INVESTIGATING INTER-ORGANISATIONAL PLATFORM DEVELOPMENT

THROUGH THE LENS OF COLLECTIVE ACTION

By

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Abstract

This thesis examines inter-organisational platform development occurring though collective action. Despite much hype about the benefits of platforms, and burgeoning stream of work on the subject in IS literature, IOP development processes and practices that lead to success or failure remain obscure. Some scholars suggest that this is perhaps because of the secrecy associated with such projects. IS literature shows that the development of inter-organisational platforms is plagued by collective action challenges, such as the conflicting interests, heterogenous goals, and coopetition between members. This is mostly encountered in designing important aspects of the platform such as architecture, governance models, and value systems. These challenges make critical mass difficult to achieve, often derailing platform development projects. Thus, it has become crucial to understand how such platforms are developed through collective efforts by multiple organisations.

This study addresses the gaps mentioned using a longitudinal case study. There was an opportunity for unusual research access to real time observations of the development processes from inception. This led to collection of a rich dataset from multiple sources. Over two-and-half years, observations were made as 46 organisations such as airlines, airports, visitor experience providers (e.g., canyon swings, ziptreks), private corporates, hotel chains, and government agencies worked together to develop a platform for sharing data resources and services in the tourism sector in New Zealand.

Findings indicate that IOP development processes vary in specific areas of development such as the designing of architecture, governance, value systems, and standards. Whilst some processes can be managed through leadership, coordination, and collective organising by a leading organisation in the collective, others require self-organisation to align complementary resources and interests. Apart from processes of activities and actions, we also found that socio-cognitive processes and joint actions between members co-influence each other during design phases. These co-influences can explain how cognitive distances and incongruencies in technology frames of references are resolved.

The primary contribution of this study is to have created theoretical building blocks towards a nascent theory of IOP development processes occurring through collective action. These building blocks include specifications of concepts, process models of design & cognitive processes, propositions of process activities & their observed outcomes, and problematisations of key constructs that extend the theoretical boundaries of such concepts as critical mass (the outcome variable in collective action). The research also contributes to platforms and collective action theories by integrating the two areas in investigating the development of inter-organisational platforms. Practical knowledge can be drawn on how IOPs are constructed in conditions of heterogeneity and coopetition requiring collective organising.

Keywords: *inter-organisational platforms (IOPs), platform development process, platform ecosystems, platform design, design process, collective action, critical mass, technology frames*

Dedication

To my mum, Lucy

&

To you, the reader…

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Declaration of Originality

I confirm that the work submitted is my own and that appropriate credit has been given where reference has been made to the work of others.

Important Notices:

Notice 1: Although I have used the pronouns “we”, “our”, “us”, etc., throughout the thesis, the work I have presented here is my own. The use of these terms in this thesis is mainly stylistic; and in some places indicates that the team of advisors were consulted about important decisions and directions in the research.

Notice 2: I primarily wrote the research papers incorporated in this thesis as first author. Supervisors contributed advice and guidance.

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Chapter 1: Introduction

Setting the Scene

Prediction: Every business will be a cloud or digital platform provider, soon.
— Marshall Van Alstyne, 2016

The emblematic organisational form of the digital era is the platform ecosystem. Be it in the form of a social media platform, a sharing economy platform, a crowdsourcing platform, or an industry-wide platform for such services as healthcare, tourism, or data analytics. Platform-based technology ecosystems are institutional forms of organising that connect independent actors around a stable yet evolving technological system. They disrupt traditional business models and industries, and challenge long-held institutional norms and regulatory orders. Platform business models capitalise on connecting previously separate business actors, (e.g., producers and consumers) enabling them to interact, and previously disparate organisations to collaboratively create innovation and share valuable resources.

Platform ecosystems are interesting for both business and academic audiences alike, not only because they exploit advances in information technology that enable new forms of value creation (Zysman & Kenney, 2018), but also because they transform the fabric of society and the nature of business competition (Tiwana, 2015**a**). Yet, despite some resounding commercial successes of the so-called platform "unicorns" – such as Apple, Facebook, Amazon, and Google, many organisations and technopreneurs suggest that designing, launching, and scaling up platform ecosystems is notoriously difficult to pull-off (Hoffman & Ye, 2018), and at times, initial success is derailed by poor strategy and governance (Parker, Van Alstyne & Choudary, 2016).

