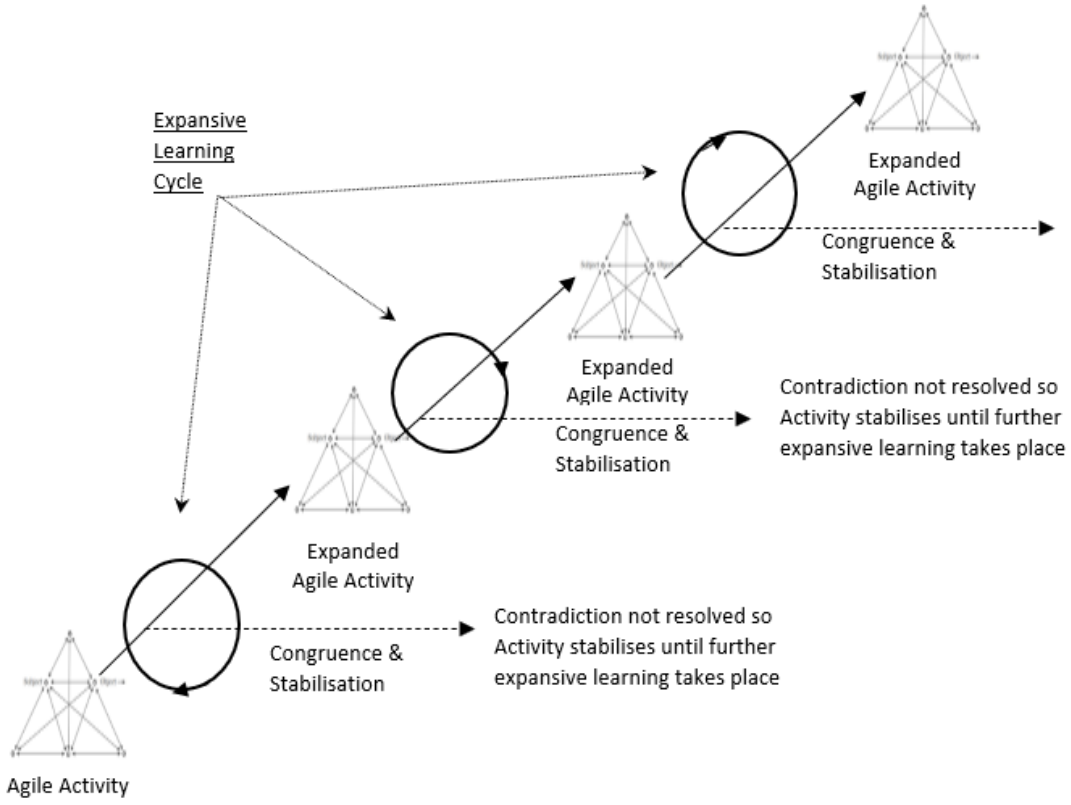


These additional elements are founded on the identification of collaborative activity, which takes place between the tramlines shown in Figure 8.1 and which was identified in Section 6.5 of Chapter 6. Within this activity, if co-operative collaborative activity takes place, then a congruence or stabilisation will result. This is illustrated by Issue 2 in Figure 8.1, where a stabilisation is reached following feedback from the tertiary contradiction (Allen et al., 2013). Where, in addition, co-construction also takes place within the collaborative activity then the activity is expanded to some extent, leading to the resolution of at least one contradiction, as is illustrated by Issue 1 then the contradiction (secondary) is resolved.

The combination of these elements facilitates the identification and location not only of organisational learning impediments within the generic large-scale Agile activities, but also of areas where there has been some movement in addressing these elements, producing compromise and stability. Where significant progress has been made around resolving impediments, insights may be gained into the organisational learning changes that occur when implementing large-scale Agile practices. Based on the data contained in Table 6.17, this was highlighted in Section 7.2.4 of Chapter 7 where the occurrence of

co-operation and co-construction events led to new forms of practice involving the delivery teams of Health Care Org. The ebb and flow of these contradictions, congruences and stabilisations within the expansive learning cycle of a generic Agile activity is further illustrated in Figure 8.2 below.

Figure 8.2: Contradiction resolution, stabilisation and congruences



The second point of development regarding the CATF is the construction and application of a Standard Question Set (Appendix D) to assist with the operationalisation of this approach. The Standard Question Set performs a similar function to the definition of the six generic Agile activities in ensuring an efficient, and guided approach to eliciting information related to situations involving organisational learning. All the aggregated data presented in Chapter 6 and examined in Chapter 7 are derived from the application of the Standard Question Set to the interviewees within Health Care Org. The Standard Question Set is an amalgamation of concepts from a variety of authors who have deployed AT, and is specifically oriented towards the organisational learning domain. The Standard Question Set is generic, so it may be applied to a variety of situations, industries, and organisations. As with Kaptelinin et al.'s (1999) Activity Checklist, the Standard Question Set of the CATF can provide guidance and context without being prescriptive. It focusses attention on the learning and change issues. The Standard

Question Set and Diagrams (Appendix E) and the thematic analysis sequence (Table 5.11) together should facilitate a repeatable application of the CATF as well as an understanding of the nature of the data to be collected.

A third point of development relating to the role of materiality and the view of knowledge as residing within practices and artifacts, was highlighted by references to different levels of artifacts and secondary contradictions.

This research identified that primary and secondary level Agile delivery method artifacts were not regarded as problematic because they were not too dissimilar to existing tools and techniques already in use. In these instances, the knowledge was less resident in the tools themselves than in the information and documents they contained. As discussed in Section 7.3.3, and based on the data in Table 6.10, the broadening of the analysis beyond the primary (physical) level of artifacts and the widening of the analysis beyond the delivery team (Community node) revealed that information transparency and data sharing were more problematic than the use of the agile tools and artifacts themselves. In terms of culture and overall approach, tertiary level artifacts caused some division with some individuals embracing them and others rejecting them outright. The latter led to a reluctance to letting go of existing practices and subsequently to varying levels of adoption of large-scale Agile practices.

The identified collaboration and co-construction events were regarded as evidence of creativity and individual agency (Section 7.2.4), but these were not evident on a widespread basis. They followed the same pattern as contradictions but were substantially fewer. At the quaternary level, there was much more evidence of collaboration and co-construction, reflecting the Delivery Managers' attempts to engage with External Departments and SBUs to pre-empt future difficulties with the interface with the delivery programme.

A fourth point of development was the establishment of the concepts of local and external contradictions. These related to elements of the diversity of power and interests that took place. External contradictions occurred predominantly within the Community node perspective at the secondary contradiction level relating to the Rules & Norms intermediating node. The establishment of these external contradictions at the secondary contradiction level and presented in Table 6.11, identified a wide range of influences that were external to the activity that the Delivery Team were engaged in, as

discussed in Section 7.2.6. Most external contradictions related to the Delivery Managers group fitting with their position at the nexus of multiple practices and interfaces. This group experienced differing interests advanced by other departments and SBUs leading to problems with advancing the D/STP. The external contradictions revealed a substantial level of influence from External Department and SBUs within the Governance and Support (G&S) activity. These influences were predominantly driven by legacy command and control structures and interactions that had been routinised interactions, and served to hamper the developing large-scale Agile practices of empowered and self-organising teams.

Overall, the creation of the CATF with its definitions of generic activities, its adoption of Cash et al.'s (2015) hierarchical structure, the use of Mwanza's (2000) simplifying sub-triangles, the incorporation of collaborative activity and congruences linked to contradictions, the definition of external and local contradictions and the inclusion of different levels of artifacts all represent an endeavour that attempts to bring together different perspectives of AT, and represents a practical and methodological contribution.

8.2.2 Implications for Agile maturity assessment

While many authors have defined their own groupings of Agile activities, the generic set of large-scale Agile delivery activities deployed within this study is derived from a re-appraisal of Agile principles. It is intended to be logical and consistent when compared with a large coherent set of Agile maturity models (Appendix F). In addition, the activities can be further disaggregated to identify tasks and artifacts within each activity. While some of these will cross boundaries to be present in multiple activities, they mostly reside in one activity.

The value of defining such activities is that they should facilitate a consistent approach to the analysis of any large-scale Agile method-based endeavour. Whether considering a small Scrum team or a large SAFe implementation, all Agile endeavours should have practices and tasks that can be allocated to one of these generic activities. The generic set of activities should facilitate a more detailed categorisation of events and occurrences, and their comparison and evaluation. Indeed, their wide applicability potentially makes them suitable for comparisons across multiple organisations, thus

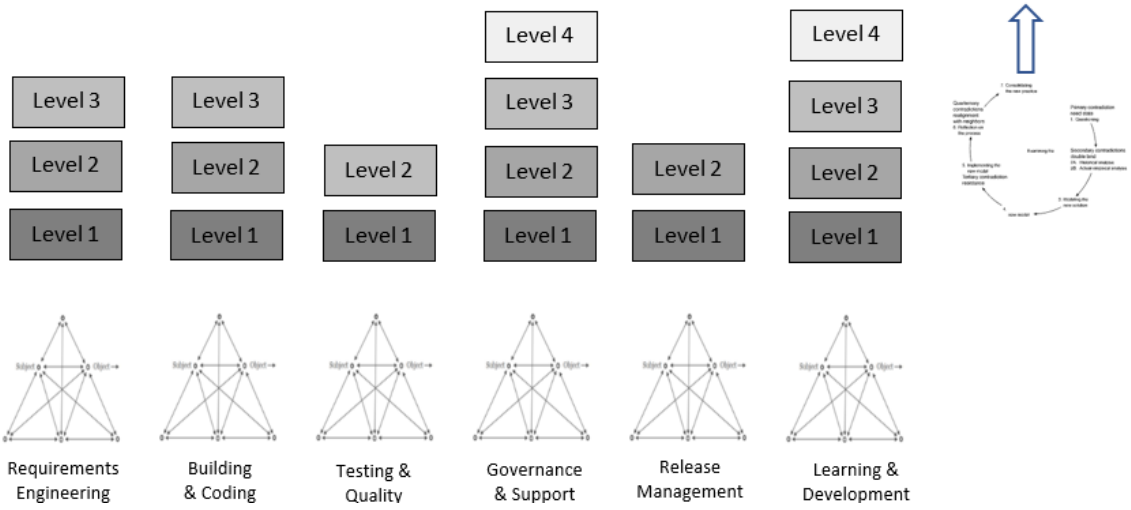
providing a form of measure. The CATF's analytical approach is founded on the establishment of these generic large-scale Agile delivery activities.

The CATF eschews a focus on the assessment of Agile capability through the presence or absence of Agile practices, and associated discussions relating to the make-up and constitution of Agile maturity and capability. Instead, the focus is on identifying the deep-seated impediments to organisational learning and development of large-scale Agile practices. In this context, the identification of large-scale Agile practices becomes less prominent. Instead, it is the transition between levels of attainment of large-scale Agile practices that becomes the focus.

