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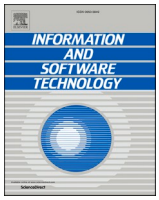

An exploratory study of sustaining organisational agility

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ABSTRACT

Context: How an organisation sustains agility over time, and the actions it takes when encountering challenges to its agility, are not well established.
Objective: This study explores how an organisation sustained its agility beyond the initial adoption stage when its agility was founded on the values, principles, and practices of agile software development.
Method: A qualitative case study of the Retail organisation within a company was carried out. The Retail organisation had sustained agility for six years.
Results: Nine main challenges are: disparate levels of maturity, resistance to change, competing priorities, lack of team empowerment, dependencies between teams, onboarding people to the agile way of working, lack of role clarity, staff turnover, and incompatible funding model. Based on the solutions to these challenges, eight general actions applied to sustain agility are: a clear reason for implementing agile principles, continuously raising agile awareness, continuously adjusting the business operating model, embedding specialist agile roles, changing the funding model, making work visible, supporting agile teamwork, and monitor, measure, feedback, and act.
Conclusions: The contributions of this article are practical. The challenges, detailed solutions, and general actions identified could be helpful for organisations that need to sustain agility in contexts similar to the case organisation. The findings should enable synthesis with future case studies and potential theory-building.

1. Introduction

The adoption of agile values, principles, and practices in the form of agile methods (i.e., agile) has grown steadily in the last two decades, reaching over 80 % of software development activity [1]. Agile methods are increasingly employed outside of IT and software development, such as new product development, software delivered through the internet (e.g. Software-as-a-Service), and when developing for the increasingly pervasive mobile platforms and technologies on which such software runs [2,3]. Given the well-known benefits of agile, such as the capacity to adapt to changing requirements and improved developer productivity, recent attention has turned to implementing large-scale agile variants to extend these benefits throughout the entire organisation [4]. Furthermore, the emphasis has shifted to sustaining agility in the long term, meaning the ongoing process of sustaining and improving agility within an organisation [5,6]. By sustaining agility, we refer to how organisations can effectively manage potentially disruptive changes while operating according to the agile software development values and principles expressed in the Agile Manifesto [5,7]. Sustaining agility necessitates a continual transformation process, which entails implications for development practices, roles, and organisational structures. Organisations face unique challenges in sustaining agility compared to those that arise during their initial inception [5,8–10]. However, most existing research focuses on the initial adoption of an agile method and adherence to method variations over short timeframes, such as the implementation phase [4,11]. Minimal work exists on how organisations sustain their agility and the associated benefits, challenges, and mitigation strategies [5]. This study aims to start addressing this gap in the literature by investigating a Retail organisation's efforts to sustain agility.

The Retail organisation was the largest operational unit within a publicly listed IT-centric company. In the remainder of this article, 'the organisation' and 'Retail' refer to the Retail unit of this company. This company provides a critical product to individuals and businesses within New Zealand. An agile approach to leadership, introduced in 2016, led to significant changes to the organisation's business operating model, organisational structure, and funding model. Agile was well embedded in the organisation, having been sustained for years despite significant

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changes in executive management, and it had led to major changes in the organisation's operations. Thus, the organisation was a good fit to explore the challenges encountered in sustaining agility.

In our previous work [12] we presented ten challenges the organisation encountered in sustaining agility. This paper elaborates on and extends that work by presenting a retrospective reflection section on sustaining agility research, and an in-depth secondary analysis of the case to address the broad research question: how does an organisation sustain agility?

This paper is structured as follows. Section 2 is a retrospective reflection of three eras of agile research, the adoption era, the post-adoptive era, and current research on sustaining organisational agility. This section also analyses the maturity of current research on sustaining agility and presents the research questions for this current study. Section 3 describes the research method, including data collection and analysis. Section 4 presents the findings on the challenges, solutions, and general actions for sustaining organisational agility. Section 5 discusses the findings, the study's limitations and threats to validity, and provides directions for future research. Section 6 concludes the article.

2. Retrospective reflection on agile research

Fundamentally, being agile is "to be able to move quickly and easily" [13] and agility refers to the ability to respond effectively to rapid and unexpected changes with flexibility, highlighting adaptability and versatility in addressing such situations [14]. In information systems development (ISD), method agility is "the continual readiness of an ISD method to rapidly or inherently create change, proactively or reactively embrace change and learn from change while contributing to perceived customer value (economy, quality and simplicity) through its collective components and relationships with its environment" [15]. Agile methods, jointly referred to as agile software development (ASD), generally conform to the agile manifesto [7], which consists of 4 software development values and 12 development principles. The manifesto sets out the basis for moving away from the 'heavyweight' traditional command-and-control organisation of software development, toward more 'lightweight' methods of software development that emphasise dynamic, iterative, incremental, and non-deterministic thinking with significant involvement of end users [7]. The four main values prioritise individuals and interactions over processes and tools, delivering working software early, collaborating closely with customers, and adapting to changing requirements rather than following a fixed plan. As an alternative set of software development methods, values, and principles, ASD aims to address the difficulties in the plan-driven software development process [16]. The benefits of ASD include team autonomy, the timely detection of defects, improved transparency of the development process and practices, improved quality and productivity of the deliverables, and improved management, team, and customer satisfaction [17]. Several methods are included in the agile family [15], including eXtreme Programming (XP) [18], Scrum [19], and Lean Software Development (LSD) [20]. These methods were originally designed to enable agility in small teams and projects.

Recent studies have examined the primary research areas and trends in ASD over the last two decades. A historical review of agile research highlighted a growing interest in several topics such as integrating agile methodologies with established fields such as usability and security, blending agile with CMMI (Capability Maturity Model Integration) and game design, applying agile methods to large projects, notable development in DevOps, which combines operations with development, as well as the relationship between agile methods and microservices [21]. Based on a tertiary study of 28 systematic literature reviews and mapping studies, one study identified 10 key agile research areas, including agile adoption, agile and GSE (global software engineering), agile and CMMI, organisational agility, agile and embedded systems, and software product line engineering [22]. Another study used main path analysis (MPA), a citation-based methodology, to analyse 1431 ASD studies published between 2001 and 2021, dividing the research into three phases: the introduction phase (2001 – 2003), the evaluation phase (2004 – 2012), and the deployment and expansion phase (2013 – 2021) [23]. These studies reveal that the introduction phase focused on agile adoption and practices, followed by the evaluation of adherence to agile practices, and the deployment phase placed emphasis on scaling and large-scale agile methods. While the above studies provide insights into key ASD research areas and trends, they did not cover the growing interest in post-adoptive or sustained agile usage research. Furthermore, though recent attention has turned to embedding agile ways of working throughout the organisation, there is limited research on understanding how ASD methods are embedded and then sustained across a whole organisation [10]. This current study focuses on this issue by exploring how organisations sustain organisational agility by identifying the challenges encountered and the solutions an organisation used to address those challenges over time.

The next section presents a retrospective review of changes in the research on sustained agile usage, divided into three sub-sections: initial agile adoption, post-adoption, and sustaining organisational agility.

2.1. Agile adoption era

During the first decade of agile adoption, in the 2000s, the primary focus was on guiding practitioners to understand agile values and principles, addressing the challenges of migrating to agile methods and communicating best practices for implementing the approach [24–26]. While some studies identified factors [27–29] that impact the perceived success of agile adoption on outcomes such as quality, time, and cost, others used a sociological perspective by investigating the social processes that contribute to the success of ASD methods [30]. More comprehensive frameworks, such as the Agile Software Solution Framework [31] focused on introducing agile practices into organisations based on the organisation's degree of agility.

During this era, a review of 24 articles on agility-oriented research in organisations found most studies focused on specific areas rather than a broad perspective on the entire organisation [32]. The review identified five dimensions of organisational agility: organisational structures, workforce, development process, management and leadership, and infrastructure. Numerous studies of organisational agility in the manufacturing sector (i.e., agile manufacturing), where agility is based on ideas other than those found in ASD [33], reported insights on their agile organisational transformation initiatives by identifying necessary changes to structure, culture, values, leadership, delivery and software development, product development, ways of working, and enterprise architecture [34,35]. However, in non-manufacturing sectors, empirical research into organisational agile transformation was extremely limited [8,33].

2.2. Post-adoptive era of sustained agile usage

In the second decade of agile adoption, in the 2010s, agile evolved to emphasise extensive methodology tailoring [36,37], agile-traditional hybridisation [38], and post-adoption or sustained usage of agile beyond its initial adoption [39,40]. Practitioners' perspectives on agile sustainability were classified as follows: being completely agile (involving the whole organisation, an agile mindset, and agile principles), independent (focusing on learning and self-sufficiency), prioritising business value and user or customer needs, and maintaining a sustainable pace consistently over time [41]. Being an agile organisation in the long term was recognised as requiring more than implementing an agile method like Scrum. Sustaining agility includes a mindset rooted in trust, collaboration, and a commitment to continuous improvement [42], where Agile mindset is defined as "*a way of thinking, that emphasizes collaboration among team members and being adaptable to changing environments to be a high-performing team*" [43].

The earliest research on sustaining agility, exploring the use of agile

methods beyond the initial adoption stage, primarily relied on innovation assimilation models as a theoretical foundation, which took into account the incremental nature of adoption rather than assuming a simplistic binary "yes" or "no" adoption state [39,40]. Most of these studies were published between 2012 and 2015. They focused on the latter three stages of assimilation, namely acceptance, routinisation and infusion, that have particular relevance to the post-adoption or sustained use of agile methods, rather than the initial stages of initiation, adoption, and adaptation of an innovation [44–46]. Acceptance involves a commitment to use, while routinisation encourages the innovation's usage as a normal activity. Infusion describes the innovation penetrating deeply into an organisation. Infusion has three facets: 1) extensive use: the extent of use of an innovation to accommodate a more comprehensive set of work tasks; 2) integrated use: using the innovation to establish or enhance workflow linkages among work tasks; and 3) emergent use: using the innovation beyond its original intended scope [45,47]. Wang et al. [40] added two additional indicators, adapting them to the context of agile practice assimilation: intensive use and deeply customised use. While intensive use refers to using an agile practice beyond that suggested by the textbook, deeply customised use is the deep adaptation of an agile practice that reflects the needs of the adopting unit or team.

Recognising that there may be a significant difference between factors that impact initial adoption and sustained usage [46,48], an *a priori* model of sustained agile usage was proposed by the first author of the current study, Senapathi [39]. That study initially formulated factors that impact sustained agile usage to explore the extent and depth of an innovation's use after adoption, rather than its adoption per se. Contrary to a few early studies that focused on the sustained use of specific agile methods (e.g., XP, Scrum) [49,50], Senapathi, et al. [39] argued that, in practice, most organisations do not strictly adhere to any single agile method such as Scrum. Instead, they select and tailor individual practices from one or more methods that reflect their contextual requirements [36]. Based on this rationale, sustained agile usage in the initial Senapathi, et al. [39] model refers to the continual use of agile methods, which can range from using specific methods, such as Scrum to combining practices from different methods, such as Scrum and Kanban. In this model, sustained agile usage combines vertical and horizontal usage: i) Vertical usage refers to the depth and intensity of agile practices, incorporating different combinations of usage behaviours specified in the three infusion facets described above: extensive use, integrated use, and emergent use, (ii) Horizontal usage pertains to implementing the innovation across the organisation, such as the percentage of projects and the number of teams using the innovation. This includes, for example, the spread of Scrum practices from one team or project to multiple teams or projects, from one region to many regions within an organisation, and from one department to another (e.g. business, finance). The model identified four categories of factors that influence sustained agile usage: innovation, sociological, technological, and organisational factors. The model is based on an exploratory cross-case analysis of sustained agile usage in two major organisations. Senapathi, et al. [39]'s model confirmed that the deeper the assimilation of agile practices into the organisation, the greater the likelihood of achieving specific improvements in systems development outcomes.