For small-to-medium size companies, the opportunities to create or join platform ecosystems that foster complementary innovation, resource re-use, and synergies with previously disengaged players is too good to pass on. However, for such organisations, joining the platform revolution seems to be proving challenging (Parker, Van Alstyne & Choudary, 2016). As they attempt to 'platformise' (Bygstad & Hanseth, 2018) or join other organisations to create *inter*-organisational platforms (IOPs)[1], they are faced with unique challenges brought by the need for collective organising. At design level, the platform technology needs to satisfy different groups of organisational participants with different information system needs. At governance level, the rules of interaction need to accommodate competing interests and to facilitate interactions amongst heterogenous firms with motivations that vary widely and change frequently as economic, regulatory, and technology changes in their environment evolve (Parker, Van Alstyne & Choudary, 2016). IOPs also rely on shared digital architecture and governance

[1] Where appropriate, hereinafter IOP(s) shall be used to abbreviate inter-organisational platform(s).

arrangements between multiple institutions which necessitates negotiation and tactical orchestration that is not easy to achieve (Nikayin, de Reuver & Itälä, 2013; Evans & Schmalensee 2010).

The need for coordinating multiple organisations brings to the fore the importance of collective organising and collective arrangements. Increasingly, it is becoming important understand how such collective action is achieved to be able to successfully develop IOPs.

1.1 Theoretical Foundation

This study used collective action theory as a lens to investigate IOP development processes. Collective action theory explains the characteristics and interaction of groups seeking to achieve a common goal (Olson, 1971; Öström, 1990). The theory provides a holistic framework to understand the development of IOPs at both architecture and governance levels (Tiwana, Konsynski & Bush, 2010) – positioning it as broader challenge of designing a 'collective institution' (Öström, 1990). Addressing the collective action between heterogenous entities, also mirrors inter-organisational challenges of platforms, such as the need to resolve tensions between openness *vs.* control, integration *vs.* modularity, competition *vs.* cooperation, collective interests *vs.* individual interests, and so on (Markus & Bui, 2012; Saarikko, Westergren & Blomquist, 2016).

As such, IOPs are a typical example of the commons in so far as they are developed to serve the interests of those who contribute to their development (Nikayin, 2014). Thus, the collaboration for developing an IOP can be studied through the lens of collective action since (i) it requires several organisations to collaborate to realise the common goal (Oliver et al., 1985; Poteete & Öström, 2004), and (ii) the common goal cannot be achieved individually (de Reuver et al., 2015; 2018). Taking a collective action approach to viewing IOPs provides a fresh perspective by considering the social characteristics of platforms. Additionally, taking a process view of how such social characteristics (e.g., heterogeneity of participants) are coordinated can shed light on some of the outstanding challenges in in IOP development processes such has how critical mass issues may be resolved before platform launch (Evans & Schmalensee 2010; Schirrmacher, Ondrus & Kude, 2017).

1.2 Research Problem

Despite much hype about the benefits of platforms, failures in developing and launching platforms are far more frequent than successes (Yoffie, Gawer, & Cusumano, 2019). There are many factors attributed to these failures such as poor design of user experience features (Vardhan, 2015), failure to balance openness and control (Ghazawneh & Henfridsson, 2013), poor pricing strategy (de Reuver et al., 2018), and so forth. There are also solutions suggested to address these challenges, such as opening the platform to users and providing extensive boundary resources to contributors (Eaton, Elaluf-Calderwood, Sørensen, & Yoo, 2015; Ondrus, Gannamaneni & Lyytinen, 2015), using pricing strategies and first-party content subsidies (Hagiu & Spulber, 2013), as well as user onboarding and

side switching strategies (Schirrmacher et al., 2017; Stummer, Kundisch & Decker, 2018). However, these challenges and solutions seem to concentrate on one-to-many type of platforms that are usually highly commercialised and consumer-facing, rather than those that are many-to-many (Thomas, Autio & Gann, 2014, p.208), collaborative, and inter-organisational in nature.