Whether these Agile practices are additional ones or whether they represent more 'mature' versions of existing ones (Lui & Chen, 2005) is irrelevant. Necessary organisational learning and development processes will still occur, and obstacles to learning will greatly influence the deployment of large-scale Agile practices. This will ultimately reflect large-scale Agile delivery capability. It is this matter that the CATF aims to brings to attention, both as a diagnostic tool, and as a means of gathering insight into the expansive learning cycle as organisations learn and deploy new practices. This is a generic capability: it is applicable whether organisations are implementing large-scale Agile practices for the first time or whether they are transitioning through different levels of large-scale Agile delivery capability.

This is illustrated in Figure 8.3 which shows each of the six defined large-scale Agile activities along with levels or states of large-scale Agile practice capability. The circle and arrow to the right represent the expansive learning cycle (Figure 4.7) that occurs as organisations transition between the different levels of large-scale Agile practices (however they may be defined), for each generic Agile activity. By avoiding the prescription and entanglement of large-scale Agile practices and focussing instead on the difficulties and issues with their organisational learning and development, the CATF avoids common critiques of Agile maturity models such as their focus on practices and the order or combination they set out around the definition of Agile maturity (Gren et al., 2015).

Figure 8.3: Expansive learning between maturity model levels (adapted from Sowden et al., 2010, p.9)



The CATF itself, potentially, has a form of 'maturity level' represented by contradiction levels. However, the levels vary in detail and the depth of analysis that is possible, in that secondary contradictions dominate the analysis. The levels represent an increasing dissemination of issues related to the organisational learning and development of large-scale Agile practices, starting at a delivery team level, then moving wider to include other stakeholders together with the challenges facing the establishment of new large-scale Agile practices. These new practices are then considered in terms of their interaction on neighbouring activities, whether they are part of the delivery programme or further afield within the organisation.

It had been intended that, through an examination of the different expansive learning actions, these maturity levels would be decomposed into further meaningful levels, to provide greater detail about expansive learning processes. However, difficulties with discretely defining each expansive learning action, and their roles and positions within the expansive learning cycle prevented this.

A feature of the CATF is in the resolution of situations where prescribed practices vary from the practices actually undertaken (Korsaa et al., 2013). Such discrepancies shed some light on the difficulties that arise when adopting otherwise successful practices. Maturity models that focus on documented practices, rather than on work actually undertaken can overlook these issues. Improvement can be compromised as there is little awareness of actual practices. The Practice Theory perspective would suggest that each organisation's, cultural and historical context has a part to play and that it is not

possible to specify which improvements will be necessary. This is because each situation is different, and individuals will do things in their own way (Barthelmess & Anderson, 2002). The CATF elements of contradictions, collaborative activity and congruences can be indicative of the discrepancies between prescribed and actual practices.

There may be an apparent contradiction where the use of a Practice Theory approach such as AT is proposed but when the approach is then extended into a form of a large-scale Agile capability assessment, the detailed definition of practices and tasks is absent. This is resolved by regarding practice theories as simply foregrounding the importance of practices and the performance of work and tasks instead of specifying what they should be (Nicolini, 2013).

Finally, in relation to Maier et al.'s (2012) guidance regarding the development of maturity grids, the CATF adheres to most aspects of the guidance and may be regarded as a 'meta' maturity model in that it acquires information on impediments to organisational learning (of large-scale Agile practices). The CATF has a clear audience of Agile practitioners and those involved in organisational learning and development. The scope of the CATF covers the six generic Agile activities that have been discussed above but, through the definition of other domain specific generic activities, the CATF may potentially be extendable to other domains.

8.2.3 Implications for organisational learning

This research has uncovered some deep seated organisational and management attitudes that were impediments to developing and adopting large-scale Agile practices. These attitudes were not necessarily associated with resistance to learning to use the Agile artifacts themselves. Instead, they related to the attendant increased transparency and visibility which some individuals found difficult. These issues created by the Agile tools, challenged the conventional practice of some Delivery Managers who had not been used to organisation-wide scrutiny. Other groups, such as the Delivery Personnel, had fewer reservations, instead appreciating access to wider information.

Within Health Care Org. there was a substantial reliance on internal volunteers to drive the changes leading to some individuals undertaking substantially increased workloads. As a response to the introduction of large-scale Agile methods, some took it upon themselves to seek out requisite training and mentoring. The Agile way of working was

a substantial motivator that attracted these volunteers. Conversely, others were reluctant to let go of existing practices, viewing the large-scale Agile methods of the D/STP as something of a 'cult'.

There was also significant hindrance from external functions not directly involved in the delivery of the D/STP. Despite early initiatives by the Delivery Managers to address these issues, there was only limited success. This led to the conclusion that it is important that all interfaces to the change programme must commit to changed ways of working, i.e. partial changes will eventually stifle progress.

Some senior managers adopted the perspective of using the newer large-scale Agile approaches in conjunction with existing practices, in a 'horses for courses' approach. Although this somewhat unusual approach was presented as a rational strategy it reflected a reluctance to completely abandon the 'big design up-front' waterfall approach. There was no consideration of intermediate options such as PRINCE2 Agile or Agile PM which would have provided the governance and compliance elements that were sought. Instead, the tertiary contradiction sub-text was that Agile would soon be abandoned and normal service could then be resumed.

Examining the change from a process-centric to a people centric perspective, secondary contradictions within the CATF were the most informative. This examination showed that Delivery Managers were at the focus of events due to their interconnecting roles. As demonstrated by the high level of secondary contradictions, Delivery Managers had difficulty with implementing the people centric perspective. This points to a discrepancy between the large-scale Agile practices prescribed by the D/STP and those that were actually employed. This also highlighted the less than optimal practice of charging individuals with the delivery of different components of different projects simultaneously. This aspect contains an inherent contradiction with the Agile practices of building coherent self-organising sustainable teams.

Investigation of secondary contradictions also identified that the demographic profile of some staff was a key obstacle to the uptake of Agile practices. Secondary contradictions are indicative of difficulties in understanding and applying practice knowledge, and in accessing the knowledge embedded within the six generic Agile practices. The presence of staff with decades of tenure and thus only a few years to retirement, was regarded as an inhibitor to the uptake of new approaches to delivery. In a related aspect, the

demographic profile of staff was also a reason for fewer conflicts and frictions between teams due to long term relationships between staff and hence trust and awareness amongst them.

The public sector and clinical cultures were frequently identified as a brake on the adoption of new change initiatives. This culture was viewed as an extreme risk aversion or 'paternalistic' perspective held by the organisation. There was requirement for all aspects of delivery, such as functionality, direction, and funding to be approved and cross-checked by senior management. This was accompanied by the requirement to demonstrate a return on investment for project expenditure linking benefits with costs. These legacy governance and compliance requirements were regarded as further impediments to the intended swift delivery of projects. They are also evidence of senior management's reluctance to relinquish authority and the adoption of new practices of delegation and empowering teams as required by Agile practices.

From an organisational and environmental perspective there was evidence of lack of engagement from other business functions. In many instances this was attributed to business functions that operated within silo structures undermining the fundamental Agile imperative of collaboration. A historical reason for this lack of engagement was the propensity for the organisation to continually trial, adopt and then abandon new initiatives. The perception was that Agile approaches were yet 'another new initiative' that would soon be discarded providing little incentive for individuals to learn new approaches and incorporate them into their work practices. This disincentive would be compounded by the demographic profile of staff as discussed above.

These elements show that there was partial progress with the implementation of Agile methods in terms of actual practices. There was also progress with the cultural and social aspects that are instrumental in Agile practices working correctly. The structured and progressive use of the CATF approach focussing on the learning and development aspects complements more traditional approaches to assessing Agility that use long lists of success factors and challenges. Such approaches tend to have little success beyond the confines of the individual organisations and the anecdotes from which they were derived.

The analysis conducted here partially addresses Gren et al.'s (2015) view that Agile is more than just practices and that some form of cultural assessment should be

considered. While this research does not address their notion that social psychological measurements would be useful for assessing the use of Agile practices, it does identify the cultural and behavioural aspects that can hamper their use.

The usefulness and usability of the CATF rests on its definition of the six generic activities, the Standard Question Set and its ability to identify contradictions, collaborative activity and congruences. These elements serve to illuminate areas for attention for organisations. The utility of the approach draws on its ability to surface deep-seated organisational behaviours underpinning the main challenges facing organisations implementing Agile delivery methods.

The above analysis indicates the deep seated issues that help to dispel the illusion of rational practices that are promulgated by the rationalist-functionalist perspective of the delivery of projects. The practice based approach reveals a richer understanding of actors, and of the problems they face when deploying new practices requiring significant efforts to resolve contradictions. The focus on cultural, social and behavioural obstacles to learning and development of large-scale Agile practices is in accord with Cockburn & Highsmith's (2001, p.5) view that "people trump process".

The Practice Theory approach reveals several issues (RQ1) that might have remained hidden. This approach is comparable with other approaches (RQ2) in providing awareness and understanding of the problems that organisations face when implementing large-scale Agile approaches. The research has constructed and applied a consolidated version of AT (RQ3) which provides a scalable, consistent approach.

The approach facilitates an alternative, complementary perspective on the difficulties in implementing large-scale Agile methods, providing a set of principles and vocabulary that foregrounds practice, routine, habits, and artifacts, as opposed to practitioners, their knowledge, and organisational concepts. This approach regards large-scale Agile methods as being collections of interconnected practices carried out simultaneously. This approach provides a more-nuanced analysis of the changes organisations undergo when implementing large-scale Agile methods, by examining the use of tools, the organisation of labour and the underlying rules and norms that affect the take-up of large-scale Agile methods.

An attribute of the CATF is its analytical and progressive structured approach. This contrasts with the more cataloguing and anecdotal approaches to problems related to

the implementation of large-scale Agile methods. The CATF based on Practice Theory can provide an understanding of the problems and their constituent elements. Such explanations are based on the historical and cultural underpinnings of problems, current forms and how this points to their development.

A further feature is the focus on the organisational aspects, in terms of the Rules & Norms and Division of Labour intermediating nodes. These areas receive relatively less attention within the IS literature: where the focus is mostly on technology, tools, and artifacts and the HCI interface. In addition, while the practice approach may be regarded as a combination of several approaches (Nicolini, 2013, p.9) this research has suggested a consistent, repeatable method for the deployment of the AT based branch of Practice Theory.

The main theoretical implications of this research relate to the construction and development of the CATF and its potential application in a wide variety of environments. The CATF, as presented, is applicable to any large-scale Agile delivery environment. Its extension into other domains requires the identification of domain specific, generic activities and their corresponding tasks. Thereafter the Standard Question Set may also need some modification and re-orientation. Once these developments have been achieved, the CATF should be capable of being applied in other contexts. Within the IS/IT context, the CATF explores elements that extend beyond an artifacts and materiality context into wider organisational realms that include the revelation of actual work and efforts and considerations of interest and power.

The main practitioner implications are the changed focus away from practices relating to large-scale Agile methods and their assembly into multiple or optimum configurations (maturity levels). Instead the focus is on the impediments and obstacles to the organisational learning of the practices of large-scale Agile methods. These impediments to learning are likely to be generic, deep-seated, wide-ranging and fundamental to the adoption of a new method. The highlighting of these obstacles should focus attention on specific problem areas which, if addressed, may impact the transition and acceptance of the new method.