The utility of the sustained agile usage model has been confirmed in independent studies. For example, Russo, et al. [51] used the model to analyse agile sustainability in two significantly different companies with diverse backgrounds, cultures, and approaches. These companies exhibited significantly different outcomes regarding their initial agile adoption and longer-term sustainability. Senapathi, et al. [52] tested the model by employing a variance-based PLS-SEM approach based on retrospective, perceptual data obtained from 114 respondents to study the factors that impact agile usage, and analysed the relationship between agile usage and agile effectiveness (i.e., sustained agile usage achieved perceived improvements in development outcomes). Their findings confirmed that agile usage, measured by intensity and extent of agile method use, significantly impacts agile effectiveness. However, although the *a priori* sustained usage model identified factors conducive to agile usage, it did not cover the impact of several other factors that may influence sustained usage in organisations such as decision-making practices, management styles such as hierarchy and bureaucracy, overall enterprise governance, or team autonomy and dynamics [51].

The initial sustained agile usage model [39] was later refined in a subsequent study by Senapathi, et al. [9], the first author of this research. This later qualitative study was based on data from a focus group with 29 agile practitioners in the software industry and semi-structured interviews with 20 agile practitioners from five different organisational backgrounds. This later study refined the initial model to incorporate a more comprehensive set of factors that formed three meaningful categories: agile team, technological, and organisational factors.

Further research on post-adoptive agile usage has focused primarily on individual agile methods or practices, which is contrary to the focus on covering the usage of agile methods as a whole [9,39]. While these studies contributed to an initial understanding of acceptance factors of agile use, their focus on individual agile methods resulted in fragmented research by missing the commonalities of agile methods [53]. Wang et al. [40] focused on the later post-adoptive stages, i.e. acceptance, routinisation and infusion, by arguing for the need to examine agile methods at the practice level. Using four case studies, they examined post-adoptive usage of specific agile methods (e.g., Scrum and XP). Fichman [54] identified time as a significant factor that influences the ability to reach the later stages of assimilation, which implies that companies that adopt innovations early will have more time to reach deeper levels of assimilation, thereby reaping the benefits of the innovation sooner. On the contrary, Wang, et al. [40] suggests that time may not be an appropriate indicator for evaluating the assimilation stages of agile practices. While time is an important dimension in studies that intend to understand how agile practices have been routinised and infused in a team or organisation, Wang argued for caution when using it as a measure to determine the successful usage of agile methods [40]. Wang, et al. [40] also found that the adopting team does not always succeed in transitioning through the assimilation stages sequentially, i.e., acceptance to routinisation to infusion. Other studies on post-adoptive agile usage focused on individual methods, such as Scrum [55,56] and XP [50] and examine one of the post-adoptive phases (e.g., acceptance) in a broad sense but do not differentiate clearly between acceptance, routinisation, and infusion. Few studies focused on the organisation level, although Baham [57] has investigated the factors influencing the transition from acceptance to routinisation by examining the extent of agile use and its relationship with an organisation's practices, structures, and organisational culture.

2.3. Current research on sustaining organisational agility

The late 2010s and early 20s turned attention to addressing the challenges related to designing and implementing frameworks and large-scale variants of agile methods to extend the benefits of agile methods beyond individual teams and projects to the entire organisation (e.g., Scaled Agile Framework (SAFe), Large-Scale Scrum (LeSS) [4]. With organisations focusing on continuous improvement of agile transformations, the practitioners' interest shifted to sustaining organisational agility [5,12].

In organisation studies, organisational agility has been studied from several perspectives, including organisational change and dynamic capabilities [33]. Organisational agility encompasses several vital factors: organisational capacity for learning and improvement, strategic, operational, and structural alignment, and organisational culture and leadership [8]. Agile people and culture are at the centre of all activities, as represented in a circular model of organisational agility with the quadrants: agile strategising, operations, linkages, and people practices [58]. Based on an organisational change perspective, the sustainability

of change is defined as "the process through which new working methods, performance goals and improvement trajectories are maintained for a period appropriate to a given context" [59]. That proposed model for the processes influencing sustainability, focuses on financial, political, and contextual factors affecting change. However, studies such as the above do not focus on sustaining organisational change when following ASD principles such as customer orientation, adaptability to uncertain environments, and team empowerment [5].

Our notion of organisational agility aligns closely with operational and structural agility concepts. Operational agility refers to an operational unit's ability to quickly respond to changes by mobilizing resources and adjusting activities, while structural agility involves the capability to evolve communication and decision-making processes, as well as change job roles and responsibilities [8]. Operational agility occurs in organisational units, programmes, teams, or projects through strategic implementation. Our perspective on sustaining agility also aligns closely with Holbeche's viewpoint [60], which emphasises organisational agility as the "capacity to respond, adapt quickly and thrive in the changing environment" when it is based on ASD's principles, which include a strong future focus – anticipating and responding to change, especially at senior levels, customer collaboration, iteration, experimentation and innovation, and empowerment. Holbeche [60] defines a resiliently agile organisation as:

- An organisational culture and structure that facilitates change appropriate to a given context and the specific situations it faces.

- Staff members who are both willing and able to give their best in a sustainable manner.

- A learning mindset that is integrated into the core business operations and supported by agile processes and routines to drive innovation.

Sustaining organisational agility means maintaining agility at a certain level throughout the organisation [5], including changes to job roles and responsibilities, decision-making processes, and extending agile methods from one organisational unit to other business units, which may present new challenges that differ from adopting agile at the individual team or project levels [42]. The landscape of challenges related to sustaining organisational agility is complex and intertwining as it involves dealing with issues arising from various team structures, roles, responsibilities, and competing priorities between business and development teams [5,9,41].

In summary, the above retrospective review indicates that sustained agile usage literature is not yet mature. The research to date has predominantly used open-ended inquiries and exploratory case studies [39,40,51] to develop *a priori* models [39], propose theories that invite further exploration of the issues raised by the initial studies, or that integrate previously separate bodies of work [9,56,57]. Preliminary tests of hypotheses driven by previous theories about how sustained agile usage affects improvements in software development outcomes have been conducted [52]. However, there is limited research on how agile is sustained and embedded at the organisational level.

To support our claim that sustained agile usage literature is not yet mature, we applied the framework devised by Edmondson and McManus [61]. They classify the state of a body of research into three categories: nascent, intermediate, and mature, depending on the maturity of the theory base on which the research builds (see Table 1). Nascent research is based on a body of literature with little or no prior theory, and the phenomena explored are often new. Intermediate research draws from separate bodies of literature to propose new constructs and or provisional theoretical relationships. Mature research is where existing precise and well-developed models can be extended or linked with other theories [61,62]. Each category of research is associated with a particular research method, qualitative for nascent theory, quantitative for mature theory, and hybrid for an intermediate theory base [62].

Applying Edmondson and McManus's framework [61] indicates that the current state of theory and research for sustaining organisational agility is nascent. In contrast, research into the sustained usage of agile methods (e.g., Scrum) and practices at the individual adopting unit (e.g., team) is at an intermediate level (see Table 1). Table 1 includes examples of sustaining agility and organisational agility research for each category. The retrospective review suggests that theory building using exploratory, open-ended inquiry is more appropriate for examining sustaining organisational agility. As the theory matures to an intermediate level, combining qualitative exploratory studies and theory testing of provisional theories will be more appropriate.

Table 1
Categories of methodological fit in field research (adapted from Edmondson, et al. [61]). The final two rows show examples.

State of prior theory and research	Nascent	Intermediate	Mature
Research questions	Open-ended inquiry about a phenomenon of interest	Proposed relationships between new and established constructs	Focused questions and/or hypotheses relating to existing constructs
Type of data collected	Qualitative, initially open-ended data that need to be interpreted for meaning	Hybrid (both qualitative and quantitative)	Quantitative data: focused measures where the extent or amount is meaningful
Illustrative methods for collecting data	Interviews, observations, and documents relevant to the phenomena of interest	Interviews, observations, surveys, and documents relevant to the phenomena of interest	Surveys, interviews or observations designed to be systematically coded and quantified;
Constructs and measures	Typically, new constructs, few formal measures	Typically one or more new constructs and/or new measures	Typically relying heavily on existing constructs and measures
Theoretical contribution	A suggestive theory often an invitation for further work on the issue or set of issues opened up by the study	A provisional theory, often one that integrates previously separate bodies of work	A supported theory that may add specificity, new mechanisms, or new boundaries to existing theories
Research on post-adoptive agile usage or sustaining agility (team or project level)	Mangalaraj, et al. [50], Overhage, et al. [55]; Senapathi, et al. [39]; Wang, et al. [40];	Senapathi, et al. [52]; Senapathi, et al. [9]	No examples found
Research on sustaining organisational agility	Barroca, et al. [5], Senapathi, et al. [12];	No examples found	No examples found

2.4. Research questions

The above retrospective review indicates a significant gap in theoretically grounded research and a lack of case studies on how organisations sustain agility over extended periods. To begin to address this gap, we conducted a single in-depth exploratory case study to examine how a large Retail organisation integrated agile values, principles and practices, the challenges it faced, and the changes it made to sustain organisational agility. We formulated the following research questions:

Xg agility?

RQ1.2: What solutions and mitigating actions does an organisation use to sustain agility?

3. Methodology

The research questions were addressed using the case study research method. We chose this method because it is suitable for answering questions about how an organisation works. This method allows for an in-depth investigation of a business phenomenon, such as sustaining agility in its natural setting, where the researchers cannot control events [63]. We followed the guidelines of Yin [63] in the case study design and execution. Ethical approval for the study was granted by the researcher's institutes (Auckland University of Technology and Whitireia-Weltec in New Zealand).

3.1. Case selection

Case selection was purposeful, and the case had to meet predesigned selection criteria. The organisation selected had to have used agile principles and practices for at least 5 years and in organisational units that were not just concerned with software development. The organisation needed to have an information technology (IT) or information systems (IS) focus, and the participants had to hold a range of positions or roles and could provide in-depth insights into how the organisation had sustained its agile values, principles, and practices. The organisation had to be based in New Zealand so the participants could be easily accessible to the researchers and avoid time zone or language differences. The organisation could be large or small, a government department, a not-for-profit, or a commercial enterprise. To locate a suitable organisation, we contacted people in our professional network. One person introduced us to a key contact in a well-known New Zealand organisation established two decades ago.

The case selected was a Retail organisation, which is the unit of analysis for this study of organisational agility. The organisation had publicly espoused and followed agile values, principles and practices for more than five years. This Retail organisation was selected because it was a large operational unit within a publicly listed IT-centric company. The company and the Retail organisation were IT-centric, relying heavily on information technology to interact with customers and perform business functions. At the time of the study, the company was organised into four units (these names are pseudonyms): Production, Retail, Wholesale, and Head Office. The initial evaluation of the non-Retail units indicated that they were not involved in the agile transformation. The company had approximately 1200 employees, of whom about 66 % worked in Retail. Retail also generated the highest revenue for the company. The purpose of Retail was to supply the product and related services to end-users (i.e. residential customers and businesses), and it included a significant software development unit. In this article, we refer to the Retail organisation as 'Retail' or 'the organisation'.