There are observations from previous research that most IOPs fail because they struggle to solve the coordination problem required to collectively organise disparate resources and actors needed to sustain and launch new platforms (c.f. Schirrmacher et al., 2017). Some studies have also observed that leadership failures in the inter-organisational coordination required during platform development resulted in dissolutions of platform initiatives (c.f. de Reuver et al, 2015). When an entire organisational field intends to launch an IOP, it faces a collective action challenge about how to form consensus on many issues such as goals, strategy, design, and implementation. This is because inter-organisational relations often present conflicting interests and goals between actors (Schirrmacher et al., 2017; de Reuver et al., 2018). In order to launch such a platform, a sufficient number of organisations is needed to join together and form a collective group with enough resources and capacity to effectively collaborate. Such benefits as economies of scale, resource re-use, and network effects (McIntyre & Srinivasan, 2017), can only be achieved if enough members join the collective action and actively contribute to it.

In addition, available literature on strategies for launching platforms appears to concentrate on analysis of variables that affect platform launch rather than examining the full length of development processes that lead to launch success or failure (i.e., they take a variance approach – Langley, 1999, p.693). Platform-launch itself is often treated as an *event* rather than a *process* (Evans & Schmalensee, 2010, p.3-4) with minimal investigations into how a platform sponsor manages a collective group and coordinates its members throughout the development process before a launch is possible – when the platform itself is still an aspirational goal. By taking a process approach, we address this gap and respond to broader calls for process thinking in information systems strategic organisation research (Garud, Jarzabkowski, Langley, Tsoukas, Van de Ven & Lê, 2020).

More so, strategies proposed to address platform development are often built either on conceptual work or on ex-post studies of successful platforms. For instance, authors looked at opening the platform to users and providing extensive boundary resources to contributors (Ondrus, Gannamaneni & Lyytinen, 2015), using pricing strategies and first party content subsidies (Hagiu & Spulber, 2013), as well as user onboarding and side switching strategies (Schirrmacher et al., 2017; Stummer et al., 2018). Empirical studies that longitudinally investigate the ways in which a platform sponsor enacts practices and manages developmental processes, and how such practices inform design activities, decisions, and actions as a platform is being developed are still largely sparse. Far less research had been done to investigate the processes, practices, and inter-organisational aspects of platform development to understand why failures are prevalent and what makes success possible. This has a potential to generate new understandings that fill this gap and provide practical insights to platform

developers and managers in inter-organisational settings. Recent studies (e.g., de Reuver, Sørensen & Basole, 2017) note a dearth of research in platform ecosystems that assesses real-time platform development projects that involve multiple institutions taking part, with a perspective that covers an entire industry sector. They have called for longitudinal work on platform development processes that details its intricacies in real-time projects rather than in retrospect.

1.3 Research Questions

Considering the problem space articulated above, the goal of this research was to conduct a longitudinal examination of processes and practices in the real-time development of an inter-organisational platform, and importantly, ***to develop a nascent theory of IOP development processes that occurs through collective action.*** To achieve this, we investigated the different outcomes of platforms (architecture and governance), the options available to the participants, the conditions established among the participants, as well as the IOP development processes and practices. The research was specifically guided by eight research questions listed below. The full research framework covering these questions in detail is available in Chapter 3 (see Table 6, p.42).

RQ 1 *What is the form & characteristics of architecture that emerges out of collective action to develop an IOP amongst a varied group of firms within the same industry?*

RQ 2 *What governance options emerge out of collective action to develop an IOP amongst a varied group of firms within the same industry?*

RQ 3 *What are considered options for openness & control in the design process for an IOP?*

RQ 4 *What are the considered options for generating and leveraging value in the IOP?*

RQ 5 *As context conditions, how does (a) heterogeneity of interests, (b) heterogeneity of resources, and (c) coopetition dynamics affect collective organising in IOP development?*

RQ 6 *How does an IOP development process involving multiple organisations working together through collective action unfold? (b) How is management practised in the process of IOP development that happens through collective action?*

RQ 7 *How do different technology frames between organisations influence collective action design process and practices during the design process of an IOP?*

RQ 8 *How do critical mass issues arise, manifest, and are managed in phases of development that occur before platform launch?*