8.3 Research Limitations

The breadth of this study and the development of the CATF represents perhaps both a strength and a limitation. The D/STP was a very large programme lasting two years. However, time and resource availability, restricted sampling and hence limited data obtained, means that the analysis can only relate to specific instances within the programme. Nevertheless, this should not diminish its value because the CATF was able to address a wide variety of elements as well as representing a targeted diagnostic tool.

Of the individuals interviewed (30) a large proportion (20) were senior staff. Consequently, the results were heavily distributed towards the Governance and Support (G&S) and Learning and Development (L&D) activities. This was regarded as a strength because these individuals were very knowledgeable and were able to provide wide-ranging perspectives. This explains the focus on contradictions taking place at senior levels, whereas contradictions within the team might have been overlooked or regarded as less significant.

A consequence of the lack of opportunities to interview developers and testers was that there were very few events related to the Building and Coding (B&C) and Quality and Testing (Q&T) activities. This is disappointing as contradictions at this technical level might have yielded further insights. For a software development organisation this would have been crucial, but this is less significant given the focus is on the adoption of a large-scale Agile delivery method for a change programme of the size of the D/STP. More evidence from events based around the Subject node, particularly involving the Rules & Norms and Division of Labour intermediating nodes, would have yielded further insight at the technical level.

Another limitation relates to the focus on co-operation and co-construction collaborative activity and the omission of the co-ordination aspect. This was based on the lack of indication of progress within the expansive learning activity, however inclusion of these events could have aided understanding of the interfaces between teams and other parts of the organisation. It may well have aided further understanding of the secondary and quaternary contradictions. Additionally, the focus on expansive learning actions was not able to provide a further level of analysis of the expansive learning cycle: the definitions and descriptions involved were not sufficiently distinct and discriminating to be applied to the data.

The definition of activities was restricted to the D/STP. The objectives of other non-delivery focussed activities within the organisation such as procurement and HR, could have been included in the analysis. Further research in this area would allow more accurate identification of the tensions and frictions between the different activities and their impact on the different managers' behaviours.

Another omission within this study was the absence of data which could have provided further insight into other elements of Practice Theory (Nicolini, 2013) particularly the materiality of artifacts and views of knowledge embedded within practices. Had there been more interviewees within the case study engaged in the Building & Coding (B&C) and Testing & Quality (T&Q) generic agile activities, then these issues might have been able to be explored further.

Although the CATF provides an alternative perspective beyond the list-based and anecdotal approach, it requires a significant level of interpretation to be able to identify these factors and therefore is likely to remain within the complementary analytical domain occupying a significant niche as a secondary level of analysis.

Overall the CATF is heavily skewed towards secondary contradictions in its approach and although this is recognised in the literature (Groleau et al., 2012; Bonneau, 2015), it does not have the consistent steps of assessment that conventional maturity models present and consequently lacks the consistent prescriptive guidance and direction that practitioners might expect.

8.4 Directions for future research

The most important further research activity would be to apply the CATF in a smaller change environment, probably involving extensive software development. This would allow the full range of generic activities to be explored, especially Building and Coding (B&C) and Testing & Quality (T&Q). This would allow more comprehensive research, providing detailed insight at a more technical level as well as insights into intermediating nodes related to the subject (team) node. This could also facilitate a more granular analysis that would enable the identification of specific large-scale agile practices and tasks.

A secondary initiative could address whether the applicability of the CATF could be increased by adapting some of the structured interview questions to an online format to supplement the interview approach and make the process quicker and more accessible.

Further work could re-examine the definitions of the expansive learning actions, determining whether they can be modified to further assist with understanding the expansive learning cycle. As well as providing clearly defined levels of expansive actions, further research may also examine the potential to further deconstruct the tertiary and secondary level contradictions.

Further work could also examine the inclusion of four types of contradictions in organisational change efforts using linguistic cues (Engeström & Sannino, 2011). These four types – Dilemmas, Conflicts, Critical Conflicts and Double Binds may provide a different perspective.

Further work could also present the results of this study to senior management at Health Care Org. to determine whether this analysis provides useful lessons, particularly in the light of their propensity for new initiatives. In addition, it would be useful to determine whether these results are 'actionable' in the sense of providing a basis for any form of remedial action.

Finally, on a cautionary note, Maier et al. (2012, p.155, quoting Andersen & Jessen, 2003) conclude that by identifying so many perspectives and measures (not just processes) contributing to maturity, it may well be the case that maturity assessment will perhaps "always be more subjective than objective".

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Appendix A: SPPMG survey results

Data was collected from a Scottish Project & Programme Management Group (SPPMG) event held on the 25th of April 2017. There were a variety of participants at different stages of Agile delivery, who had different roles within their organisations and had different motives for attending the event. They were also utilising different Agile methods. Forty-three of these people responded to the questionnaire described in Chapter 3. Data from this is presented in Figures A.1 to A.4

Figure A.1: Job roles and responsibilities of survey participants

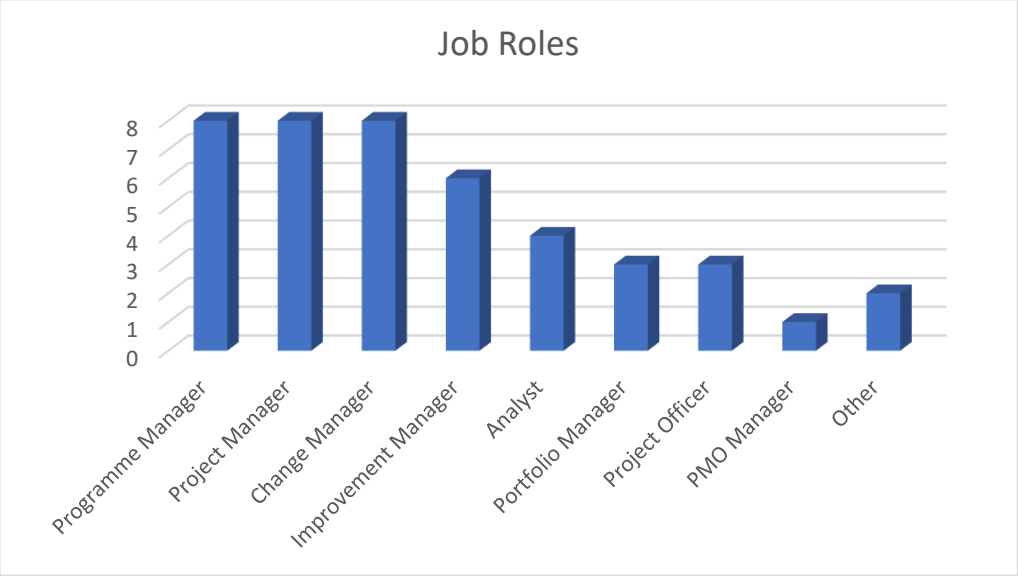


Figure A.2: Reasons given for attending the session

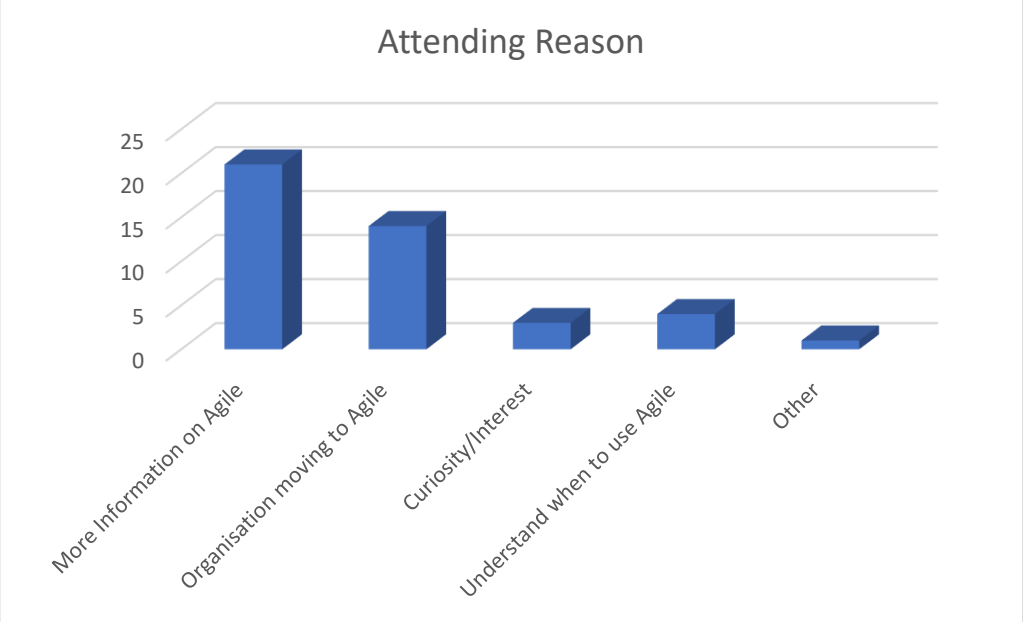


Figure A.3: The Agile method that the participants used

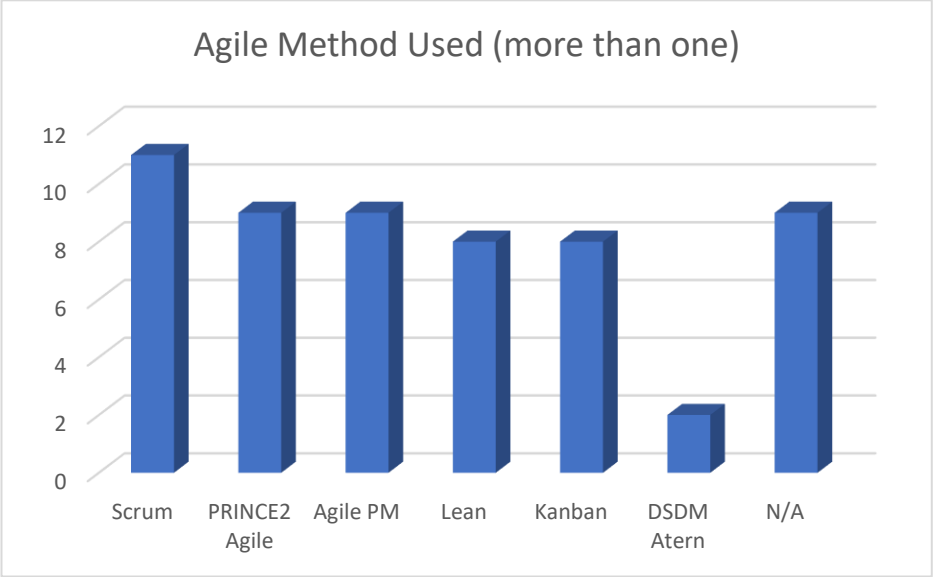
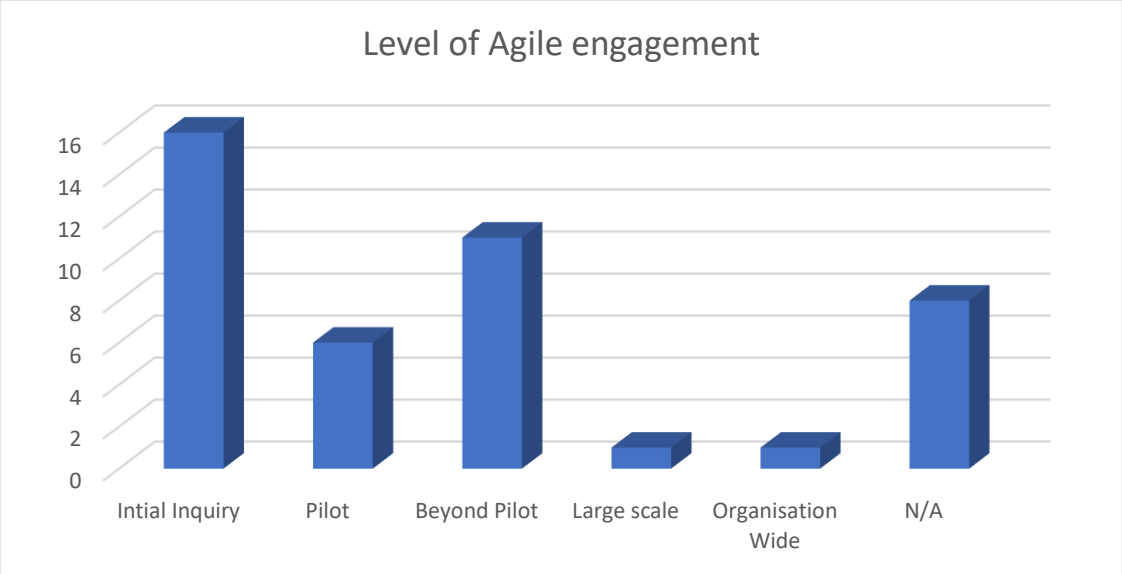