The researchers signed formal non-disclosure agreements with the organisation's management before proceeding.

3.2. Participant selection and interview protocol

The key contact invited people from within the organisation who had suitable experience and could provide in-depth insights into how the organisation had sustained agility. Nine people were invited to be interviewed and all agreed. None of the interviewees were known to the researchers before the study commenced.

Before the interviews began, an interview protocol, including a semi-structured interview schedule, was developed. The interview protocol and interview schedule were adapted from the Critical Decision Method (CDM) [64,65]. The CDM protocol involves first interviewing a person who has a broad knowledge of key events related to the research question. Each event is then followed up during interviews with people who have more in-depth knowledge of specific events. Although the CDM method is designed to capture an overview from the initial interviewee of key events where decisions were made and in-depth details of specific events from the later interviewees, we adapted the interview schedules in the CDM method into a single schedule so that all interviewees had the opportunity to mention any challenges and changes associated with a challenge they had experienced in sustaining agility. We did this to ensure that as many challenges and changes as possible, not just those salient to the initial interviewee, were captured.

The interview schedule, as shown in Fig. 1, had three parts. First, a preamble to ensure the interviewee understood the purpose of the interview, and that their participation was voluntary, names would be anonymised, and the interview recorded. Second, questions about initial adoption issues, and then more recent sustainability challenges and changes the organisation had made to address these challenges. A change can be viewed as a potential solution that the organisation had made to address a challenge in sustaining agility. We asked for specific examples and details about challenges and changes, and how well agility is currently embedded in the organisation. For example, the participants identified a change relevant to sustaining agile. We asked them to elaborate on the change by outlining the context in which it emerged and explaining the processes and mechanisms through which this change was implemented. The third section consisted of questions about the experience and role of the interviewee.

3.3. Interviews

The interviews included a single interviewee and two interviewers and were online. Shortly before the interview, the interviewee was sent an information sheet about the study and a consent form to sign. All interviews were recorded and transcribed in MS Teams with the verbal and written approval of the interviewee. Each interview was scheduled for 1 hour, at a time and place that best suited the interviewee. Nine interviews were carried out over 2.5 months in the fourth quarter of 2022. The first interview was with the key person who had contacted and invited the other interviewees to take part. This person was an operating model implementation lead. The second interview was with a senior manager who had been with the organisation since the first phase of the move to agile began in 2016 and was instrumental in implementing the agile principles and practices at all levels. Following this interview, the other participants were interviewed at times that suited them best. The profile of the participants and interview durations are shown in Table 2.

3.4. Additional case material

The case study data included additional material used to develop an accurate background history of the Retail organisation and its agile use. This material also improved the accuracy of the timing of challenges and some of the main organisational changes made to sustain agility. This material included the company's public annual reports, news reports from local newspapers, a video of an agile business conference presentation describing the organisation's transition to agility, and two PowerPoint presentations provided by the participants to the researchers. These PowerPoint files were created to explain to the staff the organisation's agile adoption and changes to the operating model. The company's public website and organisation chart also contributed to the case study evidence. These materials were used to verify facts, events, and processes raised in the interviews. The company website was used to confirm our understanding of the company's structure to access all public annual reports. Annual reports and newspaper reports verified the sequence and dates of major company events, and confirmed facts such as the number of employees in the company and the organisation's revenue. The content of presentations confirmed details such as the reason and purpose for adopting agility, why the organisation was making changes, how the operating model and team structures evolved.

3.5. Data analysis

Data analysis involved first cleaning the transcripts to ensure their

Interview Questions

- Were there challenges in the initial adoption? What? How were these overcome?
  After the initial adoption challenges, and as things started to settle down, please tell us:
  - What are the main challenges <the organisation> faces in sustaining an agile way of working?
  - Can you think of an example/experience/event/ issue that was particularly interesting or that sticks out in your mind (related to a specific challenge and how you (or your team) went about addressing it)?
- Please give us specific examples of particularly significant changes <the organisation> has needed to make in order to sustain agility
  - Please explain one or two examples of changes made in detail:
- How well do you think agile working is embedded now?

Demographics

Finally, I will wrap up by asking you a few demographic questions.

i. Please indicate your age range: 20-30, 31-40, 41-50, >50
ii. How long have you worked for this organisation?
iii. What is the name of your current role?
iv. How long have you worked in this role?
v. Please describe your current role.
vi. Before your current role/function, what were the other functions that you performed in this organisation?
vii. Did you use Agile before you joined this organisation? If yes, how long for?
viii. Do you have any questions for us?
ix. Is there anything you would like to add?

Fig. 1. Interview schedule questions.

Table 2
Participant profiles and interview duration.

Person code	Age range	Duration	Prior agile experience	Current role	Interview duration (Average: 47 min)
P1	31–40	6	2	Retail operating model architect	43
P2	41–50	5, 2	2	Delivery coach	45
P3	41–50	4	0	Retail operating model implementation analyst	41
P4	>50	5	5	Operating model architect	46
P5	31–40	4	2, 6	Product owner chapter lead	37
P6	>50	3	18	Operating model architect	56
P7	41–50	5, 6	0	Group chapter owner	50
P8	31–40	4	11	Platform experience owner	59
P9	>50	4, 6	13	Delivery coach	45

Key
Age range – in years
Duration – years working in the organisation in years and months
Prior agile experience – experience working in agile environments before this organisation in years and months

accuracy. This involved listening to the recording and checking and removing any errors in the transcription. The data analysis followed the process described by Schreier [66] for qualitative content analysis. As described in this process, a coding frame was developed after both researchers independently coded the first transcript. Coding involved each researcher independently reading the transcript to identify historical events and any challenges and changes mentioned by the participants. The coding frame was then revised iteratively and jointly. That is, as the researchers coded each transcript in turn, they discussed adjustments to the codes. In discussion, codes were renamed, added, or merged into the coding frame. Categories of codes were then developed by grouping the codes. This grouping was discussed and agreed upon by the researchers. This led to a set of challenges published in a conference paper [12].

To identify changes made by the organisation to solve or mitigate each challenge, and elicit more details on the history of the organisation and its agile experience, the transcripts were analysed a second time by both researchers individually and with extensive discussion until agreement. This led to some changes to the names and grouping of certain challenges. The final step in analysis was to look for common themes in the solutions, which we named general actions. These general actions are the broad explanations of how the organisation sustained agility.

4. Findings and analysis

This section describes the case organisation's history of agile adoption, gives a profile of the interviewees, and an analysis of the challenges and solutions the organisation encountered. The final subsection describes how the organisation sustained organisational agility.

4.1. Case description

In 2016, the company began a digital transformation primarily to improve the customer experience. Alongside this digital transformation, the Retail organisation began an agile transformation to support the overall aim of becoming more customer-centric.

Before 2016, the company's strategic planning was typically done 15

to 20 years in advance, following a well-established process where problems, solutions, and delivery timeframes were well-known. The company had traditional leadership behaviours and mindsets, a hierarchical organisational design, and a traditional incentive structure. As a result, command and control management and waterfall project management were deeply ingrained. However, the dynamics in the rapidly growing sector were changing, with less predictability, a greater need for testing and learning, and the increasing importance of communicating with customers to maintain their loyalty and support. Consequently, some people in Head Office and Retail recognised that the organisational structure and culture have evolved in a way that was not ideal for coping effectively with change, learning, and being customer-centric. These individuals recognised that Retail would benefit from being more agile but would need to undergo a significant transformation to achieve success with agile approaches and fully embrace them as part of the business.

The first phase of Retail's move to an agile organisation started in 2016. An agile way of working was recognised as a way to improve Retail's responsiveness to its customers. At this time, Agile methods were already in place in some teams, such as the software development unit. The change to an agile way of working was driven by the CEO and some members of the executive and senior management who sought to bring the benefits of successful agile environments into Retail. The need for change was viewed as critical for Retail.

"we sold it as a little bit of a burning platform … thing. Where we were a brand that had effectively become quite staid and … stuck in its ways and… we were losing quite a lot of customers. And so, the way we sold it to people was hey, if we keep going like this, in five years' time we won't have any customers and so … we need to change somehow. We need to do something different. … We can't carry on, doing what we're doing. And so that was a big … push to change the way we did things" [P1].

The shift was described as "more of an evolution than a transformation" by one long-serving staff member. It started with agile adoption in specific areas of Retail and tended to be isolated within teams.

The second phase during the pre-COVID-19 (pre-2020) period involved significant internal changes to Retail's structure and funding models. The Spotify model [67] of agility was introduced with teams organised into chapters and squads with product owners. Another significant change was when project funding was devolved to the team level (squads) when Retail recognised that its traditional funding mechanism was causing problems with product quality.

In 2020, a consultancy assessed Retail, and their report provided the impetus for additional change to an agile way of working. The Cynefin model [68] was used to evaluate what parts of Retail would most benefit from the agile way of working. Ideas from Team Topologies [69] were introduced to reduce challenges caused by interdependencies and the lack of clearly defined interactions between teams. The Retail teams were structured into business value-stream aligned teams, platform teams, and technical teams. Value-stream-aligned teams prioritise delivering value to clients (customers) and meeting their needs quickly and efficiently, while the other team types support these teams. This structure defines the service level expected of a team and how one team should be able to consume the product or service provided by another team. By this stage, the early challenges of getting executive backing, management backing, and changing the Retail organisational structure had been met.

In 2022, a new operating model called 'Retail ways of working' was launched. By mid-2022, Retail had implemented agile more fully because it had a type of work that is more dynamic, less predictable, more amenable to testing and learning, and with a stronger need to talk to customers than was necessary in the Wholesale or Production sections, where the work had a more predictable nature. The agile way of working was then scaled up incrementally. For example, initially, Retail had a strong agile chapter, holding weekly or fortnightly meetings to discuss organisational issues and initiatives to improve agility. A business analyst's chapter was then set up, and due to its success, the organisation started a product owner chapter, a product manager chapter, and test chapters. At this stage, Agile was considered well embedded, *"provided we keep focusing on the things that are not working yet, and keep iterating on them, then I think we will have something…quite solid and really good…we're on the right path*" [P9]. A summary of the main phases and some major events is presented in Fig. 2; however, most events did not have specific start and end dates.

At the time of the research, most people in Retail understood the purpose of following agile values, principles, and practices and were supportive. Interviewees noted that Retail had overcome initial challenges, such as gaining executive endorsement and support, restructuring the organisation (e.g., transitioning from general managers to value stream owners), and had reached a high level of agile maturity; a level they had not observed in comparable organisations. However, at the time of the interviews, in late 2022, Retail faced several further challenges that posed potential threats to sustaining its agile principles and practices, and was taking proactive steps to address these issues; however, some challenges remained unresolved, with no clear solutions.

4.2. Participant profiles

The nine interviewees were mature, experienced staff with different levels of seniority and roles in the organisation. At least three interviewees had over a decade of experience in agile workplaces, mainly in an ASD context. Their current roles were all specialist agile roles. Table 2 shows the profiles of the participants. P1 was the most senior staff member.

4.3. Challenges and solutions to sustaining agility

The following subsections describe the challenges encountered (in no particular order) with examples from the case evidence. Following an explanation of the challenge, the changes (a solution or solutions or mitigating actions) the Retail organisation made to address the challenge are described. At the end of the section, the challenges and solutions are summarised in Table 3.

4.3.1. Disparate levels of maturity

Disparate levels of maturity occur when teams and organisational units have different levels of agile knowledge, and maturity in using agile mindsets, principles and practices. Disparate levels of maturity arose in five areas.