1.4 Research Design

A longitudinal case study was used to investigate IOP development processes and practices that occurred through collective action between multiple organisations. The case presented a unique opportunity (Benbasat et al., 1987) to track real-time events covering an entire organisational field involving 46 organisations (see ***Appendix 4***) working together to develop an IOP for sharing data resources and services between members. The researcher had access to the project from inception, and as it evolved over a two-and-half year time-period. Data gathered includes over 70 interviews lasting between 30-75 minutes and over 500 pages of documents. Additionally, the researcher made semi-participative observations in the case as events unfolded, attending multiple workshops, meetings, and events that enabled the gathering of notes, memos, minutes of meetings, and illustrative photographs among other data. This resulted in a rich dataset, which was used to reconstruct and analyse IOP development processes and practices that occurred through collective action. Previous studies noted that research on platforms has so far not revealed much direct design knowledge because the secrecy of most platform projects makes reliable first-hand data on design and governance decisions almost impossible to ascertain (c.f. de Reuver et al., 2017, p.129). Thus, this case was selected for its promise of becoming a revelatory exemplar (Davis, 1971) as it presented an opportunity for "unusual research access" (Eisenhardt & Graebner, 2007, p.27).

1.5 Contributions

This research took a process perspective to collective action in IOP development that has seldom been investigated in IS literature. ***The primary contribution of this study is to have created theoretical building blocks (Whetten, 1989) towards a nascent theory of IOP development processes occurring through collective action.*** These building blocks are presented in Figure 34 (p.185) and can be articulated as follows:

(i) Examining and specifying the unique problem space of platform development that occurs in inter-organisational settings and through collective action.

(ii) Identifying and defining seventeen fundamental process concepts and constructs in IOP development that occurs though collective action.

(iii) Developing process models that illustrate actions and activities of IOP development in platform domains such as designing architecture, governance, openness & control, and creating a value system.

(iv) Developing a socio-cognitive process model of technology frames of references (TFRs) that provides a visual representation the co-influences between TFRs and design practices that can propel collective design process. This illustrated how frame incongruences and cognitive distances may be resolved through joint actions at different design stages.

(v) Problematising critical mass, by using our case data to raise questions and to confront original theoretical ideas about critical mass – the outcome variable in collective action (see Figure 34, p.185).

These building blocks are a significant step towards a nascent theory of IOP development through collective action. They already provide useful insights and practical knowledge of how IOPs are constructed in conditions of heterogeneity and coopetition requiring collective organising.

1.6 Thesis Structure & Summary of Contents

This thesis is organised into nine chapters which are summarised here (see Table 1, p.7). ***Chapter 2*** provides a review of related literature focusing on the first problem space: development of platform ecosystems with special emphasis on inter-organisational platforms. ***Chapter 3*** lays the theoretical foundation of the study by exploring the second problem space: platform development through collective action. By looking at IOP development from a process perspective, and through a collective action lens, we were able to propose a research framework investigated in this study. ***Chapter 4*** lays out the research methodology employed to address the research questions. ***Chapter 5*** presents findings and insights on IOP development, zooming into IOP development domains such as architecture, openness & control, and governance, and a summary of the platform development journey. This addresses the first five research questions. ***Chapter 6*** provides findings and insights on processes and practices in IOP development through collective action as observed from the study. Case data is used to develop the key concepts behind process actions and activities. Six process models that capture development processes in specific platform domains are also presented here. This addresses the sixth research question. ***Chapter 7*** complements chapter six by exploring the socio-cognitive process, which uncovers technology frames between members in the project, and how issues such as incongruences and cognitive-distance are resolved. This addresses the seventh research question. Take note that chapter seven is presented as a self-contained paper, as it is being prepared for submission to a journal. ***Chapter 8*** makes an in-depth examination of the outcome variable in collective action for IOP development, i.e., critical mass. Problematising critical mass using our case data illustrated how uniquely it manifests in IOP development than previously observed in other types of platforms. Fundamentally, it provides conjectures on how the building blocks from our theoretical development can be used to address its unique challenges in IOPs. This addresses the eighth research question. Also note that chapter eight is a published paper in the 2020 *Proceedings of the Americas Conference of Information Systems*[2]. ***Chapter 9*** concludes the thesis by providing an integrative summary of the theoretical and practical contributions of the study, its limitations and future research paths.

[2] I primarily wrote the research papers incorporated in this thesis as first author. Supervisors contributed advice and guidance.