Figure A.4: Different participants stages of Agile engagement/delivery



Participants were asked to identify the organisational obstacles and facilitators to Agile progression that they had experienced. Results are detailed in Figures A.5 and A.6 below.

Figure A.5: Obstacles or issues that the participants identified as hindering their progression towards Agile delivery: (participants selected their top three)

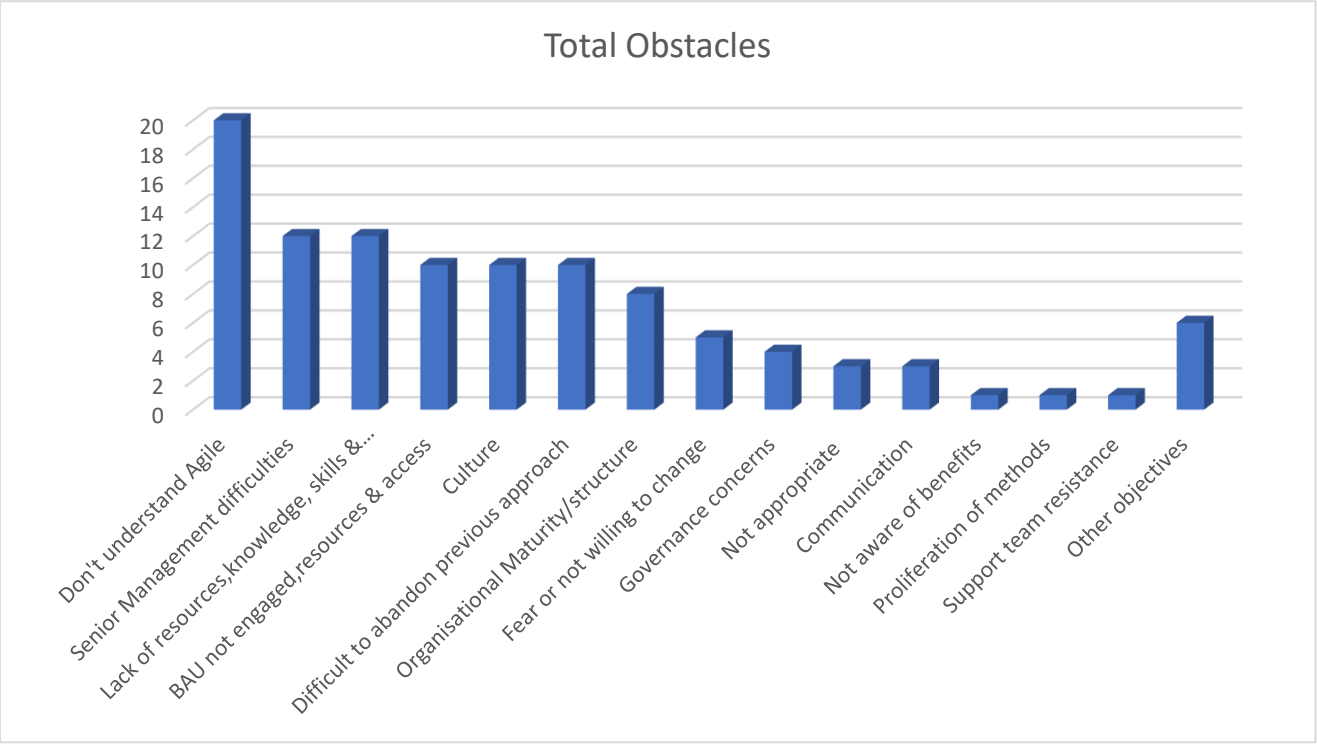
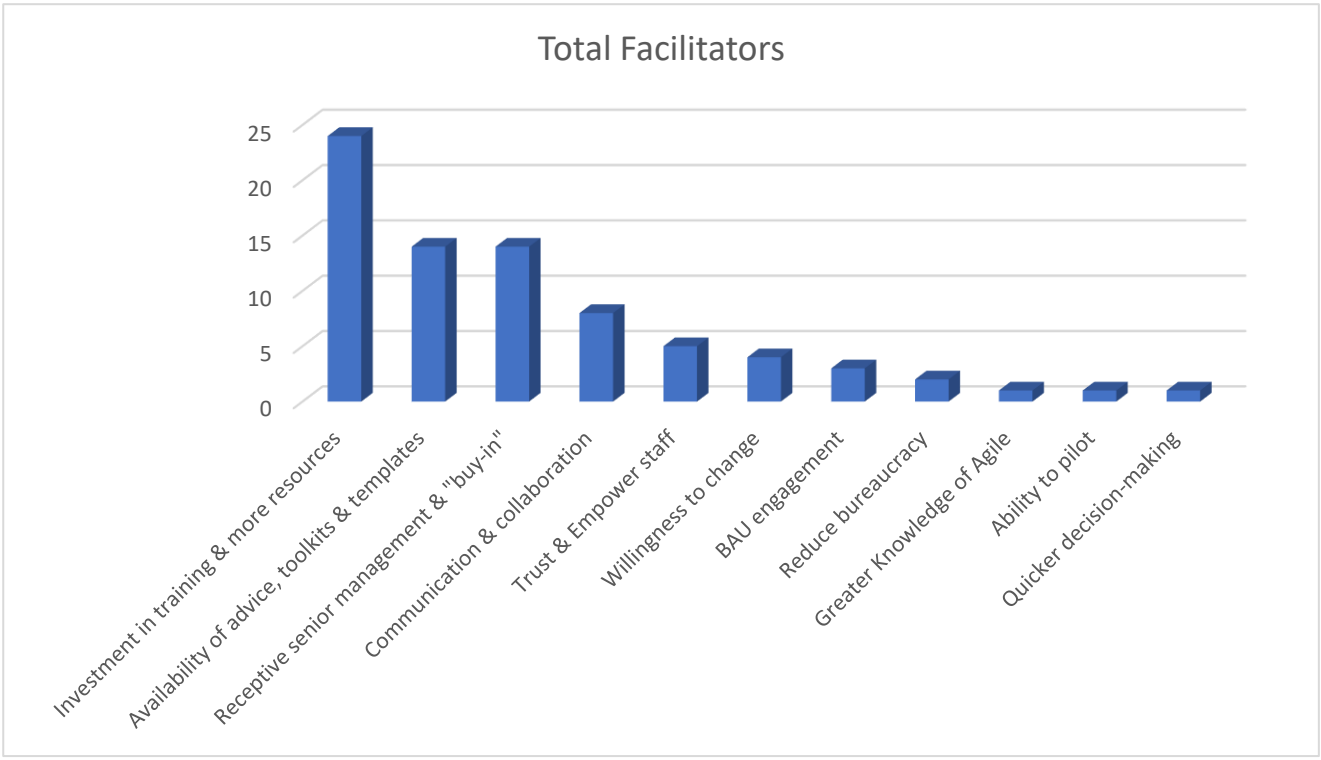


Figure A.6: Facilitators or factors that the participants identified that would assist in their progression towards Agile delivery: (participants selected their top three)



Appendix B: Activity levels applied to Agile delivery

Table B.1: Hierarchical decomposition levels: Action

Based on Cash et al. (2015), drawing on Bedny and Karwowski (2004) and Bedny and Harris (2005)

Characteristics	Deconstruction and expansion
Action definition (a) The discrete parts of a task that fulfil intermediate conscious goals (b) Is identified in relation to the completion of specific sub-goals required to complete a task (c) Corresponds to lower-level elements that are linked over time.	
Discrete parts of a task	The term 'discrete' indicates some form of bounded, distinct, and separate element. Therefore, it should be identifiable as something separate. Engeström & Sannino (2010) indicate that an action has a definite beginning and an end.
Intermediate conscious goals	Conscious indicates the level above operations, where the action is knowingly undertaken rather than being done subconsciously. Therefore, this level takes place above subconscious elements. Examples include riding a bike or changing gear whilst driving a car.
Completion of specific sub-goals	Must be linked to the achievement of something, so is a constituent part of something bigger.
Correspond to temporally linked lower-level elements	This implies the inclusion of lower-level elements that are linked over time. In this case it might be writing text on paper or typing a paragraph on a computer. It does indicate some sort of progression of a sense of moving forward over time so that it constitutes a part in the development of something over time.
Cash et al. (2015) Example	Recording a single idea on a whiteboard as part of a brainstorming exercise.

Software development examples	Recording a software development task on a Kanban Board would be similar, as would perhaps moving a task from the 'doing' column to the 'completed' column.

Table B.2: Hierarchical Decomposition Levels: Tasks

Based on Cash et al. (2015), drawing on Bedny and Karwowski (2004) and Bedny and Harris (2005)

Characteristics	Deconstruction and expansion
Task definition (a) "A logically organised system of actions required to achieve a goal under specific conditions" (b) Is identified in relation to "the completion of specific goals and corresponds to a number of temporally linked actions". The goals are aligned with the motivation of the associated activity as well as across related tasks.	
Logically organised system of actions to achieve a goal under specific conditions	The key words here are 'organised' and 'system', indicating that attention has been given to achieving the delivery of something
Relates to the achievement of specific goals	These goals occur at a higher level than the sub-goals that are addressed by the lower 'Action' level.
Corresponds to several temporally linked actions,	Similar statement to 'Action' above, but at a higher level where it is the actions that are the linked elements over time
Cash et al. (2015) example	The generation of ideas in a brainstorming session. The brainstorming session is the 'organised system' that contributes to a higher goal which is the development of a design concept.
Software development example	A task may well be the production of a backlog list of software development modules to be coded. Similarly, a task may also be running a retrospective session or a planning session.