Agile knowledge and experience. When new people were hired, some were fresh graduates who tended to come with suitable agile knowledge acquired from their education (i.e., agile mindset, principles, and practices), some had no agile experience, others came from organisations that had a unique agile way of working and these people often had preconceived ideas of how agile should work. There was also a need to engage with suppliers and parts of the organisation that operated in non-agile and more traditional ways. For example, the legal team had no knowledge of agile practices.

Mismatch in the degree of agile knowledge between IT and non-IT units. While most technical people, such as software developers and testers, were knowledgeable about agile methods, some people in non-IT roles and teams did not know what agile meant for their type of work. For example, most product owners and marketing teams did not know the underlying principles of Agile beyond Kanban and Scrum practices, and some had never heard of the Agile manifesto. Some business areas were described as "*a bit of a wasteland as far as agile goes*" [P9]. Disparate maturity levels in different teams and organisational units made it harder for teams to work together effectively.

Lack of common understanding of what agile meant for individual job roles. Related to the above issue was the lack of common understanding of agile principles and practices when job roles changed. For example, moving from the traditional managerial role to a product owner role was

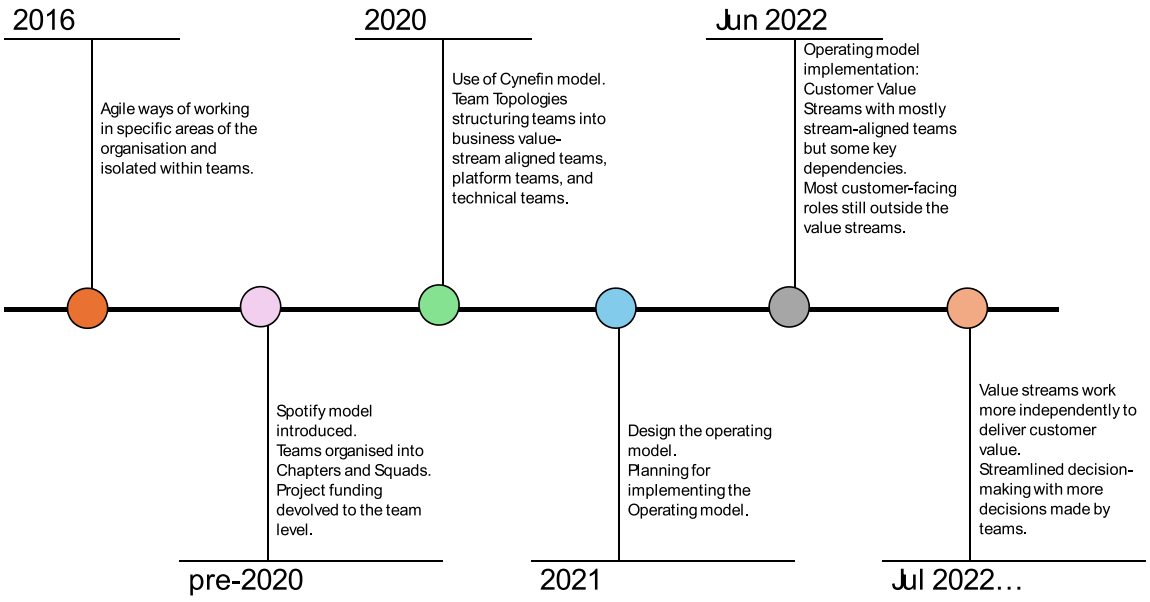

Fig. 2. Timeline of the main phases and events in sustaining agility.

one of the most significant changes for many teams,

"you move from having managers to product owner… you're supposed to be in end-to-end squads that will enable a piece of work. I think a lot of these people were moved, but the journey was not quite there, where everyone actually understood what agile means for them" [P8].

Non-technology teams were given agile roles and Scrum events [70] (also referred to as ceremonies) to perform but preferred to continue working in the same way as they did in their pre-agile roles.

Several steps were taken to address these three challenges. The organisation provided training at all levels. Many senior leaders underwent technical training, such as product owner training, which taught them about prioritisation and estimation, leading cross-functional teams, and not planning everything in full detail before starting a piece of work. Similar sessions were held in parallel for others in the development team as they moved into agile ways of working. The organisation also assigned more experienced people to work with teams new to agile, non-IT teams, and those less experienced, to improve their overall maturity. An agile team maturity model was implemented to evaluate how the teams performed against the reference model, allowing less mature teams to be formally identified and assisted. Continuous training and awareness initiatives were implemented to promote understanding of the agile way of working across the entire organisation.

Technical debt. Technical debt had increased due to reduced planning and taking shortcuts during development. Although efforts were made to balance technical debt and up-front planning to deliver working software to the customer early, the non-IT teams did not understand technical debt and how early decisions can have long-term effects on systems.

The organisation handled this challenge by maintaining a register of potential technical debt issues and allocating time to reduce them. IT people also dedicated time to explaining the significance of technical debt and the impact and consequences of not handling it for the system at multiple levels to other squads and managers.

Using Scrum in a way that hinders agility. Hindering agility occurs when an agile principle or practice has some detrimental effect on another agile principle or practice. Some development teams found Scrum events, such as sprint reviews, burdensome. Instead of serving their true purpose, which was to provide authentic feedback on the team's work, the reviews were used as showcases to impress senior leaders. As a result, the teams had to conduct two sprint reviews: one for managers and another 'real' review among the team, creating extra work and time. Furthermore, Scrum was found not to work well for the last 10–20 % of the projects where the teams were very close to releasing something to production or a product to the customer.

"*We found that in the last four weeks, Scrum doesn't work well because the framework has put in so much control over what people should and shouldn't work on* [P7]".

And if someone had finished their work earlier in the sprint, they were not allowed to

"*start a new piece of work because the team's not ready to pick up a piece of work and we had times where people sit around* [P7]"

This situation resulted in blockages for some teams, leaving staff with no new tasks to start.

To resolve this challenge some Scrum practices were adapted, but the teams decided how they wanted to do it. Depending upon the type of task or piece of work, the teams could switch to Kanban (with Work-in-Progress limits on each iteration) to loosen up the strict requirements in Scrum on task completion in an iteration or sprint.

4.3.2. Resistance to change

Resistance to change is when people are unwilling to adopt unfamiliar ideas and practices.

During the initial adoption phase, the top and middle management were uncomfortable with the increased transparency expected in agile projects and were resistant to changing their working methods. In addition, they did not understand how the role of the leader in a self-organising environment differs from a more traditional leadership role. There was a lack of buy-in from senior leaders who could not see the benefits of changing to agile,

"lack of buy-in from senior leaders or managers… to how they are used to working. They are very … traditional hierarchical, and now you are asking them to flip that to being self-organising, …and what it means to be a leader in that space" [P2].

The resistance to agile increased as it spread across organisational boundaries into the broader Retail section, which consisted of numerous teams, value streams, and business units. For instance, some value stream owners and platform owners accustomed to traditional methods felt that agile hinders the development process. These owners, who were accustomed to directing the team and were resistant to teams and product owners making customer-centric decisions,

"they are not used to people coming back and disagreeing with them or challenging their thoughts, they are used to saying, hey, this is what I think

Table 3
Summary of challenges and solutions for sustaining agility.

	Challenges	Sub-challenges	Solutions to sustain agility
1	Disparate levels of maturity (Section 4.3.1)	Agile knowledge and experience	• Provide technical training to senior managers on agile ways of working • Train operational staff on agile ways of working • Assign agile-experienced people to teams • Evaluate agile team maturity and assist low-maturity teams • Implement continuous training and agile awareness initiatives for the whole organisation
		Mismatch in the degree of agile knowledge between IT and non-IT units	As above
		Lack of common understanding of what agile meant for individual job roles	As above
		Technical debt	• Register technical debt issues and allocate time to reduce them • Explain technical debt's negative effects to non-IT squads and managers. IT people explain
		Using Scrum in a way that hinders agility	• Allow teams to try alternative agile practices (Switch to Kanban and use WIP limits)
2	Resistance to change (Section 4.3.2)		• Hire senior managers with agile experience and commitment to agile principles • Provide empirical evidence of the value of agile ways of working (metrics and data) to management • Conduct post-implementation reviews • Evaluate and adapt the business operating model to achieve agile principles • Sustain continuous agile awareness and training throughout the organisation
3	Competing priorities (Section 4.3.3)	Financial versus customer-centric priorities Traditional governance versus agile principles	• Revise the business operating model
4	Lack of team empowerment (Section 4.3.4)		• Introduce specialist agile roles designed to identify issues and educate individual teams and managers ○ Delivery coaches ○ Operating model architects ○ Group chapter owners • Encourage questioning; 'Ask me anything' sessions • Revise the business operating model to make role changes and clarify decision-making responsibilities
5	Dependencies between teams (Section 4.3.5)		• Use 'big room planning' on a quarterly cadence • Visualise multi-team workflow and dependencies with information radiators • Revise the business operating model to implement team topologies thereby clarifying team roles and interactions
6	Onboarding people to the agile way of working (Section 4.3.6)		• 'Agile at X' sessions to explain this organisations agile way of working • Sustain continuous training • Specialist agile roles (as above) closely with newcomers • Support experienced team members to help new members understand this agile way of working
7	Lack of role clarity (Section 4.3.7)	Defining roles	• Explain agile roles and how they contribute to team function • Create versatile cross-functional teams • Introduce specific roles to increase clarity and standardization • Use role cards to explain the responsibilities of a role
		Balancing responsibilities	• No solution yet tried
8	Staff turnover (Section 4.3.8)		• Encourage staff to learn new skills to become T-shaped and cross-functional • Encourage teamwork and backup behaviour • Support team longevity • Support swarming on issues • Accept that things will take longer
9	Incompatible funding model (Section 4.3.9)		• Change the funding model

you should work on. We think you should do… and our product owners and teams are going, it is not what our customers are asking from us" [P6].

While some teams adapted to the agile way of working, there was ongoing resistance to change at different levels, from senior management to value stream owners and individual teams.

"we have some senior people who have been in the company for a while now, and so they are on board and they want to do things, but we do have some … value stream owners and platform owners that are from a traditional environment and they are like, 'this is slowing us down, we don't want to do this work' … The way we are trying to combat that is making sure that the value stream owners who are on board [act as]… an ambassador. And so it doesn't become just us [those in senior roles], but the other people who see the benefit are carrying it across, and then hopefully create a peer pressure … where we are all on board and we want to do it, but we still have couple of people in the senior positions that don't see the value." [P3]

The organisation addressed this challenge in several ways. The

organisation hired two senior managers from overseas with previous experience in agile transitions and a new CEO, who also had knowledge and experience in agile ideas. The new CEO's goal was to make the organisation customer-centric and deliver products that customers valued. With the support of these committed leaders at the senior management level, the organisation could move forward quite quickly. More new people with prior agile experience were hired. Organisational learning was implemented through ongoing education and training in agile.

At the level of teams, the teams provided empirical evidence to the management, with metrics and data, to show the value and effectiveness of the agile way of working.

"We were able to sort of narrow down things and make logical, sensible arguments around what we should be delivering… It became very easy for the management and execs to see exactly what value they were getting out of what we were developing. So that really changed the attitude" [P2].

Post-implementation reviews were introduced to seek teams' feedback and identify any issues or challenges. The reviews were used to show the management that delivery expectations work against the agile way of working, and traditional governance cannot be wrapped around agile projects.