Table 1: *Thesis summary*

Chapters	Topic	Outcomes
Chapter 1	Introduction	Setting the scene
Chapter 2	Exploration of problem space 1: Development of platform ecosystems	Identification of research gaps in platform ecosystems development literature
Chapter 3	Exploration of problem space 2: IOP development through collective action	Development of a research framework that considers research gaps in both collective action & IOP development
Chapter 4	Research Design	Detailed explanation of methods used
Chapter 5	Findings and insights on IOP development	Insights into how architecture, openness and control, governance, and value systems are designed
Chapter 6	Findings and insights on processes and practices in IOP development focusing on behind process actions and activities	Identification and definitions of fundamental process concepts Development of six process models of IOP development
Chapter 7	Findings and insights on processes and practices in IOP development focusing on the socio-cognitive process	Development of a socio-cognitive process model of technology frames Insights on resolving frame incongruences and cognitive distance in IOP development
Chapter 8	In-depth examination of critical mass, the outcome variable in collective action for IOP development	New perspectives to critical mass that are unique to IOP development
Chapter 9	Conclusions	An integrative summary of the theoretical and practical contributions of the study, its limitations, and future research paths

Chapter 2: Review of Related Literature

Problem Space 1: Development of Platform Ecosystems With Special Emphasis on Inter-Organisational Platforms

That is part of the beauty of all literature.
You discover that your longings are universal longings, that you're not lonely and isolated from anyone. You belong.
— F. Scott Fitzgerald

This review follows the approaches that were put forth by Templier & Paré (2015) and by Webster & Watson (2002). We explain the steps taken to set the boundaries of this cumulative review, to identify and retrieve relevant articles, and to analyse and synthesise empirical evidence and theories about platform ecosystems development and governance. The details of the procedures can be found in ***Appendix 1***.

The objective of this review is to examine and synthesise empirical findings, conceptualisations and theories that are specific to IS research on platform ecosystems, with attention to their development in inter-organisational settings. We delineated the boundary of our search about the 'platform ecosystem' phenomenon within the information systems research domain. We used Zmud & Benbasat's (2001) advice about errors of inclusion and exclusion to demarcate the review boundary by ensuring that platform ecosystems were considered as the object of interest in the research we reviewed. As such, we developed criteria for relevance screening (***Appendix 1***), in which studies needed to primarily study a *platform ecosystem*, as explained above, in terms of its development and governance. Studies of platform ecosystems that employed variance and process approaches were considered (Langley, 1999, p.693). While research designs and epistemological stances in the included studies varied, their complementary views of platforms shed light on how platform ecosystems are developed and managed from conception, through design phases until they are launched.

The chapter is structured as follows. First, we present various perspectives that have been used as lens by IS scholars to conceptualise and study platform ecosystems. These perspectives highlight and obscure different facets of platform ecosystems. They also shed light on the underlying operational logics of digital platforms. We integrate these perspectives by proposing an inclusive, but still specific working definition of platform ecosystems for the purpose of this review. We then describe the methods used to identify relevant literature on platform development. This is followed by a presentation of the findings covering six areas: (i) platform architecture, (ii) platform openness & control, (iii) platform governance, (iv) collective organising to manage heterogeneity and coopetition in inter-organisational settings, (v) critical mass, and (vi) value system creation (see Table 3, p.14). The analysis of the findings leads to identification of research gaps. Research questions (developed and investigated in this research sought to address some of these gaps (see ***Section 3.3***, Table 6, p.42).

2.1 Platform Ecosystems Concepts and Definition

Platform ecosystems have their origins in the electronic marketplaces and inter-organisational information systems of the 80s and 90s (Malone et al. 1987; Munkvold, 1999). Since these early developments, IS scholars have adopted different conceptual perspectives in studying platform ecosystems, depending on what aspects they choose to examine. Like the classic parable of the blind men and the elephant, these perspectives are useful in a pragmatic sense in helping us develop an understanding of platforms as phenomenon, but they remain incomplete vantage points that brings to the fore specific platforms aspects while relegating others to the background. As suggested by the fish scale model of omniscience (Campbell, 1969), it is through the juxtaposition of the theorisation and findings from the work done in the complementary perspectives that a holistic understanding of platforms can be gained. We have identified three conceptual perspectives in the IS literature on platforms. We do not consider this categorisation of perspectives to be exhaustive of all perspectives that have been used in the IS literature; it is meant to be illustrative of the relative emphasis found in major streams of IS literature, in order to provide a pragmatic basis from which to elaborate an inclusive definition of platform ecosystem. The perspectives are also not mutually exclusive, and some platforms aspects sit at the interstice of the perspectives. It is also worth noting that these perspectives are independent of any given platform (e.g., Facebook), as the perspectives are driven by the research questions pursued by IS scholars and thus, a platform can be considered from any of the perspectives.