Table B.3: Hierarchical Decomposition Levels: Activity

Based on Cash et al. (2015), drawing on Bedny and Karwowski (2004) and Bedny and Harris (2005)

Characteristics	Deconstruction and Expansion
Activity definition (a) "A goal directed system where cognition, behaviour, and motivation are integrated", after Bedny and Karwowski (2004). (b) Are identified in relation to 'An overall motivation' (c) Linked to 'A number of conceptually linked tasks'	
A goal-directed system	Self-explanatory
Cognition, behaviour and motivation are integrated.	Self-explanatory
Identified in terms of an overall motivation	This implies that this is the driving force for whole activity.
Associated with several conceptually linked tasks	Similar to above but at a higher level where it is the tasks that are the linked elements over time
Cash et al. (2015) example	Development of a new design concept
Software development example	Working from the previous levels, the logical order of the next level would be as follows: an activity could be engaging in planning activity. This would involve several conceptually related tasks such as running a planning session or an estimating exercise. This would allow several sequential activities, as discussed by Cash et al. (2015) to occur either simultaneously or consecutively.

Appendix C: Activity Theory methods and questions

	Originating Question and Source	Proposed Question/s	Comments
Korpela, 1997 - ActAD. According to Quek and Shah (2004), Korpela (1997) provides a framework for IS developers to analyse the sociocultural features that can inform the development of an IS. First step is to analyse components of the activity. The second step looks at surrounding activities. The third step looks at the development of the activity. The fourth develops new tools based on the step three.			
1	**Step 3 - History:** How has the activity emerged and developed to what it is now? Can you identify some phases or stages in the overall development?		
2	**Step 3 - Problems:** What kind of weaknesses, deficiencies and imbalances there are within and between each of the constituent parts analysed before? Previous parts are Step 2: 1A-5a: What kind of rules, division of labour, communications etc. apply between us so that each one's work contributes to a joint process? Step 2: 1A-6a: What kind of group are we – a closely related team working together all days, a hierarchical organisation or a group of people who work occasionally on the same issue but never meet? Step 2: 1A-7a: How would you characterise the way we are conducting the work as a whole – what is the spirit or 'custom of the house'? Step 2: 1B-4b: From whom do we get the tools and knowledge we need? How do they produce that? Step 2: 1B-5a: Who sets the rules for us? How are the rules generated? Where do we get the means we need to communicate with each other?		
3	**Step 3 – Potential:** What kind of strengths and emerging new possibilities there are within and between the constituent parts analysed before? What kind of a new mode of		

	Originating Question and Source	Proposed Question/s	Comments
	operation of the whole setup could be strived after? What would be the next desired staffed in the historical development of this activity. To achieve that stage, what improvements are needed in and between the various parts?		
Kaptelinin, Nardi & Macaulay, 1999 - Activity Checklist. According to Quek & Shah (2004) this framework aims to enable researchers to identify the contextual factors that influence the use of computer technology. Two versions (Design and evaluation) have four columns based on AT principles.			
4	**Means/ends (hierarchical structure):** What are the criteria for success/failure? Decomposition of target goals into sub-goals? Conflicts between goals? Conflicts between target goals, other technologies and activities Constraints imposed by higher levels goals?	'Target technology' will be taken to refer to Agile approaches. This could be referring to conflicts between Agile and other methods and other activities. (4th contradiction)	
5	**Environment (object orientation):** Role of target technology in producing the outcomes of target actions? Access to target tools? Division of labour and organisation of work? Rules, norms and procedures regulating social interactions and co-ordination related to the use of the target technology?		
6	**Learning (internalisation/externalisation):** Knowledge about the target technology? Where does it reside and how is it distributed and accessed? Time and effort to master the target technology? Level of self-monitoring and reflection that was conducted? Support and assistance for help and when break downs occur?		

	Originating Question and Source	Proposed Question/s	Comments
	Use of shared representation to support collaborative work? Individual contribution to shared resources of the group?		
7	**Development (Development):** Use of the target technology throughout the lifecycle? Effect of using the target technology on the structure of actions? Higher level goals that could be achieved because of the target technology? Attitudes to the target technology (resistance) and changes over time? Dynamics of potential conflicts between the target actions and higher-level goals? Anticipated changes in the environment and the level of activity they directly influence (operations, actions or activities)?		
Mwanza, (2001) - Activity Oriented Design Method (AODM), According to Quek & Shah (2004) this approach is intended to contribute to the early phases of systems development supporting requirements capture, analysis and design relating to HCI aspects.			
8	**Stage 1:** Uses the 8-step model (8 Questions) 1: What activity am I interested in? - *Activity* 2: Why is this activity taking place – *Objective* 3: Who is involved in the activity - *Subjects* 4: By what means are the subjects carrying out the activity – *Artifacts* 5: Are there any cultural norms, rules or regulations governing the performance of this activity? - *Rules* 6: Who is responsible for what and how are roles organised? – *Division of Labour* 7: What is the environment in which this activity s carried out? – *Community* 8: What is the desired outcome from carrying out this activity? *Outcome*		

	Originating Question and Source	Proposed Question/s	Comments
9	**Stage 2:** **Produce an activity system** of the situation being investigated. This apparently helps to identify areas that need to be focussed on during the investigation.		
10	**Stage 3:** **Introduce the Activity Notation** to aid the process of breaking down the situation's activity triangle system into smaller manageable units or sub-activity triangles. Use an Actor (Subject or Community) with a mediator (Rules, Artifacts or Division of Labour) and finally the Object.	This involves decomposing the activity into the sub-triangles that Mwanza uses. This is a prelude to the next step in answering.	
11	**Stage 4:** **Generate Research Questions**. These will be specific to a combination of the above. S-A-O: What tools does the subject use to achieve the objective and how? S-R-O: What rules affect the way the subject achieves the objective and how? S-D-O: How does the Division of Labour influence the way the Subjects achieve the Objective? C-A-O: How do the artifacts affect the way the community achieve the objective C-R-O: What rules affect the way the Community satisfies the objective and how? C-D-O: How does the division of labour affect the way the community achieves the objectives?	S-A-O: How do Agile methods/tools/techniques help to deliver projects? S-R-O: How do behavioural norms and working practices help to deliver the project? S-D-O: How do job allocations and roles affect the way the project is delivered. C-A-O: How does Agile methods influence the way the whole organisation (SAFe) delivers projects. C-R-O: How do organisational management practices influence the delivery of Agile projects. C-D-O: How does the organisational roles and responsibilities influence project delivery – Agile coaches etc.	
12	**Stage 5: Conduct a detailed investigation** based on results from Stage 4 which are questions used as pointers as to what to look for in observational studies, questionnaires and interviews.	Analyse and identify possible contradictions with the help of the previous questions. Contradictions are just the beginning for further analysis.	

	Originating Question and Source	Proposed Question/s	Comments
13	**Stage 6: Interpret Findings** Data is analysed and interpreted in terms of AT's notion of Contradictions.		
Jonassen & Rohrer-Murphy, (1999) - Framework. According to Quek & Shah (2004) this framework relates to the design of Constructive Learning Environments (CLE). It consists of six steps where each is divided into sub-steps. As Quek & Shah (2004) note, there are a lot of questions. Interestingly they state that the level of granularity is not always clear.			
14	**Step 1: Understand the context of the activity and who is involved**. Generate a list of prioritised problems execs face – also where and when What are the subject's motives and goals? What are the expectations of them and who sets these? What factors contribute to the dynamics of the activity. Understand overall factors and contradictions that affect the activity. Outcome: Information gathered here will guide the definition of the problem space.		
15	**Step 2: Analyse the activity system. Each component of the activity is examined.** Who are the participants in the activity and their role and implied rules? What criteria are used by the community to evaluate the success of the activity? What struggles had to be overcome to reach the current state and maturity? What are the goals and motivations and rewards of the subjects? What are the social interaction structures within the group? How will successful completion of the activity fulfil individual's goals. Outcome: is a description of all aspects of the activity.		

	Originating Question and Source	Proposed Question/s	Comments
16	**Step 3: Decomposition of learner's activities into actions and operations** Probably not needed here. Outcome: A description of the activities, actions and operations. In my case activities, tasks and actions.	This justifies my own approach. Authors quote Kuutti (1996) who say that the same actions can be part of other activities. This again agrees with my approach. Authors state that according to Leont'ev (1978) all operations can be automated. Going back to their examples of operations it's not clear how they could be automated – so there's a problem there (reviewing applications and engaging in small talk for a counselling activity)	
17	**Step 4: Elicit the tools and mediatory means that can be deployed within the activity.** Important to analyse mediators and their transformation over time gives important historical information as to how and why activities exist. Most common mediator is the tool which often represents an 'off-loading of cognitive responsibility' from the subjects (Gantt chart). Most common tool is the computer these days. What tools are used, how have they changed and how available are they? How are they used across different 'settings' and activities? What models, theories and methods will guide this activity? Are they mandated or is their use flexible? What formal/informal rules/laws/assumptions guide the activities? How have they evolved and how well understood are they? Who traditionally assumes what roles? How does this affect the activity? What forces drive the role changes? **Outcome:** Mediators describe how things (tools, rules, labour) constrain and affect activity.	Authors state that the subject, community and object elements do not act on each other. Instead, they are mediated by artifacts, rules and labour divisions. This supports my adoption of Mwanza's sub-triangles. So, Agile is a tool. So therefore, the focus is on these tools. These rules and norms are organisational practices.	Could adopt this intent and outcome process for this study.

	Originating Question and Source	Proposed Question/s	Comments
18	**Step 5: Analyse the context and sub-steps that guide the community, rules and norms, division of labour elements in the community.** What are the beliefs, assumptions models and methods that are commonly held? What tools did they find (un)helpful in the activities? How willing are they to use them again? What is the social interaction structure in the activity? What limits are placed on the activity by the organisation? How are tasks allocated/divided and shared? Is there a difference in implied and actual rules and roles? What informal/formal rules and assumptions guide the activity? **Outcome:** A description of the problem context which will make obvious the kinds of conversations and collaboration tools required to support the activity. Also what other individuals are involved in the activity.	Interesting point about the value of AT. Authors note that traditional methods of (task analysis) focus on only the technical core of performance ignoring the real-life non-instructional contexts within which the activity takes place. Activity both is defined by context and also defines context. People will consciously create context through their own objects (objectives).	Context is both internal to people (objectives) as well as external (artifacts, rules and community).
19	**Step 6: Analyse the interaction and rules for the relationships that exist within and between the components of the activity system and how they affect each other**. What are the dynamics between the difference elements of the activity? How formal/informal are the relationships described? Are their contradictions between the needs of the people and the delivery of the project/activity? How do people perceive the objectives regards their own individual success and the how to achieve it? What are the drivers for change and how lasting is it? What factors drive the formation of work groups and how permanent and lasting are they?	These points need to be considered.	

	Originating Question and Source	Proposed Question/s	Comments
	What factors kept the work group together? **Outcome:** Linking the different components of the activity together. So the different parts of the problem space are linked together.		
Martins & Daltrini, (1999). According to Quek & Shah (2004) this approach for requirements elicitation consists of three steps. The framework focusses mainly on the hierarchical decomposition principle - activity, action and operation.			
20	**Step One**: Identify the procedures performed in the system that could be classified as activities		
	Step Two: For each activity identify the different elements (subject, tool etc)		
	Step Three: Decompose the activities into actions and operations	Perhaps not the most appropriate elements for this study.	