The organisation also addressed several resistance-related issues through continuous improvements to the operating model, supported by ongoing agile awareness and training throughout the organisation.

4.3.3. Competing priorities

Competing priorities occur when priorities vary between different parts of the organisation. Two types of competing priorities arose.

Financial versus *customer-centric priorities*. There were competing priorities in the leadership team as their Key Performance Indicators (KPIs) were measured based on financial outcomes and benefits for the individual business units, rather than on what was valuable for the customer and of overall benefit to the organisation. There were about 50 different business units across the whole of Retail. This created a lot of silos where everyone had competing priorities. At the time of the interviews, when there were already 130 large pieces of work in progress and because of competing priorities, some people wanted to start another 56 pieces of work.

"especially our leadership team have KPIs which are measured on financial results … and so everyone was out for themselves, rather than what was best for the organisation and the customers" [P6].

This challenge occurred because some members of the leadership team prioritised their status and preferences over the organisation's best interests. The operating model architects, who worked at the system level rather than the team level to support the value streams to work more effectively, saw these competing priorities as a significant hindrance to sustaining agility.

Traditional governance versus *agile principles.* Competing priorities also occurred between Retail's overall governance requirements, which expected a business case with firm estimates of cost, time, and benefits, and following agile values, principles, and practices. The management was unwilling to compromise to accommodate agile working methods. The teams felt pressure to provide answers about meeting specific deadlines, as the management needed reassurance about delivery dates and budgets. This created a challenge of convincing governance managers that while finance and the business case need to show firm costs and deadlines for completion, agile is based on estimates, and technical issues can arise that change costs during development.

This challenge was alleviated by reviewing and making regular changes to Retail's business operating model (e.g., shifting the decision-making and governance to the value streams). An executive action team was established that met regularly to discuss the changes to the operating model. A central management team with change management capabilities collaborated with the senior leadership team. Managers received ongoing agile education and training about the operating model tailored specifically for the organisation, along with guidance on the implemented changes and the rationale behind them, such as fostering a customer-centric vision.

4.3.4. Lack of team empowerment

"Highly empowered teams have a high degree of responsibility and power to lead themselves" [71]. Team empowerment is important because it is known to foster team adaptability [71,72].

The organisation's leaders often did not understand the implications of decision-making (who makes the decisions) on team empowerment. Senior and executive managers would often make decisions without understanding the implications for team empowerment. Some value stream owners were accustomed to directing the team and making priority decisions in their previous roles. This was well expressed by one of the operating model architects,

"they tell the team what they want them to do and to work on, and what that leads to then is an unempowered team. They don't have autonomy; they don't have empowerment" [P7].

These managers were not used to the teams or product owners challenging or disagreeing with their decisions. This lack of empowerment at the team level, i.e., by those doing the work, clashed with agile values such as doing what the customer wants and being customer-centric. So, the challenge was to change this decision-making behaviour and empower teams by handing over the decision-making to the teams.

"we're looking at people, who previously were the decision-makers, [who] no longer had the power to dictate what the teams underneath them are doing. So you know that's a dramatic change for any organisation" [P4].

The solution to this challenge was to introduce the role of delivery coach to support individual teams. There were eight delivery coaches, each supporting two to three teams based on the level of support needed by each team. Some teams with high agile expertise did not have a delivery coach. Another solution was introduced by senior operating model architects and group chapter owners, who were responsible for the community of agile practitioners and who worked at the system level (similar to an agile enterprise coach). This group introduced "ask me anything" sessions at all organisational levels. Delivery coaches facilitated these sessions, allowing people to ask questions at any time, such as the benefits of agile, team empowerment, and how empowered teams have improved customer responsiveness. The operating model architects dedicated significant time to educating the senior leaders and value stream owners about the changes in their roles. Their roles had shifted from making decisions to understanding the issues faced by the teams and assisting in their resolution. The new operating model reflected the clarity of decision-making and moving the power down to the teams. These initiatives led to significant changes in how teams made decisions. For example, some value teams started making decisions based on their customer research to understand what the customer wants, prioritise customer needs, and decide if a customer need would work.

4.3.5. Dependencies between teams

Multiple dependencies involving knowledge, processes and resources can exist in team-based work [73]. The organisation had difficulty in addressing multiple dependencies between a large number of teams.

At the time of the interviews, the value stream structure had increased the number of teams from 9 to 40. Furthermore, many decisions were linked to other teams or business areas such as billing, legal, and technology. This created multiple dependencies that were difficult to address effectively,

"Some other squad out there may be waiting for a technology squad to do your thing. And we are not big enough to have lots of those people to be shuffled as different projects come up and down …so, we have those challenges and …what is most important to me may be quite different to what is most important to you and …right now I might be waiting for the billing team to do… and then I might be waiting for legal to do something, and then someone might be waiting for me to get this API's published…" [P8].

In some cases, about 8 to 10 teams depended on each other to complete all the necessary work for a customer. There was a lack of visibility of work between units and a clear understanding of the priorities. For example, a team of about 50 people that provides technical support to all the platforms, such as the service desk and support desk, often had the challenge of not having the,

"Visibility of … the work that was being requested of them, and they didn't understand the priorities" [P6].

Many interviewees saw dealing with these scaling challenges and the increasing number of dependencies as an ongoing obstacle to sustaining agility.

To address this challenge, the organisation experimented with a session similar to "big room planning" at the beginning of each business quarter to share all the work across units. Big room planning is a meeting involving multiple teams, which is recommended in SAFe™, where it is called PI (program increment) planning https://scaledagileframework.com/pi-planning/. This collaborative effort established a quarterly planning cadence at the organisation level. This involved cross-functional teams, product owners, and leaders working together to plan and size work for a specific timeframe. The use of visible task boards and information radiators showing multi-team workflow enabled the identification of dependencies and other challenges faced by teams. The operating model architects and delivery coaches facilitated these sessions. They identified the main challenges, and strategies to mitigate them, such as explaining the issue to teams if their work is vital to other teams, and swarming on that work to provide the needed support (swarming is used in agile teams when a high-priority work item or issue is causing problems; team members focus exclusively on this single work item to resolve the issue collaboratively).

Another solution was to make significant changes to the business operating model. This involved introducing ideas from Team Topologies [69] to redefine the Retail organisation's team types and how teams would interact. This meant particular types of teams (e.g. platform team) interact with other teams in specific ways to reduce dependencies, or create services that other teams can consume without queuing for work. The

"intent of that was to reduce some of the challenges we had around interdependencies between teams and …unclear or undefined interfaces and interactions between teams. Team topologies really helps us to define the service level that you should expect from a different team and how you should be able to consume the product or service that team provides" [P1].

4.3.6. Onboarding people to the agile way of working

Onboarding is the process through which new employees join and integrate into an organisation. Onboarding can create unique challenges for agile software teams, including the need for mindset change, understanding the way teams are composed, the importance of communication, and the need to provide a community of practice (COP) [6].

Several interviewees identified issues related to onboarding new people into the agile way of working, including mindset change. Although some recruits had previous agile exposure, they lacked the experience and mindset to work in self-organising teams and were unfamiliar with the organisation's unique agile way of working; "*every time you get a new person into a team, they are like, why are we doing it this way?"* [P6]. So, there was the need to maintain constant education with newcomers to sustain the organisation's agile way of working.

To address this challenge, 'Agile at [organisation]' sessions were held for all newcomers during their induction and onboarding. These sessions were used to explain what agile meant for the organisation, the key aspects of how it worked, why it worked that way, and some terminology. A group chapter owner explained,

"Anyone can actually come, but particularly targeted at those who work in the parts of the business where we do our job, [we hold] an 'Agile at [X]' session where it's kind of an introduction to 'this is what agile is, at a very high level. This is what agile is, this is what it…means for us, these are the key things you need to know about how we work and why we work this way, and what we're trying to achieve, and some terminology, and all these sorts of things. And then we have roles within our business, we call operating model architects and delivery coaches now, but basically, ways-of-working-in-agile specialists, and depending, obviously, on which team or area those people go into, they get … time … over the first few months with those people to understand a bit more. A lot of our teams now are pretty good at helping new members, you know, learn the way we do things here, and why we do it." [P7]

In addition, supporting teams through the stages of forming, storming, norming, and performing [74] was an ongoing challenge as they learned to work together to achieve common goals. And

"as turnover increases the volume of needing to [teach the agile way of working] increased and we've got fixed capacity in terms of, at the moment what we can spend, how much time we can spend doing that" [P7].

Specialist agile roles, such as the operating model architects and delivery coaches, worked closely with the newcomers, depending on which teams those people went into. More experienced team members were also supportive in helping new members settle into the agile work environment.

4.3.7. Lack of role clarity

Lack of role clarity occurs when people are unclear about the tasks and responsibilities associated with their new role. Two challenges were related to role clarity.

Defining roles. Organisational roles such as product manager and product owner were not clearly defined. Without a role definition, it had become normal for product managers to do the product owner's work and vice versa.

"a lot of the time product owners are wearing both hats of delivery and working on strategic product decisions and within the squads…they are acting a little bit more like market leads, and they are not distinctly managing products and the commercial [aspects] of those products that they would then recommend to a product owner" [P5].

A long-standing lack of role clarity became more apparent as agile methods spread throughout the organisation. With agile, people's ways of working were not under as much scrutiny as in the past, because the emphasis shifted to how different skill sets fit together to form a cohesive team. It became important for people to know their changed roles. Some people preferred to work in a specific role that matched their skills. A delivery coach explained how they were dealing with a,

"mix of people where I've got a product manager who'd like to do a little bit more product ownership as we've defined here in [the organisation] and I've got a product owner who actually thinks that she would rather be a product manager" [P9].

To solve this challenge, delivery coaches organised sessions for all product owners and product managers to review their current agile roles and how their roles contributed to the overall team function. T-shaped roles and cross-functionality were encouraged to create versatile teams capable of delivering value across different areas (team members with T-shaped skill sets, also called generalising specialists, have advanced knowledge in one skill area and general knowledge in several related skill areas [75]). Many role descriptions were updated to increase clarity and standardisation. For example, those leading platform teams were given a new title called 'platform owner' and those leading complicated sub-system teams or mixed types of teams were called 'lead'. With a growing understanding of the different team types, the role titles were introduced to help quickly understand the specific purpose of these teams and how to engage with them. Role cards (an explanation of a role written on a small card) were also introduced to help people understand their agile role.

Balancing responsibilities. Balancing responsibilities is related to a lack of role clarity. If roles are not well defined and a person has more than one assigned role, then it can be unclear what time and effort the person should devote to each role.

This challenge arose when a new operating model was introduced that changed the structure of the Retail organisation. The new model

was based on some of the ideas in the Spotify Model [67]. The new model created several chapters (i.e., a chapter is a group of specialists) such as the agile chapter, business analyst chapter, product owner chapter and product management chapter, and roles such as value stream owners and chapter leads. This change led to concerns about balancing the commitment and responsibilities between the different types of work, for example, the percentage of time that a chapter member should spend on chapter work (e.g., fixing a faulty process that affects all teams) versus business-as-usual, which was the work of a value stream.

"We have still got a bit of a struggle here to work out exactly what the remit of the chapter is because originally it was to spend time helping members of the chapter hone and improve their skills. But what's happened with some of the chapters is that there is a whole bunch of systems and processes that no single team is responsible for that are broken, and they have taken it on themselves to start fixing those" [P9].

Although the chapter structure was a good way of identifying and improving problems and processes that affected multiple teams, it raised another challenge of balancing a team member's responsibilities to their chapter work versus the work of the team.