i) The ***economic perspective*** considers a platform ecosystem as an intermediary of market exchanges. It explains how platform ecosystems match users, developers, and complementors; and facilitate and capture value from transactions between two or more actors (e.g., Bakos, 1991; Grover & Ramanlal, 1999; Parker, Van Alstyne, & Jiang, 2017; Yates, & Benjamin, 1987). Work following this perspective tends to examine, for instance, how platforms create market efficiencies by reducing transactions costs (Lin et al. 2011), how they extract economic rents from the network effects generated by the interactions between and among users on each side of a platform (Parker & Van Alstyne, 2018), and how they erect barriers to multi-homing and switching behaviour by users and developers (Hyrynsalmi, Suominen, Mäntymäki, 2016; Koh & Fichman, 2014).

ii) The ***technology perspective*** sees platforms as a technological architecture composed of a set of hardware, software, data, networks, products, services, and routines. Work following this perspective examines how architectural design and choices, such as modularisation, decomposition, and de-coupling, allow the emergence of platform complements and user customisations (Baldwin & Woodard, 2009). Particular emphasis of this perspective is how platforms can be designed so that they evolve and extend with changes in their environment (Tiwana et al., 2010; Agarwal & Tiwana, 2015), and so that they can survive and achieve

commercial success (Tiwana, 2018). This perspective also considers how a platform's architecture generates innovation by allowing complementors to add value to the core of the platform and serve a wide range of heterogenous user needs (Um & Yoo, 2016; Woodard & Clemons, 2014). Not all platform ecosystems are alike, since software platforms (e.g., SAP, Salesforce, Mozilla), data platforms (e.g., IGSR and 23andMe, see de Reuver et al., 2018; Jarvenpaa & Markus, 2018), content platforms (e.g., YouTube, Spotify, Netflix, Wikipedia), social networking platforms (e.g., Facebook, LinkedIn), and sharing economy platforms (e.g., Uber, Airbnb) vary in the kinds of architectural challenges they face.

iii) The ***social perspective*** considers platforms as the nexus of collective action, and as the site of collective sensemaking, political contention, and institutional work. Platforms connect actors into communities, bridging the spatial and temporal boundaries of physical connections (Kane et al. 2012), and provide the affordances that support the emergence of crowd-based organising (Majchrzak & Malhotra, 2013). Work following this perspective usually focuses on how actors participate in joint value creation, through distributed work arrangements, peer-to-peer sharing of resources and services, and shared collective identity (Jha, Pinsonneault, & Dubé, 2016; Leong, Pan, Newell, & Cui, 2016). This perspective is also concerned with the practices involved in achieving negotiated agreements about platform governance, and in managing social evaluations from stakeholders, regulators, and public audiences (Greenwood & Agarwal, 2013; Zhang, Sia & Lee, 2017).

What is common to all conceptual perspectives is that a platform ecosystem can be considered an organisational form that rely upon a large-scale, complex socio-technical system. The particularity of this organisational form is that a platform's principal does not have full hierarchical control over the various actors, such as third-party developers and consumers, that contribute and benefit from using the platform (Jacobides, Cennamo & Gawer, 2018). Their reach can be wide and their organisational boundaries porous. Circumventing a platform's sphere of influence thus pose unique challenges in comparison to hierarchically integrated value chains and bureaucracies (Santos & Eisenhardt, 2005). A second key element of platform ecosystems is their architecture: the "conceptual blueprint that describes how the ecosystem is partitioned into a relatively stable platform and a complementary set of modules that are encouraged to vary, and the design rules binding on both" (Tiwana et al., 2010, p.677). Platform ecosystems also involve governance arrangements, which dictate "who makes what decisions about a platform" (Tiwana et al., 2010, p.679), and about who gets what in terms of value co-creation, exchange, and capture from the interactions that take place on the platform. For the purpose of this review, we combine these three elements in an inclusive conceptualisation that captures elements of previous definitions by Constantinides, Henfridsson & Parker (2018), Gawer (2014), Jacobides et al. (2018), and Tiwana et al. (2010). We thus propose the following working definition of platform ecosystem:

An organisational form based on a socio-technical configuration of interdependent actors and resources that (1) is not fully hierarchically controlled, (2) has the architectural attributes of modularity, evolvability and scalability, and (3) governs the creation, exchange, and capture of value, such as services and content, through interactions, transactions, complementarities, and innovation.