Appendix D: Standard Question Set

Numbers in last column (Comment/Source) relate to numbered rows in Appendix C.

	Area	Question	Comment/Source
What's the Activity?			**Show Page 1: Six/seven triangles**
1	The Activity?	What is the activity you are engaged in, its scope and why does it happen?	1; 8; 18
2	History and origins?	How did it develop and evolve (struggles) and what are the drivers for the change to using Agile?	1; 8; 18
What are the Outcomes /Objectives?			
3	Scope?	What is the desired outcome of the activity?	18; 8
4	Success criteria?	What are the criteria used by the organisation to determine success or failure of the activity?	4/15
Who are the Subjects/Team?			
5	Who?	Who is involved in the activity and what are their responsibilities?	2; 8
6	Working environment?	How do you go about your work and communicate within your team? (openness, sharing, learning and experimenting, flat structure, hierarchical)	2; 8

	Area	Question	Comment/Source
7	Subject's motivations and goals	What are your motivations and goals and how does the activity help to achieve them?	14/15
8	Subject goals and other's goals?	Are there any contradictions between you and team needs and delivery of the project/activity?	19
9	Group cohesiveness	What factors kept the team working together?	
Division of Labour:		**Show Page 2: Circle diagram (logical given previous focus on activity subjects**	
10	Who and their roles?	How were the roles organised/allocated/divided/shared?	8/18
11	What affected role formation	What factors drove role formation and changes and how lasting were they?	17
12	Roles and achieving objectives?	How do the allocated roles influence the way the team achieved the objectives? (S-D-O)	11/17
13	Actual and implied roles	Is there a difference in implied and actual and roles?	18
The Artifacts used in the Activity?		**Show Page 3: Tasks and artifacts table.**	
14	What Agile approaches?	What specific Agile approaches were used, how have they changed?	17

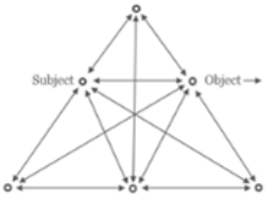
	Area	Question	Comment/Source
15	How did they help to deliver?	How did the Agile approaches help to deliver the objectives of the activity?	5
16	Mandated or flexible?	Were Agile approaches mandated or was their use flexible?	17
17	Previous knowledge?	What previous knowledge did you have about Agile approaches?	6
18	Time and effort to master?	How much time and effort was involved in mastering Agile approaches?	6
19	Support and assistance?	What level of support and assistance was available and provided for Agile approaches?	6
20	Changes to ways of working?	Did Agile approaches change the way you structured your work/actions and achieve your goals?	7
21	Best and worst Agile approaches	What Agile approaches did you find particularly (un)helpful in the activities?	18
22	A changed attitude to Agile?	Did your attitude to Agile approaches change over time?	7
23	Use them again?	How willing would you be to use these Agile approaches again?	18
Rules & Norms?			**Back to Page 2: Circle diagram**
24	Rules and norms in the activity?	Are there any cultural norms, rules or regulations governing the performance of the activity?	8/11/5

	Area	Question	Comment/Source
25	Who sets them?	Who sets the rules and how are they generated?	2
26	Informal Rules & Norms	Are there any informal, unwritten rules, beliefs or assumptions that guide the activity?	17/18
27	Origins of informal rules	If so - how have they evolved and how well understood are they?	17
28	Rules and Norms	What rules/norms and social interactions and co-ordination exist regards the use of Agile approaches.	5
Community - Organisational Context and Challenges			**Show Page 4: Two circles diagram**
29	Background to community	What are the major problems (prioritised) that senior management (organisation) face?	14
30	Rules and norms of Community.	What rules/norms affect the way the Community satisfies the objective and how? (C-R-O)	11
31	Limits?	Are there any constraints or limitations imposed on the activity by higher level goals?	4
32	Outcome conflicts?	Are there any conflicts between organisational, team and individual goals/outcomes?	4
33	Roles and allocation community	How do role allocation and work groups affect way the community achieves the objectives? (C-D-0)	11
34	Community	How do Agile techniques affect the way the community achieve the objective? (C-A-O)	11

	Area	Question	Comment/Source
35	Did it all 'hang together'	Strengths and merits of roles, artifacts and labour division within the activity and their dynamics	3
36	Formal/informal aspects	How formal/informal are the relationships described?	
37	Activity improvement	What improvements and new modes of operation are needed in various parts of the activity?	3

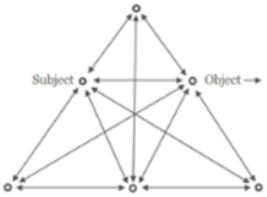
Appendix E: Interview diagrams and tables

Page 1: Agile Activities



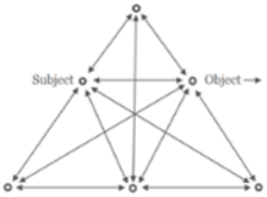
Requirements Engineering

Testing & Quality



Coding & Building

Release Management



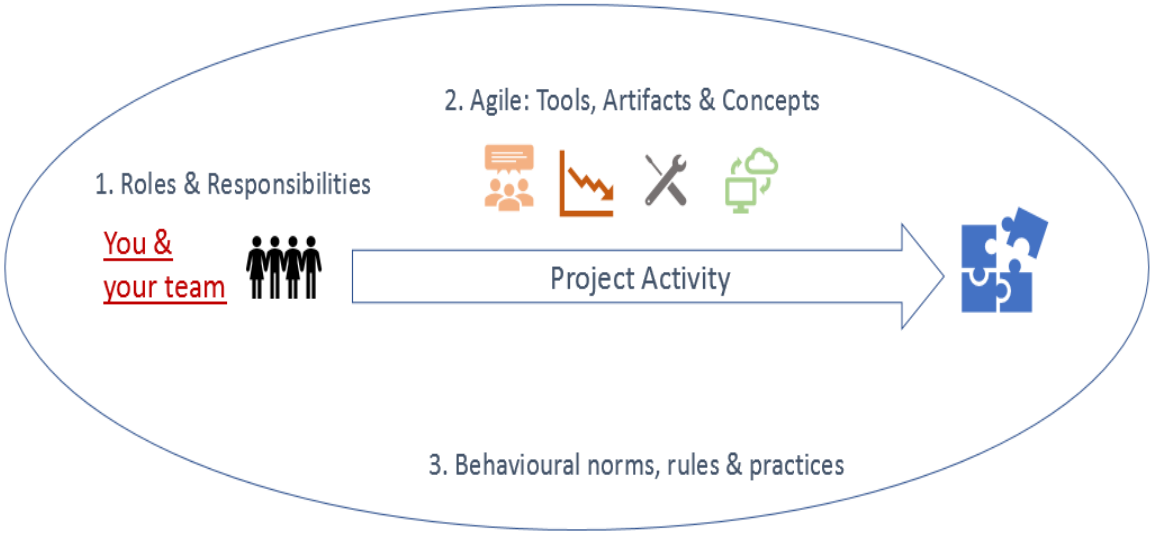
Governance & Support

Learning & Development
main

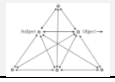
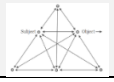
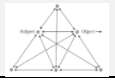
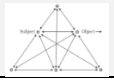
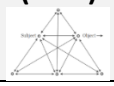
Other

Activity Name	Contents and Tasks
Coding & Building	Frequent iterations, simple and incremental design and evolution refactoring, coding standards and shared coding
Release Management	Planning, Continuous Integration and Configuration Management
Testing & Quality	Test driven development.
Requirements Engineering	Customer focus, gathering and developing user stories, use cases etc.
Learning & Development	Retrospectives for incremental improvement, Training education and mentoring
Governance & Support	Incorporating management practices such as programmes, portfolio project management and other organisational support elements