"you can only have so much percentage of time to do that because we also have our business-as-usual work that needs to be attended to. Nobody has actually made the decision yet about what additional time, if any, should be devoted to chapters who are working on improving their processes" [P9].

At the time of the interviews, there was no clear solution to this problem with the chapter structure.

4.3.8. Staff turnover

Staff turnover is the number of staff who leave an organisation over a certain period. Due to the impact of the COVID-19 pandemic on the labour market, the organisation experienced higher turnover rates than usual. Despite the organisation's substantial investment in providing new and ongoing employee orientation and agile training, the constant need to reacquaint staff with the organisation's agile way of working was seen as a significant challenge in sustaining agility.

"*So, the challenge of maintaining the working level of knowledge and agile knowledge [caused by staff turnover] becomes more difficult*" [P7].

Due to a reduced number of staff, although some teams were in the process of hiring staff, several teams experienced difficulties maintaining their value stream. The reduced staff in some dependent teams meant that these teams took longer to complete their work, disrupting the smooth flow of value through the system. Thus, understaffing caused a major bottleneck. In addition to insufficient resources for maintaining value streams and losing agile knowledge, pressure for resources spread to other teams. For example, a squad or team would be working on one of their highest-priority items, but due to insufficient resources, they would seek support from another team. However, that team's roadmap would be full for about six months. So,

"the next question is, well, why don't we just give the team the resource that it needs to be able to do it, but we cannot give the team the resource to be able to do it because that resource is so scarce in the first place and also expensive that you just back into square one" [P5].

Several approaches were considered to address the turnover issues. The organisation needed to change its approach to staff recruitment by balancing the requirement for an agile mindset and behaviours with the skills the business needed. To cover for staff shortages, existing staff were encouraged to learn new skills so they could contribute to T-shaped cross-functional roles. These people were then more able to contribute to backup behaviour by covering the work of absent staff. Role cards were used to help people understand their agile role, and teams were reminded not to say,

"'that's not my job', because that's not what these cards are about. These cards are to give you sort of a base of where you come from, but we all work together as a team" [P9].

Team longevity supported the backup behaviour of some teams,

"is just the longevity of some of those team members who have been in the same team with each other for a couple of years now…They support each other naturally because they care about the people in their team and they've worked together for a long time." [P9].

While most teams were willing to contribute to backup behaviours, in some cases, it took longer due to the inexperience of new members. Nevertheless, staff were still encouraged to swarm on an issue even if it was out of their skill areas.

"I know it's not what you're used to doing, but if you're happy to pick this up, it doesn't matter if it takes twice as long, because you're learning. Because twice as long is faster than none at all." [P9]

4.3.9. Incompatible funding model

The problem of funding agile software development projects in non-agile contexts is well-known [76]. Funding can be problematic because agile projects do not have traditional completion milestones and firm end dates to which funding is definitively allocated. In agile software development, increments of product (development tasks) are identified and prioritised so that the most valuable tasks are worked on and completed first. The assumption with this agile process is that, at the end of any development iteration, if the customer decides to halt development, they will be provided with some functioning work product. The organisation encountered various funding issues related to its software product development.

Several interviewees identified the misalignment between the agile way of working, based on task priority, and how finances were organised and allocated. For example, some of the senior managers who had a budget allocation (e.g., CapEx, OpEx) to do projects in a specific application platform, pressurised the teams to build their preferred features first,

"We had OpEx budget and CapEx budget, and each leader … had a bucket of each of those things … I can give you … a specific example [for] … [AppX] … our app and web platform. What would happen is, you had about 8 leaders who had … project money to do projects in [AppX], … build a feature in the app, essentially. The [AppX] team … were entirely funded by this project money. But what the leaders … would say is, 'Well, I want my feature built. Here's a project budget to build that feature, and I want a June delivery' … And the team … would say, 'Well, we're already doing these 3 other features for these 3 other leaders for their project budgets', and so then the 4th leader will say, 'Well, oh, if I'm not getting it then I'm gonna go spend my project money on something else'." [P7]

When the teams recognised the deficit in their funding, they would panic and chase after other project money. This resulted in fluctuations in velocity and output, and reduced product quality due to a focus on building new features for which they were funded, rather than on application stability and performance, which was not funded,

"…those people with the project money wanted new features. They didn't care about app stability and performance and things like that. So, the team was purely focused on building new things. And … our app started to crash because the team had said, 'Well, we're funded by project money to build new stuff, so we haven't even been looking at actually maintaining this thing'… all of a sudden, we had huge issues with the app… one of the solutions… was, we moved to what we called squad funding at the time. This happened years ago now." [P7]

The organisation solved this challenge about 3 years before the interviews. The organisation significantly changed the funding model once these flaws were recognised. A key application crashed, drawing immediate attention to this issue. The organisation then changed the funding model to devolve funding to squads. This provided more consistent funding for ongoing projects, and improved product quality because squads could decide how much time and effort to spend developing new features versus ensuring product quality.

Another issue related to funding agile projects was with estimating. If a piece of work took a few additional sprints to complete, more than the initial estimate, though it did not make a huge difference from a delivery perspective, it raised concerns from a finance perspective about the increased costs and whether the benefits were still relevant. This

challenge had not been solved,

"from a financial business case benefit perspective, we still have not figured a way that works well for both the business and the delivery teams" [P8].

In summary, the interviewees reported nine main challenges, some with sub-challenges. Some challenges had multiple solutions or mitigating actions, but balancing responsibilities, estimating, and governance had not yet led to any changes or a solution. The challenges and solutions used to sustain agility are summarised in Table 3. The challenges are numbered for convenience and do not imply any order of importance.

4.4. Sustaining organisational agility

Overall, to sustain agility, this organisation used multiple solutions. By grouping the detailed solutions that emerged in the interviews listed in Table 3, column 4, we identified seven general actions the organisation applied to sustain agility. Evidence that contributed to the case description provided one additional action that we have placed first because it supports all of the other actions.

4.4.1. Have a clear reason for implementing agile principles

A clear reason for implementing agile principles is needed so that when questions arise from people in the organisation, such as, Why are we doing this? What are these changes for? there is a clear justification for the changes and a straightforward answer that everyone in the organisation can understand. For the organisation, the purpose was to become a more customer-centric organisation, and agile values, principles and practices were viewed as an appropriate way to achieve this purpose. The reason the organisation wanted to become more customer-centric was to maintain and increase the organisation's customer base. Two operating model architects explained.

"to become a more customer-centric organisation and be able to… deliver products that our customers valued" [P1]; "So that we can work more effectively; so that we can deliver more to our customers" [P6].

Having a clear reason for implementing agile principles helped to address all challenges, except staff turnover, because it helped convince people at all organisational levels that the changes made to sustain agility had a purpose that would benefit the whole organisation.

4.4.2. Continuously focus on raising agile awareness

A continuous focus on raising and maintaining agile awareness involved formal and informal training and agile awareness initiatives for the whole organisation, including executive and senior managers, managers, teams, new hires, and other operational staff. Explaining agile roles and how they contribute to team function was continual. Various practical solutions to raise awareness were apparent. For example, agile-experienced team members were assigned to help new members and existing teams understand the agile way of working, 'Agile at X' sessions (as explained in Section 4.3.6) were held to onboard people, and the negative effects of certain work practices on agility (e.g. ignoring technical debt) were carefully explained to teams and management. In the following quote, chapter members would talk to parts of the business that were less aware of agile values, principles and practices and would swarm on an issue if necessary.

"For those parts of the business that we rely on who … have a more traditional way of working, … we are, especially in our agile-ways-of-working chapter, we go and talk to them about it. … it's about providing support in those areas and that's probably where we … want to swarm on to try and unlock it because it has such an impact for the teams." [P6].

4.4.3. Continuously adjust the business operating model

Continuously adjusting the business operating model to sustain agility involved monitoring the organisation to identify internal and external challenges in the organisation's environment, having staff in key roles to carry out the monitoring, and empowering staff to change the operating model. Changes to the operating model always had an underlying purpose and were communicated formally across the organisation. The operating model was revised to sustain agile principles and involved changing organisational processes (e.g., workflow) and clarifying team roles, interactions, and decision-making responsibilities. One early key reason for changing the operating model was to change decision-making behaviour from traditional top-down leadership to empowered teams and people with autonomy to make decisions, as explained,

"Trying to push decision-making autonomy, empowerment down to the teams, the people who are doing the work" [P6]. "That was one of the problems …We removed that problem, [it's] not totally gone yet because some of the behaviour is still there." [P4].

In October 2022, the organisation published evidence of five revisions of the business operating model (see Fig. 3).

4.4.4. Change roles – embed specialist agile roles

Introducing specialist agile roles and embedding them at all organisational levels, not just at the team level, was used to increase clarity about agile values, principles and practices, and standardize agile knowledge across the organisation.

"The sheer volume of agile specialists that work at the company now is possibly a good example [of a significant change]. When I joined, there were probably about four or five, but now there is a room full of us" [P2].

These roles provided agile-knowledgeable people responsible for integrating newcomers into the organisation's agile way of working, maintaining awareness of and identifying issues with the organisation's agility, and educating teams and managers in the agile way of working. Table 2, Participant profiles, shows six specialist agile roles, and other roles such as value stream owner were also in place. These roles come from Scrum, the Spotify Model, and Team Topologies (as explained in 4.1 Case Description) and supported the agile way of working at different organisational levels.

4.4.5. Change the funding model – use an appropriate funding model

This general action facilitated the agile way of working by adjusting how funding was allocated to units and projects. The funding allocation was changed when the organisation recognised that its traditional funding mechanism was causing problems with work prioritisation that, in turn, reduced product quality. The organisation changed from a traditional CapEx and OpEx funding model (capital and operational expenditure) to a model where decisions made about what to work on were based on value rather than on *"who's got the money"* [P7]. The organisation made a significant change by devolving project funding to the team level (i.e., squads). The problem that led to this action is explained in Section 4.3.9 Incompatible funding model.

4.4.6. Make work visible across the whole organisation

This general action made work visible by increasing transparency across the organisation to support an effective workflow and reduce holdups as work products passed from team to team.

"The key challenge there was around visibility and priorities of work and making it visible, … collaborative planning has really helped." [P6].

To achieve visibility, regular 'big room planning' sessions held quarterly were tried. Later, these sessions were reviewed and revised (explained in Section 4.4.8).