2.2 Literature Search & Relevance Screening

The steps followed to conduct the review are summarised in Table 2 (p.12). Considering that major contributions to a topic of interest are likely to be in leading journals of a discipline (Webster & Watson, 2002), we used the AIS 'senior scholars' basket of eight[3] as a starting point. An initial search of this set of journals was conducted using keywords. Templier & Paré (2015, p.126) suggested that at least two complementary electronic databases should be used to scan the extant literature on a given topic of interest. Literature search was conducted on ProQuest and Web of Science databases that index all the basket of eight journals. After removing duplications found by repeating the searches between the two databases this search yielded 239 papers. Webster & Watson (2002, p.126) also suggested that reviewers should scan table of contents to pinpoint articles filtered out by the keyword sieve or not indexed by major databases. A manual search through scanning the journal site listings was further conducted in which a further 43 articles were identified.

To augment the review coverage, we considered conference papers published in the International Conference on Information Systems (ICIS) from 2012 to 2019. We considered that articles in earlier proceedings would have organically found their way into mainstream IS publications that were also considered in this review. The AIS Electronic Library that indexes IS conferences was searched using the search term 'platform' and adding other relevant identifiers[4] all of which yielded 316 papers (after searching in titles, abstracts, and keywords). From the 316 papers retrieved, only completed empirical and conceptual research papers were included (n = 234). In that batch, we also included completed research published in the proceedings as short papers as well as research-in-progress (RIP) papers that already had insights at their current stage. Editorials, panel statements, and research-in-progress papers without empirical results were excluded (n = 128).

Although the AIS 'senior scholars' basket of eight journals represents the core of the IS discipline, the cumulative approach taken required the inclusion of papers published in peripheral journals so that important IS contributions to platform ecosystem research were not missed (Templier & Paré, 2015). Initially we conducted a co-citation analysis to identify seminal papers. We then

[3] EJIS, ISJ, ISR, JIT, JMIS, JSIS, JAIS, and MISQ

[4] We used several key words such as 'platform' or 'ecosystem' and synonyms of these words to search for literature on platform ecosystems. Some of the synonyms include inter-organisational (information) system, electronic hubs (e-hubs), electronic markets (trading platforms, electronic commerce), and variations on these words. See ***Appendix 1***.

conducted forward searches (papers that cite a paper of interest) and backward searches (references cited in a paper of interest) following the advice by Webster & Watson (2002). Both Web of Science and Google Scholar citations were used to identify citing articles in forward searches. This exercise yielded 91 papers. We included papers from peripheral IS journals that happen to publish IS papers, and that fit with the objectives and boundaries of this review (Table 2 below; ***Appendix 1***).

Table 2: *Literature identification and relevance screening procedures*

STEPS	Procedure	Source(s)	Articles Found	Excluded	Justification for Exclusions	Article Yield
STEP 1: Literature Identification	Repeated keyword search in ProQuest and Web of Science Databases	AIS Basket of 8 articles listed in ProQuest and Web of Science Databases	239	47	Various forms of repetition	192
	Manual scan of journal site listings	Basket of 8 articles in site listings (not indexed in the above databases)	43	–	–	43
	Keyword search in AIS Electronic Library	ICIS Proceedings (we targeted papers between 2012-2019)	316	192	Editorials, panel statements, papers already published in journals and included in the alternate criteria, and research-in-progress papers without conclusive results	124
	Backwards and forward searches (Forward searches were performed on both Google Scholar and Web of Science)	Peripheral Journals	91	43	Research on platforms in other fields such as marketing, economics, and strategic management – IS was a tangent	48
Total No. of Articles Identified			**689**	**282**		**407**
STEP 2: Relevance Screening	Selection of **IS** papers focusing on platform ecosystems	–	425	191	Articles addressing platform ecosystems with emphasis on reference disciplines rather than IS (e.g., economics, marketing etc.)	234
	Selection of IS papers focusing on platform ecosystems development processes	–	234	166	Articles addressing platform ecosystems with an IS focus but not directly addressing the development of platform ecosystems.	68
Total No. of Articles Included						**68**