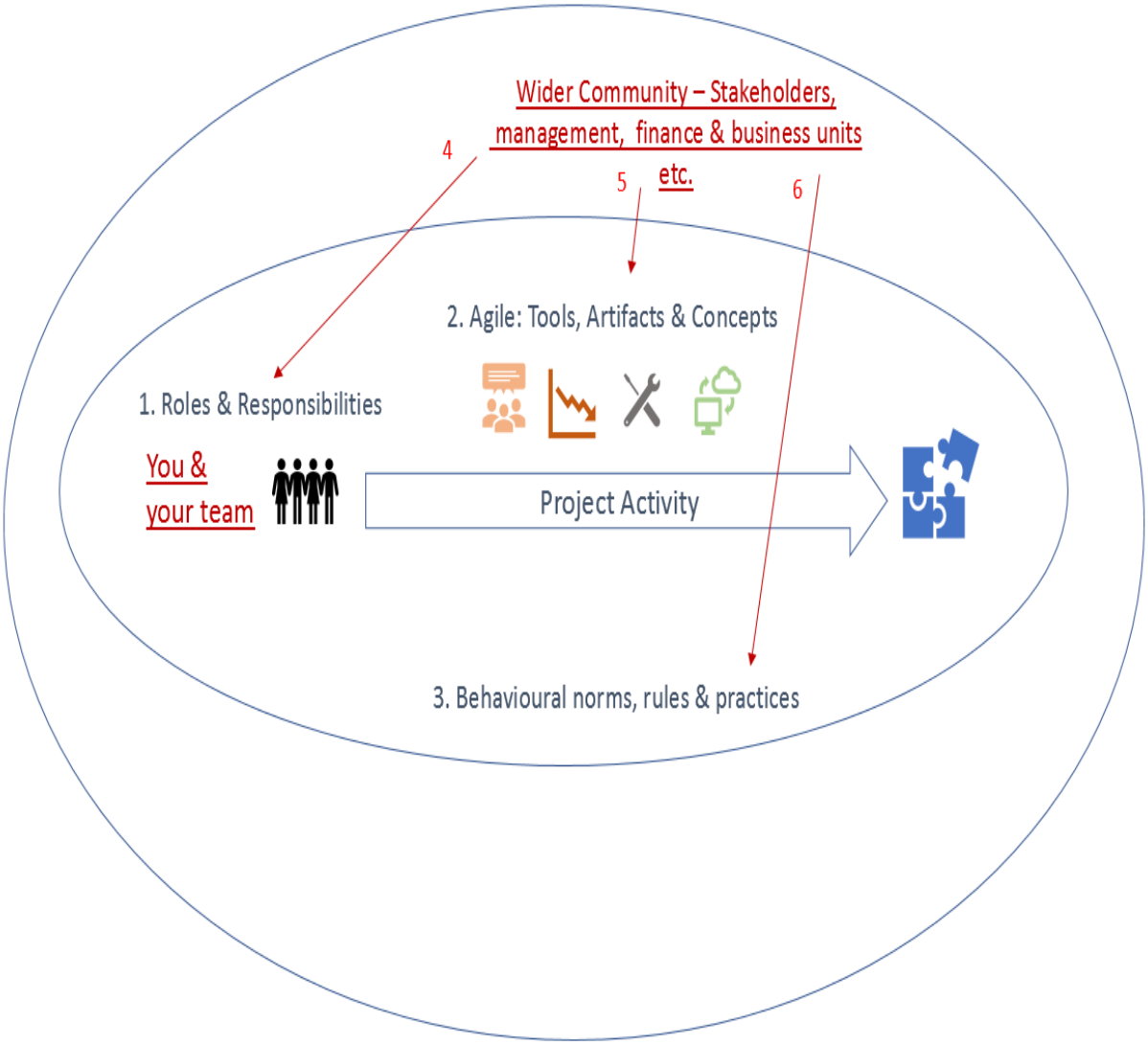
Page 2: Project Delivery Factors



Page 3: Agile activities: Constituent tasks and artifacts

Agile Activities/Practices					
A Development (Dev) 	**B Release Management (RM)** 	**C Testing & Quality (T&Q)** 	**D Requirements Engineering (RE)** 	**E Learning & Development (L&D)** 	**F Govern-ance & Support (G&S)** 
TASKS					
Coding standards (4)	Estimation (4)	Test Driven Development (2,4)	Customer Collaboration (4)	Sprint Retrospectives	Daily stand-ups
Pair programming (4,1)	Frequent/small releases (1,2,4)	Unit testing (1)	Manage requirements changes (1)	Training (10)	Self-Organizing empowered teams (4)
Shared code ownership (1)	Release/ Iteration/Sprint Planning (1)	Acceptance testing (1)	On-site customer (1,2)	Knowledge Management (10)	Scrum of Scrums (14)
Refactoring (1,2)	Agile Release Train (14)	Defect Analysis (6)		Project Retrospectives	Development Environment (5)
Spiking solutions (1)	Integrate often (1)	Regression Testing (8)			Risk Management (10)
Architecture Configuration (9)	Continuous Integration (2)				Sustainable pace (6)
	Configuration Management (8)				
Artifacts (Conceptual and Physical)					
Product Backlog	Planning game (6)	Automated Testing (14)	User story (1)		
Project Velocity (1)			Story card (6.7)		40-hour week (1,2)
Metaphor (2)			User Profiles		
Burndown Charts (5)			User Personas		

Page 4: Organisation wide delivery factors



Appendix F: Agile maturity models comparison

The following sections briefly outline the significant elements of each of the fourteen articles identified by Fontana et al. (2018). Where these articles mention activities and tasks that map to the proposed set of generic activities and tasks (Table 4.11) these are identified. The mapping is shown using abbreviations within brackets and in italics such as (contains elements from…), or as just the abbreviation (RM) of the generic Agile activity.

The purpose of this Appendix is to corroborate the proposed set of Agile activities and tasks (Table 4.11) and hence avoid reliance on the critiqued work of a single author (Meyer, 2015), as well as substantiating the selected generic activities.

F.1 Nawrocki et al. (2001)

The contribution by Nawrocki et.al. (2001) entitled 'Towards Maturity Model for eXtreme Programming' splits the XP practices (On-site customer; Refactoring; pair programming etc.) into 4 groups and adds an additional practice. The four main groups along with a mapping that links them to the proposed activities above (Table 1.3) is listed below.

- Planning *(contains elements from RE, RM, Dev, G&S).*
- Designing *(contains elements from Dev).*
- Coding *(contains elements from RE, T&Q, G&S, Dev, RM).*
- Testing *(contains elements from T &Q).*
- Facilities an additional practice *(contains element from G&S).*

These core practices are then assembled into a four level maturity model (Non-Compliance, Initial, Advanced and Mature) in which each level of maturity assesses how well these practices are conducted, Unfortunately, a detailed explanation as to what practices help to define a particular maturity level and how is not provided.

F.2 Lui & Chen (2006)

Lui & Chen (2006) in their work entitled 'A Road Map for implementing eXtreme Programming' focus on implementation of XP practices in inexperienced teams. They advocate a step-by-step approach, but point out the intertwined and mutually

dependent nature of Agile practices. Usefully they identify 'cluster' patterns of XP practices saying this can assist in identifying what would in effect be a maturity progression of XP practices. The basis of this progression is the connections between the XP practices: they argue that those XP practices having the most connections to others should constitute the lower levels of the maturity model progression. Rather than mapping XP practices to specific maturity levels their approach advocates a form of maturity based on ease of learning and adoption.

F.3 Packlick (2007)

Packlick's (2007) contribution entitled 'The Agile Maturity Map: A Goal Oriented Approach to Agile Improvement', re-examined XP practices in terms of their underlying goals. In consultation with experienced Agile practitioners within an air transport organisation, Packlick (2007) identified over 30 user stories or needs related to Agile practices and categorised them into five high level goals or practices. These are listed below and are mapped to Table 4.11 and the proposed set of Agile activities.

- Acceptance Criteria (contains elements from RE).
- Tests & Builds (contains elements from T&Q).
- Iterative Planning (contains elements from G&S; RM)
- Learning & Adapting (contains element from L&D)
- Engineering Excellence (contains elements from Dev; T&Q)

These user stories (practices) are then distributed across a continuum of maturity levels that represent the different stages of learning or maturity that a team will progress through. The distinguishing feature is that these maturity levels are not related to the adoption of specific practices at certain levels but are levels of attainment across all practices.

Level 1: Awareness - team understands goals & their acceptance criteria.

Level 2: Transformation- development practices to satisfy the goals are regularly applied.

Level 3: Breakthrough - consistent use of Agile practices even under pressure & have found ways to work around regular barriers to adoption.

Level 4: Optimization - improvements are made on a continual basis.

Level 5: Mentoring - here performers coach others.

There is no clear explanation of why one level appears to be higher than any other because theoretically a breakthrough can occur anywhere and mentoring also can take place at any point.

F.4 Sidky et al. (2007)

Sidky et al. (2007) in their work entitled 'A disciplined approach to adopting Agile practices: the Agile adoption framework', propose an Agile measurement index (Sidky Agile Measurement Index – SAMI) and five levels of maturity to provide guidance for organisations taking up Agile approaches. The SAMI index is used to determine the agility of an entity or its Agile potential. It has four components namely.

A. Agile level: - This represents the core qualities of agility of a project. These have been drawn from the Agile Manifesto. The increasing levels of agility are Collaborative, Evolutionary, Effective, Adaptive and Encompassing.
B. Agile principles: – the 12 Agile Manifesto principles are condensed into 5 principles which guide the refinement and tailoring of the above levels of agility. These Agile Principles map well to the proposed activities/practices of Table 4.11.

1. Embrace change to deliver customer value *(contains elements from Dev)*
2. Plan & Deliver software frequently *(contains elements from G&S; RM)*
3. Human-centric *(contains elements from G&S; RE)*
4. Technical Excellence *(contains elements from Dev; T&Q)*
5. Customer collaboration *(contains elements from RE)*

C. Agile practices: – The concrete activities and practical techniques used to develop software in an Agile manner. These 40 Agile practices are mapped to a 2x2 grid consisting of the above Agile Principles and Agile Levels. From an AT perspective, the practices that Sidky et al. (2007) identify within this grid could be regarded as tasks and the principles correlate to the Agile activities as set out in Table 4.11.
D. Indicators: – From the Agile principles and their goals, a set of questions were derived to determine whether the goal has been met. The authors have provided over 300 questions for all the 40 Agile practices that they identified https://arxiv.org/abs/cs/0612092). This might be a useful source for research questions.

F.5 Qumer & Henderson-Sellers (2008)

Qumer & Henderson-Sellers (2008), in their work entitled 'A Framework to support the evaluation, adoption and improvement of Agile methods in practice', develop a framework (Agile Software Solutions Framework –ASSF) to assist organisations with identifying what degree of agility that they need, as well as the appropriate way to introduce it. Included in their framework is a governance element addressing aspects of responsibility, accountability, and business value within the context of Agile development. This is regarded as particularly important when scaling Agile and mindful of avoiding unnecessary overheads and bureaucracy is intended to provide a light-touch approach.

In addition, the authors also point to the business value delivered as a key determinant of the Agile practices to be adopted. They indicate that the establishment of a cost-benefit metric would be helpful in determining the business value delivered through Agile delivery but point out that such an approach has not yet been adopted.

F.6 Patel & Ramachandran (2009a)

Patel & Ramachandran (2009a) in their contribution entitled 'Agile Maturity Model (AMM) A Software Process Improvement framework for Agile Software Development Practices', approach the notion of Agile maturity from the perspective of adaptability & suitability assessment and improvement for best practice. They indicate that maturity models are process-oriented, with maturity dependent on the practices that are followed. They provide a five-level maturity model that identifies different Agile practices at each level.

Level 1 - Initial: no Agile software development process present.

Level 2 - Explored: focus is on

- Planning & story cards & release planning
  (Release mgmt. & planning put together). *(RM)*
- Requirements Engineering – story cards. *(RE; T&Q)*
- Customer & Stakeholder focus or orientation & collaboration. *(RE)*

Level 3 - Defined: focus is on

- Customer satisfaction & relationship. *(RE)*

- Improved communication. (G&S)
- Better software quality – frequent delivery & coding practices (pair programming) (Dev; T&Q)

Level 4 – Improved: focus is on

- Management aspects, self-organising teams, empowerment, risk assessment (G&S)

Level 5 –Sustained: focus is on

- Release Management. (RM)
- Story card driven development. RE)

F.7 Patel & Ramachandran (2009b)

In the work entitled 'Story card Maturity Model (SMM): A process Improvement Framework for Agile Requirements Engineering Practices', Patel & Ramachandran (2009b) deal predominantly with story card issues, such as requirements conflicts, missing and ambiguous requirements, and a structure for story cards. They note that conventional maturity models such as CMMi do not address the quality of the requirements engineering process, and that story card errors can be costly.

Therefore, the authors emphasise the importance of the requirements engineering activity within Agile development approaches. They argue that there is a need for a process improvement model (a maturity model) for the requirements engineering process. The authors identify key questions that will identify the key areas for process improvement. They produce a four level-maturity model for story cards.

F.8 Benefield (2010)

In the contribution entitled 'Seven Dimensions of Agile Maturity in the global Enterprise: A Case Study', Benefield (2010) addresses the complexity of a large organisational roll out of an Agile method, where there were many interdependencies between disparate teams. Benefield (2010) states that this can be helped by understanding the maturity of the practices of the interdependent teams, and outlines a framework developed by BT Design that has seven dimensions.

1. Automated regression testing: significantly reduces time to fix code issues especially when running alongside code building.

2. Code quality metrics: coding standards & design & code reviews enables management of code complexity.
3. Automated deployment & backout: provides uniformity of deployment to guarantee consistent behaviour.
4. Automated build & configuration management: build consistency & effective configuration management with standard code version control.
5. Interlocked delivery & interface integration: addresses the ability of the transparency of work across the different delivery team to better enable alignment to avoid hold-ups and misalignments.
6. Test driven development: provides assurance regards the effectiveness of the code
7. Performance & scalability testing: able to build and scale systems.

These dimensions focus heavily on the software development (Dev), Test Driven Development (T&Q) and release management (RM) elements and Benfield identifies five levels of maturity for each of these seven dimensions mapped onto a spider diagram with increasing maturity levels moving away from the centre.