"Take the technical side of the business or the team … that provide all of the technical services, support all the platforms…, the service desk or support desk. They do all the project work that's required, everything technically related. Probably a team of … maybe 50 people and … the challenge was they didn't have visibility of the work that was being requested of them and they didn't understand the priorities, … so what we experimented with was … big room planning, getting the whole wider tech team together at the start of each … quarter. And sharing all the work that was there, … and the teams… planned that day and had an opportunity to … talk". [P6]

Another way work was made visible was to standardise the tools that

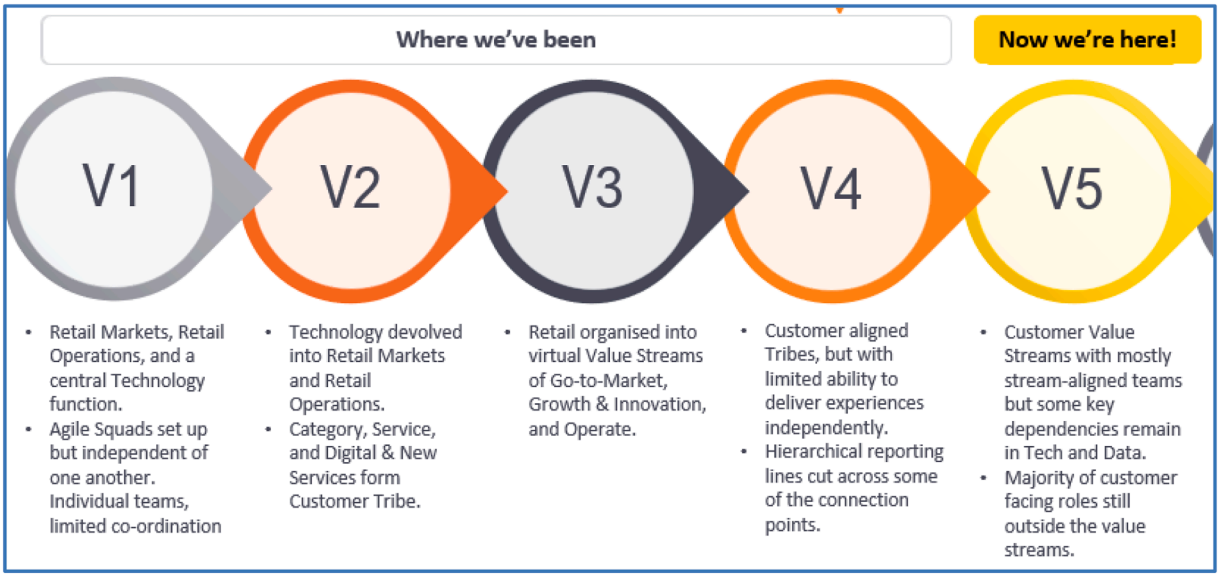

Fig. 3. Changes to the operating model up to late 2022 (from an organisational presentation to staff. The proposed future changes are hidden).

enabled information sharing and visualisation of multi-team workflow and dependencies. The organisation standardised on a single project management tool.

"One [challenge] is visualization of the work across the whole … [organisation]. Some people had it in a spreadsheet, some people didn't have it, there was nothing, it was all in their heads, … and some in Jira. … we had two different tools that were being used, one was JIRA and one was ADO [Azure DevOps]. So that was one of the problems. As well, it was stored in different locations, and they were not compatible … So, we ended up phasing out Jira. Some parts of the companies still use it, but for our agile squads, we said 'ADO is now our tool of choice, and so we will start using that … to get everyone using the same tool and some level of consistency'." [P4]

4.4.7. Support agile teamwork behaviours

This general action was to continuously support agile teamwork behaviour. This included creating versatile cross-functional teams with T-shaped skills because T-shaped skills enabled meaningful backup behaviour (the ability to take on the tasks of teammates when necessary). Backup behaviour is also enhanced with team longevity because teams with familiarity and trust more readily enact backup behavior. So, the organisation kept teams together over time. In addition, empowerment of teams and individuals, another typical agile teamwork behaviour, was a focus in the organisation. Teams and individuals were empowered to ask questions and given decision-making power to try alternative agile practices that suited their work. This quote explains how a delivery coach supported backup behaviour.

"I think there's a willingness, certainly amongst the team members, to step in where they can and do a little, … do stuff which is outside of their comfort zone. And we've set up environments here where it's like it's, 'I know it's not what you're used to doing, but if you're happy to pick this up, it doesn't matter if it takes twice as long, because you're learning. Because twice as long is faster than none at all'." [P9]

A delivery coach explained the effects of T-shaped skills and team longevity.

"I think there are probably 2 main things that make that work for us. One of them is definitely the encouragement … and support that they get for wanting to learn some new skills and be T-shaped." [P9]

The effect of team longevity is addressed in the quote by this delivery coach [P9] in Section 4.3.8 Staff turnover.

4.4.8. Monitor, measure, feedback, and act

"Experimentation, test, and learn, is something we do very well in my company" [P2].

This general action involved constantly collecting empirical evidence of the value of agile ways of working using metrics and data to support decision-making about what agile practices to introduce, replace, or abandon. Agile team maturity was also evaluated at intervals. This meant that less agile units of the organisation could be identified and supported to improve their agility.

"We … have ended up creating sort of maturity assessments for the different platforms or areas we use … and … for the teams themselves as well." [P6]

Practices such as post-implementation reviews and registers of issues, that affect the work of multiple teams (such as technical debt) also provided feedback to support the continuous improvement aspect of agility.

Monitoring, measuring, and feeding back helped to ensure appropriate changes were made to the business operating and funding models, as explained in Section 4.4.3 Continuously adjust the business operating model.

Monitoring was not just internal to the organisation but also external, in that curious people would monitor what was happening outside the organisation and use that knowledge to initiate changes.

"We are curious. We want to know how to make things better…And we are listening to our teams. I think there's a lot of empathy… And so, we hear the teams' frustrations. … We look outside to learn from others. And I think if you've got an agile mindset, you've got a growth mindset, … you're curious. You're always looking for new ways of doing things. You want to learn…. And you always want to experiment with something. I don't know if that is something you are born with…" [P6]

"There is that continuous drive … to improve things. And so, you look towards other companies and what they've done globally, you look at the state-of-agile reports. We also had [a consultancy], a company within New Zealand, come in and do a report, like an assessment … in terms of our…state of agility… the main thing that came from that report that they … said to our exec team, 'you've got all the brains-trust already existing in your agile chapter. You need to listen to them. They've got it nailed. They know what they're doing. They've got a wealth of experience, they are way ahead of a lot of people in New Zealand,' because we are looking externally, and 'they've been successful, you need to listen to them'." [P6]

Feedback also worked from teams to chapters in the organisation. When 'big room planning' was not effective for some squads, feedback to initiate a change came from the team via the chapters. A platform experience owner explained.

"This big room planning…session, …I really found that it doesn't work well for us… as product owners, it's a very messy day. You know people, people run around to talk to different teams, and we want to try to do… sizing of work, and we try to come up with a timeline in a matter of a day… Thankfully, [this has] changed in the last two or three years. As a team, this is us feeding back to the agile chapter … 'these things don't work'. So, [the organisation] did away with it about 18 months ago. We stopped doing this type of big room planning. What we do ask is for all the product owners to do a sync [meeting] with each other at the right time… [The organisation] …, we use the increment… each quarter is an increment for us. So, we asked that… each squad … sync up with different product owners, understand dependencies, and that takes … a few days… It's not something that you can have instantly. Sometimes you need to go back and find answers to questions, etc., … that's something that … sticks out to me because I've seen this in two places now [different organisations], and at both of them it didn't work well. It's a good kick-off, it's a good energy boost for people. But if you…want to use that day for planning, it's not that great." [P8]

Feedback was also acquired through surveys.

"We did a survey at the end of each quarterly meeting to see … is this really helping you?" [P6]

In summary, these eight general actions show how the organisation sustained its agility over time. Six of these solutions were applied continuously, including having a clear reason for implementing agile principles, focusing on raising agile awareness, adjusting the business model, making work visible, supporting agile teamwork behaviours, and monitoring, measuring, gathering feedback and taking action.

Two other general actions had occurred only once since the organisation formally adopted agile principles and practices. They were to embed specialist agile roles and to use an appropriate funding model. However, these actions indicate that the organisation is prepared to change the roles or the funding mechanisms, and may do so again in future if the situation changes.

5. Discussion

The purpose of this study was to explore how an organisation sustains agility. The case was a Retail organisation within an IT-centric company. The Retail organisation had primarily based its agility on the values, principles and practices of agile software development and had sustained its agility over six years. First, we sought to understand the challenges the organisation faced in sustaining agility when that agility is based on principles and practices from ASD (RQ1.1). Second, we identified the detailed solutions (changes or mitigating actions) the organisation applied to address each challenge (RQ1.2). Grouping these detailed solutions into general actions led to explanations of how the organisation sustained agility (RQ1).

The findings identify nine main challenges and some sub-challenges (see Table 3). Most of the challenges caused the organisation to make changes to resolve or mitigate them. For some challenges, multiple solutions were implemented; for a small number of challenges, the organisation had implemented no solutions at the time of the data collection and was still considering what they could do to address the challenge.

Many of the challenges reported in this study have been identified in other theoretical and empirical studies; however, not all have been identified in the limited literature on how organisations can sustain agility. Our study demonstrates that all these challenges can occur within a single organisation, making a unique contribution to the literature on sustaining agility.

The challenge of disparate levels of agile maturity (Section 4.3.1) occurred as agile principles spread from one part of the organisation to another. This disparity had a negative effect when the teams and organisational units were dependent on one another to complete work, mainly because the lack of transparency in non-agile teams led to holdups and tensions between teams. Although many agile maturity models exist [77], they tend to focus on agile teams rather than the whole organisation and do not consider agile maturity that is not uniform across the organisation. Our findings show that disparate agile maturity manifested itself in five different ways. Maturity was disparate vertically, varying from senior management to operational staff. Maturity was disparate horizontally, varying between IT and non-IT units (e.g., the IT unit had a high level of experience with agile principles and practices and understood technical debt). Disparate maturity was also evidenced when less mature teams with a limited understanding of agile principles implemented certain agile practices in rigid ways that restricted agility.

The challenge of resistance to change (Section 4.3.2) is common when an organisation undergoes change [78]. Kalenda et al. [79] and Dikert, et al. [80] reported this challenge when scaling up agile in organisations, and Denning [81] proposed that management buy-in would be a problem for organisational agility, as we found in our case. In our case organisation, resistance was not resolved in the initial adoption but continued to arise over time.

The challenge of competing priorities (Section 4.3.3) in the organisation took two different forms. The first challenge was that the goal of meeting traditional KPIs clashed with providing value to customers. New ways of implementing KPIs in agile environments are proposed by Scharold, et al. [82]. However, the extent to which this issue is a widespread problem in organisations is unclear. Our study provides an insight into this issue. The second challenge was meeting the expectations of traditional governance practices when they clashed with agile principles and practices. The need for new ways of performing effective governance for agile environments at the organisational level is recognised, but is still tentative, with little practical guidance currently available [83] for sustaining agility based on ASD principles and practices.

Team empowerment (Section 4.3.4) is a critical element in effective teamwork and has been studied for decades [72] before becoming an important ASD principle. In our case, the lack of team empowerment was a two-way challenge as managers had to give up power, and teams had to learn to be empowered. Stray, et al. [84] identified this challenge in agile practitioner workshops and called for research to find out "How to change the mindset of the wider organisation to adopt agile autonomous teams". In organisation studies, Silver et al. [85] identified 10 lessons for sustaining empowerment in organisations, although not specifically for agile transformations. They found that sustaining team empowerment requires championship, leadership, and management support and training. Strode, et al. [8] reports this challenge as a tension between distributing authority to teams (i.e. empowerment) with fulfilling wider organisational goals.

Dependencies between teams (Section 4.3.5) were a challenge because coordinating the work of multiple teams is more difficult than for single teams. Dependencies between teams are reported in large-scale agile transformations by Dikert et al. [80], Berntzen et al. [86], and Berntzen et al. [87]. So our findings support this issue and show that it also affects organisational agility.

The challenge of onboarding (Section 4.3.6) is reported by Gregory, et al. [88] who found that finding the right people with agile experience or training was a challenge for agile software development teams. Barroca, et al. [5] identified a factor called 'knowability', which determines how easily new team members integrate into an agile team and its work. Research into onboarding into agile organisations is limited in human resources literature [89] and in workforce agility studies [90], so our study contributes an additional insight into the effect of this challenge in sustaining agility.

The challenge of a lack of role clarity (Section 4.3.7) took two forms, defining new roles and balancing the responsibilities of roles. In our case, introducing value streams and a team topology structure [69] led to new roles that were not always clearly defined enough. Lack of role clarity can lead to problems with authority and delegation in agile teams [91], and can be detrimental in individual agile teams, leading to problems with effective collaboration [92]. However, evidence that role clarity is a general problem in whole organisations when sustaining

agility is currently lacking. The need to balance responsibilities occurred for members of a chapter and a squad. This challenge appeared to be a side-effect of the matrix structure of the Spotify model [67]. For this challenge, we could not identify any prior research. Therefore, our study provides some insight into the nuances of role change when organisations are sustaining agility.

Staff turnover (Section 4.3.8) was a challenge in sustaining agility because it led to workflow bottlenecks. The new staff required effective onboarding into the agile way of working, and the reduced staff numbers caused the remaining staff to take on extra or different work to sustain an agile value stream of work. This issue is not addressed in organisational agility literature so our study provides insight into the effects of turnover on sustaining organisational agility.

The final challenge of an incompatible funding model (Section 4.3.9) occurred in the case when the organisation found that the traditional funding model applied in agile projects resulted in low product quality. This challenge was also found by Senapathi, et al. [9] and contributes to their model of sustained agile usage. Therefore, our findings provide additional support for that aspect of their model.

Multiple individual solutions were applied to address the nine challenges (described in Section 4.3 Challenges and Solutions to Sustaining Agility, and listed in Table 3). These detailed solutions and evidence from the Case Description formed themes we named general actions the organisation took to sustain agility. The eight general actions identified in the findings as follows:

1. Have a clear reason for implementing agile principles.
2. Continuously focus on raising agile awareness.
3. Continuously adjust the business operating model.
4. Change roles – embed specialist agile roles.
5. Change the funding model – use an appropriate funding model.
6. Make work visible across the whole organisation.
7. Support agile teamwork behaviours.
8. Monitor, measure, feedback, and act.

The organisation had a clear reason for implementing agile principles (1). This justification enabled all people in the organisation to understand, and perhaps be more accepting of, the significant and continual changes that occurred to sustain agility.

Although all staff can have a role in sustaining agility, embedding specialist agile roles (4) appeared to assist with the other actions. These specialists provided a pool of knowledge of agile principles and practices that could be used to support agility across the organisation. They were involved in maintaining the focus on raising agile awareness (2), supporting agile teamwork behaviours (7), informing adjustments to the business operating model to support agility, by identifying and then introducing different ways to structure individual roles, and operational teams to aid agility (e.g. forming squads, chapters, and platform teams) (3). They helped to identify the funding model challenge and provided advice on how this could be improved (5). They were involved in making work visible (6), by supporting practical actions (e.g. Chapters, Big-room planning) to improve the visibility of work dependencies and workflow between teams, and by working to ensure that issues affecting the workflow were identified and addressed quickly. In addition, the specialists were important actors in setting up and maintaining the cycle of activities used to monitor, measure, provide feedback, and act (8).

The general actions highlight the continuous nature of most of the changes needed to sustain agility. That is, actions 1, 2, 3, 6, 7, and 8 all involve continuous adjustments. Another observation is that different kinds of continuous change were necessary. Sustaining organisational agility involved continuous adjustment to thinking and knowledge (1 and 2), organisational structure and roles (3), behaviour (7), and agile practices (6 and 8).

The two exceptions that were not continuous were embedding specialist agile roles (4) and adjusting the funding model (5) to accommodate organisational agility. These actions happened only once, but caused significant structural and financial changes to the organisation.

Overall, some of these general actions are covered in the literature on managing organisational change (e.g., Kotter (1995) published in [93]) and literature review summaries (e.g., challenges in organisational agility [94,95]). However, those studies are generic and are assumed to apply to all types of organisations, whereas our study provides specific details on how to sustain agility when the agility is based on agile principles and practices from agile software development. Studies of agile transformation (i.e., large-scale adoption of agile methods) in software development organisations [80] and single cases of SAFe transformation also report some of the challenges and solutions we report, for example, problems with understanding the implications of agile roles [96] and change resistance [97]. However, our case differs significantly from those cases in some contextual aspects, such as the type of agile methods and practices used, and the type of work carried out by the organisation (i.e. not primarily software development). Furthermore, some of our findings are not reported in these studies (e.g. regarding changes to funding, business operating models, and processes for monitoring, measuring, and feedback), indicating that large-scale agile transformation in software development organisations differs from other types of organisations sustaining agility.

Practitioners working in contexts similar to the Retail organisation may gain insights from these findings. Practitioners could use the challenges identified in Table 3 to increase their awareness of potential challenges their organisation may encounter over time in sustaining agility. Practitioners might also gain insights into how to sustain their organisation's agility from the eight general actions described in Section 4.4 Sustaining Organisational Agility. In addition, they could find solutions relevant to their challenges in the specific solutions given in Table 3, which summarises the multiple solutions the Retail organisation used to sustain agility.

Overall, our findings illustrate that challenges continuously emerge to threaten organisational agility. An organisation needs to be in a state of awareness so that such threats are recognised. An organisation must also be capable of making broad organisational changes as well as finely tailored changes to meet these challenges and sustain its organisational agility.

5.1. Limitations and threats to validity

The study has limitations. Exploring a single case means that the type and number of challenges we identified are not likely to be complete. Other organisations might encounter different challenges or apply different solutions to the same challenges. This means further research into sustaining agility involving other organisations is needed to understand this phenomenon fully. We recommend two main areas for future research in Section 5.2.

Another limitation is that we have assumed that a solution can be either a mitigation or a complete resolution of a perceived challenge. We acknowledge that a change introduced to the organisation to meet a challenge may lead to a complete solution or might, in future, raise another new challenge that requires a new solution. We have not addressed the possibility of this type of sequence of events in this study, which would require a longitudinal study.

We examine validity from three viewpoints: internal validity, construct validity, and external validity. Internal validity does not apply to our study as it does not focus on theory testing [98]. In case study research, construct validity refers to how accurately the case description reflects reality [63]. To ensure construct validity, researchers interviewed individuals with long experience in the organisation and who had experienced much of the agile transformation. All interviewees had a specialist agile role in the organisation, and although they had a strong interest in responding to questions about the organisation's agility, this introduced a limitation to the findings because these people could have been biased towards a positive interpretation of events. Therefore, more

challenges might have emerged with a broader selection of people within the organisation. In addition, while the interviewees' perspectives were likely to represent reality, they were recalling events from up to six years before the interviews. This could mean that more recent events tended to receive more emphasis and explanation. This issue was mitigated somewhat by triangulation, with multiple interviewees. Some people recalled and described the same event. Secondly, the researchers conducted all the interviews using the same interview guide for each interview [63] (see Fig. 1). This consistent interview protocol included explaining the purpose of the interview, inviting clarification questions at any stage, and explaining the main terminology. Before conducting interviews, the researchers reviewed the questions for biases and ambiguities. To avoid leading the interviewees to answers, the interviewers retained a neutral stance about the interviewees' explanations and descriptions. To reduce researchers' biases influencing the interpretations of the qualitative analyses of the interview data, the data analysis was collaborative, and the results were discussed between the two researchers until a consensus was reached. Lastly, construct validity was increased by including data from more than one resource, such as publicly available documents and videos.

The external validity of case studies is generally low due to the uncertain effects of changing contextual factors such as organisational structure, project, and team characteristics. The findings from our single case study do not claim to apply to other contexts. However, they may provide valuable insights for organisations in similar contexts. One method to increase the analytical generalisability of a single case study is to provide a detailed description of the case organisation, because this allows for effective analytical comparisons and synthesis with other similar studies [63]. We included a case description and a comprehensive analysis of the organisation's key challenges and solutions to enable future comparisons and synthesis with other case studies for future theory building [99].

5.2. Future research

The study highlights two concerns regarding current research on sustaining organisational agility. First, a lack of theoretically grounded research on how organisations sustain agility over long periods. Second, minimal empirical research exists on the challenges and changes organisations must make to sustain organisational agility when it is based on ASD principles and practices. Accordingly, we suggest two key focus areas for future research on sustaining organisational agility.

(i) Generate more theoretically driven insights based on existing models

Our review shows that post-adoptive agile usage research has drawn primarily from traditional information systems (IS) theories such as assimilation, routinisation, and diffusion of innovations. While these IS theories have proven to be valuable in addressing specific aspects of agile transformations, alternative perspectives are needed to examine how to sustain agility throughout the organisation [10]. Since such studies tend to be long-term, we suggest that future research investigate specific aspects of organisational agility based on existing, well-established theoretical frameworks. For example, Barroca, et al. [5] identified three perspectives to examine the factors IT organisations consider when making changes to sustain agility: an organization-wide perspective, an awareness of the external environment, and an understanding of how external changes affect its agile teams. They used three established theoretical frameworks from previous studies on agility, (i) Paradox theory to characterise the ongoing paradoxes and tensions in sustaining agility (ii) Situation awareness to examine the interdependence among team members, between teams, and across the organisation, and (iii) Shared mental models to understand how teams adapt to change.

Another potentially useful theory is the normalisation process theory (NPT), which proposes a novel model to examine the phases that innovations undergo from their initial adoption to being embedded and sustained in complex and emergent conditions [100]. NPT is successfully employed as an explanatory framework in fields like health science and, more recently, to examine the key challenges in the process of sustaining and embedding large-scale agile methods [10]. We believe NPT could be valuable for examining how organisational agility can be sustained and drawing insights into the factors that influence and the challenges that inhibit its sustained use.

(ii) Conduct more case studies focusing holistically on the whole organisation

There is limited empirical evidence on how organisations sustain agility. Therefore, we recommend that future research conduct multiple qualitative case studies on how organisations continuously embed, support, and sustain agility at all organisational levels. Case studies should also be conducted to understand the dynamic nature of the sustaining process by incorporating narratives that describe the involvement of stakeholders and the sequence of events to explain how agility evolved and how it was embedded in practice.

6. Conclusion

In recent years, due to the success of agile software development at the team and project level, interest in extending the benefits of agile values, principles and practices throughout an entire organisation has significantly increased. The emphasis has shifted from adoption issues to sustaining agility in the long term, meaning the ongoing process of sustaining agility within an organisation. This study aimed to address the lack of empirical research on sustaining organisational agility by analysing the efforts of a large retail organisation. Nine challenges were identified. Analysis of the organisation's detailed solutions to the identified challenges revealed eight general actions taken to resolve or mitigate them, thereby sustaining organisational agility. Although some of these challenges are recognised in prior research, they have neither all been identified in a single organisation, nor have the detailed solutions and general actions an organisation must take over time to sustain agility been identified. For practitioners, these challenges highlight potential issues that organisations in similar contexts should be aware of when seeking to sustain agility beyond the initial adoption phase. In addition, the findings identify actions that an organisation may need to take to sustain its organisational agility. For theorists, the findings on how an organisation sustains its agility may provide significant concepts suitable for future theory-building research.

CRediT authorship contribution statement

Mali Senapathi: Writing – review & editing, Writing – original draft, Visualization, Validation, Resources, Project administration, Methodology, Investigation, Data curation, Conceptualization. **Diane E. Strode:** Writing – review & editing, Writing – original draft, Visualization, Validation, Resources, Project administration, Methodology, Investigation, Data curation, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data will be made available on request.

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