F.9 Fontana et al. (2014)

Fontana et al. (2014) in their work entitled 'Maturing in Agile: What is it about?', attempt to evaluate how to identify maturity levels. They state that the Agile community has been trying to build a concept of maturity that does not follow the traditional maturity model (CMMi) emphasis on process definition and control.

The authors consolidate practices used by the Agile community mapping them to the Software Engineering Body of Knowledge (SWEBoK). They produce a table that identifies the main grouping of Agile practices that have been discussed in the literature (including some of the approaches identified above). These are as follows.

1. Software Requirements
2. Software Design
3. Software Construction
4. Software Configuration Management
5. Software Testing
6. Software Engineering Management & Software Project Planning

7. Software Engineering Management / Review and Evaluation
8. Software Engineering Tools & Methods
9. Environment
10. Customer
11. Software Engineering Process

From their analysis of 87 responses from individuals attending a Brazilian Agile conference where they asked respondents to rank the above activities in an incremental sequence of maturity, they concluded that Agile maturity is not about following a pre-defined path. They also conclude that the maturity model approach is not really that useful, because of the variability in organisational circumstances and across Agile teams. Also, rules must be simple in order for Agile approaches to be effective and to cater for novelty and innovation.

From their analysis they conclude that practitioners do not regard a maturity model focus as being appropriate for Agile maturity. The authors quote another Brazilian study (Melo et al. 2013) that indicates that as experience grows then more Agile practices are adopted. Conversely as experience grows, some companies actually start to abandon Agile practices (estimation techniques). Hence rather than following prescribed paths, Agile teams will tailor the Agile method to suit their circumstances. This usually occurs at levels that are beyond essential Agile practices.

F.10 Silva et al. (2014)

Silva et al. (2014) in their contribution entitled 'A reference model for Agile Quality Assurance: Combining Agile Methodologies & Maturity Models', present an Agile quality assurance reference model to help with QA implementation. They identify five maturity levels (numbered in sequence) and eighteen process areas. These areas are as follows.

2.1	Quality Assurance Planning Assurance	3.1	Organisational Quality Assurance
2.2	Team Assistance	3.2	Lessons Learned Management
2.3	Process Assessment	3.3	Training
2.4	Product Assessment	3.4	Knowledge Management
2.5	Noncompliance Management	3.5	Quality Assurance Quality

2.6	Customer Satisfaction Assessment	3.6	Integration Management
		3.7	Risk Management
		3.8	Cost Analysis
4.1	Quality Assurance Measurement	5.1	Defect Prevention
4.2	Self-Organisation & Sustainability	5.2	Decision Making Support

This approach is similar to those of Benefield (2010) and others above, in that maturity relates to the adoption of specific Agile practices. Hence an increase in maturity is indicated by the inclusion of additional Agile practices.

F.11 Silva et al. (2015)

In a slightly later contribution, entitled 'Using CMMI with Agile software development: A Systematic review', Silva et al. (2015), undertake a systematic literature review of maturity model literature up to 2011. This provides an evaluation of the use of CMMI maturity model approaches in conjunction with Agile development methods. From 81 articles, they identify the following practices and activities that have most been cited within the Agile literature (in order of citation).

1.	Daily stand-ups	*(elements from G&S)*
2.	Testing and test driven development	*(elements from T&Q)*
3.	Continuous Integration	*(elements from RM)*
4.	On-Site customer collaboration	*(elements from RE)*
5.	Pair programming	(*elements from Dev)*
6.	User stories	*(elements from RE)*
7.	Iterative development	*(elements from Dev)*
8.	Product backlog	*(elements from Dev)*
9.	Retrospectives	*(elements from L&D)*
10.	Sprint review meetings	*(elements from L&D)*

The contribution then examines the relationship between Agile and CMMI and groups the analysis into two sections.

- Organisation
- Development process consisting of
  - Process understanding, knowledge and communication.

- Management and configuration
- Requirements
- Tests
- Maturity
- Productivity
- Quality

Overall, the authors indicate that their results are inconclusive regards the feasibility of combining CMMI and Agile methodologies.

F.12 Ozcan Top & Demirors (2014)

Ozcan Top & Demirors (2014) in their work entitled 'Assessing Software Agility: An Exploratory Case Study', develop a software Agility assessment model to assess Agility and to provide roadmaps to organisations for continuous improvement. The model has two dimensions with four maturity levels and Agile processes and practices grouped into the following five categories. They also grouped Agile process and practices into 5 groups. As usual the identified activities in this study are mapped to the group.

1. **Exploration**:
   Capturing needs, requirements *(elements from RE)*
2. **Construction**:
   Architecture design, coding and unit testing *(elements from Dev)*
3. **Transition**:
   Build integration, testing & deployment *(elements from Dev; T&Q)*
4. **Management**:
   Planning, estimating & monitoring Agile *(elements from RE)*
5. **Culture**:
   Adopting environmental and people elements
   according to Agile approaches. *(elements from G&S)*

F.13 Soares & Meira (2015)

In a short paper entitled 'An Agile strategy for implementing CMMI Project Management Practices in Software Organisations', Soares & Meira (2015) set out a strategy for organisations to implement CMMi based Project Management activities in an Agile way.

The authors produce a table highlighting Agile maturity model literature which includes many of the contributions discussed above. Because the focus is on the Agile implementation of CMMI based PM practices it is not clear why this paper was included in the original analysis by Fontana et al. (2018).

F.14 Stojanov et al. (2015)

Finally, a paper entitled 'A Maturity Model for Scaling Agile Development' by Stojanov et al. (2015) extends Sidky et al.'s (2007) Agile adoption framework to cater for additional practices to scale Agile for approaches such as SAFe (Scaled Agile Framework). This incorporates all of the practices identified by Sidky et al. with additional elements of Governance & Support (G&S) practices such as Scrum of Scrums.

Approaches to practices and maturity in Agile maturity models

In the above literature, the authors choose to group Agile practices in many different ways and identify different categories. In addition, it is apparent that all of the proposed set of Agile activities (Table 4.11) for this study are present in some grouping or category within the key Agile maturity model literature. The proposed set of Agile activities therefore represents a coherent and logical categorisation that has no omissions.

From the literature discussion and from Table 4.10, there are a number of questions with regard to Agile maturity models. There are in addition to the previously mentioned question of whether Agile maturity should be considered in terms of alignment with traditional maturity models or whether to develop an alternative Agile maturity model. Essentially these questions are:

1. Should Agile maturity models adopt traditional maturity model hierarchies & how many are there?
2. Whether Agile maturity should be based on the extent to which activities align with Agile principles.
3. Does adopting increasing numbers of Agile practices indicate greater maturity?
4. Perhaps it is not the total number of Agile practices, but the competence achieved in them.
5. Does the adoption of one Agile practice rather than another, indicate a different level of maturity?

6. Do connections & inter-dependencies between Agile activities indicate a level of maturity?
7. Are maturity levels appropriate for all organisational and development team circumstances?

Consequently, approaches to Agile maturity are highly variable and it depends on how individuals choose to approach the problem. From the literature it is apparent that many of the choices that have been made have provided little rationale for their approach. Maturity models are intended to provide frameworks for process-improvement in terms of software delivery capability (Paulk, 1999). The increasing levels are intended to be evolutionary, with organisations becoming increasingly effective at delivering software. Traditionally, this is achieved by identifying practices that are central to achieving the delivery capability. Most of the literature is focused on maturity model 'assessment' frameworks that aim to identify the presence of or improvement to the key practices. Underpinning these concepts is the essential premise of all maturity models i.e. superior delivery capability will result in greater business value added.

Appendix G: Research consent and privacy notice

Edinburgh Napier University Research Consent Form

Learning Agile Methods: An Activity Theory Perspective

Edinburgh Napier University requires that all persons who participate in research studies give their written consent to do so. Please read the following and sign it if you agree with what it says.

1. I freely and voluntarily consent to be a participant in the research project on the topic of learning processes and activities as part of adopting Agile delivery methods to be conducted by Pritam Chita, who is a staff member at Edinburgh Napier University.
2. The broad goal of this research study is to explore organisational & other factors that are increasingly regarded as key influencers regards the take up of Agile methods. Specifically, I have been asked to participate in an interview, which should take no longer than just over an hour to complete.
3. I have been told that my responses will be anonymised. My name will not be linked with the research materials, and I will not be identified or identifiable in any report subsequently produced by the researcher.
4. I also understand that if at any time during the interview I feel unable or unwilling to continue, I am free to leave. That is, my participation in this study is completely voluntary, and I may withdraw from it without negative consequences. However, after data has been anonymised or after publication of results it will not be possible for my data to be removed as it would be untraceable at that point.
5. In addition, should I not wish to answer any particular question or questions, I am free to decline.
6. I have been given the opportunity to ask questions regarding the interview process and my questions have been answered to my satisfaction.

I have read and understand the above and consent to participate in this study. My signature is not a waiver of any legal rights. Furthermore, I understand that I will be able to keep a copy of the informed consent form for my records.

Participant's Signature **Date**

I have explained and defined in detail the research procedure in which the respondent has consented to participate. Furthermore, I will retain one copy of the informed consent form for my records.

Researcher's Signature **Date**

Privacy Notice:
Pritam Chita is providing you with this information in compliance with the General Data Protection Regulation (EU) 2016/679, which requires him to tell you what will be done with your personal information.

Name of Research Project: Learning Agile Methods: An Activity Theory Perspective

Description of Project: The objective of the project is to understand the organisational and cultural influences that occur when Agile methods are implemented and improved.

Data Controller	Edinburgh Napier University Colinton Road. Edinburgh EH10 5DT. Tel: 0131 455 2700
Purposes for collection/processing	The specific aim of this interview is to obtain views and comments on an Activity Theory based perspective of the Agile project management process.
Legal basis	"Processing is necessary in the exercise of official authority vested in the controller" (Article 6(1)(e) refers) (commonly known as "public task"). The University's Statutory Instruments refer: "for the objects of providing education, carrying out research and promoting teaching, research and general scholarship".
Whose information is being collected	Employers, employees, consultants and professionals engaged in the use and promotion of Agile software development methods.
What type/classes/fields of information are collected	Individual's places of work, department & job titles will be collected. Information and voice recordings of individuals expressing their views and opinions on the deployment of Agile project management methods & approaches within an organisational use context which may be their place of work.
Who is the information being collected from	From the data subject (directly).
How is the information being collected	Audio recorded interview either face to face or by telephone call.
Is personal data shared with externally	For the purposes of transcription only the recorded interview may be shared with 1st Class Secretarial (https://www.1stclass.uk.com). The University already has a data processing agreement with this organisation. Anonymised information provided by the interviewees will potentially be aggregated and published in research output & an academic thesis.
How secure is the information	Interview recordings and transcripts will be kept on the University's secure research drive.
Who keeps the information updated	The information collected is a record of a specific moment in time. It will be updated if and when changes occur.
How long is the information kept for	Transcripts will be kept for 10 years. Audio files will be deleted once the transcripts have been verified.
Will the data be used for any automated decision making	NO
Is information transferred to a third country? Outside the EEA and not included in the adequate countries list.	NO
Information on subject rights and data protection queries: https://staff.napier.ac.uk/services/governance-compliance/governance/DataProtection/Pages/default.aspx	