Overall, of the **689** pool of articles identified, 282 were excluded and 407 were taken forward to the next stage of relevance screening (see Table 2 above). Relevance screening was an iterative process in which we conducted several rounds of meetings between the four authors (one graduate student and three faculty mentors) to consider which articles would be included or excluded from the

407 articles selected. To overcome any possible selection bias, we followed the advice by Templier & Paré (2015) and conducted parallel independent assessments of studies for inclusion. A spreadsheet database was used to document and manage our independent selection activities, which we compared at meetings. To carry out the exercise effectively, we first identified and excluded articles addressing platform ecosystems with emphasis on reference subjects rather than IS such as economics, marketing, and management (n=191). In that batch there were also papers that merely used the term platform although entirely focusing on other forms of information systems (see ***Appendix 1***). This left us with 234 IS articles that focused on platform ecosystems.

Secondly, we used our research objective to identify papers that focused on platform ecosystems development (i.e., conception, launching, designing, etc.). We especially considered papers that provided learnings on inter-organisational aspects of the platforms studied, even if such platforms may have been consumer facing marketplaces. For instance, coordination challenges faced by a two-sided accommodation rental platform in managing organisational players such as local authorities, housing associations, competing providers and so forth that causes failure to launch successfully. We managed to do this by studying the research questions, key variables, and main issues in each article (see ***Appendices 2 & 3***), selecting those that were related to our research objective. This led us to include **68** papers and to exclude 166 papers, most of which focused on other aspects of platform ecosystems such as users, performance, success, and impact (Table 2 p.12; for full criteria, see ***Appendix 1***).

2.3 Literature Synthesis

Spreadsheet tabulations were used to capture items of interest from the articles, such as research question, research methods, and a summary of findings (see ***Appendix 3 & 4***). For quantitative studies, we identified the effect size and significance of key findings, so that empirical evidence could be compared across studies. For qualitative studies, we considered whether the cases focused on practices, discourse, or whether they employed cross-sectional (synchronic) or longitudinal (diachronic) designs (Barley, 1990) (see ***Appendix 3***). The analysis was iterative in that multiple rounds in which, as authors, we engaged in our own activities of divergence, by discussing the papers and trying to make sense of the findings and theoretical approaches, following by activities of convergence, by defining a categorisation scheme and then working to test the coherence of our categorisation by doing thought experiments, comparing cases, and categorising papers.

Ultimately, we collectively engaged in an open card sorting exercise, in which the graduate student and a team of three faculty mentors identified six key domains of platform ecosystems development – (i) platform architecture, (iii) platform governance, (ii) platform openness & control, (iv) collective organising to manage heterogeneity and coopetition in inter-organisational settings, (v) critical mass, and (vi) value system creation (see Table 3, p.14).

Table 3: *Key issues in platform development with special emphasis on IOPs*

Area	Key Issue	Explanations	Exemplar Papers
1. Platform Architecture	Competing design options, each with benefits and drawbacks, and each with a potential to set the platform on a different developmental course than the other.	- Embedding design features for malleability such as modularity, variation and mutation enables future generativity but may constrain standardisation and stability at launch. - Designing a highly stable platform and standardised interfaces enables platform stability but constrains future generativity. - Launching a high modular platform will encourage variation, specialisation and innovation amongst contributors but reduces provider autonomy over innovation and creativity activities. - Launching a vertically integrated platform will discourage external innovation and specialisation but will maintain provider autonomy	- Baldwin & Clark (2006) - Constantinides, Henfridsson & Parker (2018) - Foerderer, Kude, Schütz & Heinzl (2014) - Grisot, Hanseth & Thorseng (2014) - Hukal (2017) - Thomas, Autio & Gann (2014) - Tiwana (2014); Tiwana (2015**a**); Tiwana, Konsynski & Bush (2010); Tiwana (2018) - Um & Yoo (2016) - Um, Yoo & Wattal (2015)
2. Platform Governance	When multiple firms have decision making rights, governance is complexified by the need to reach consensuses between actors with different and at time conflicting goals and interests.	- Governance in IOPs is made difficult by the need to reach consensus in decision-making when members differ considerably in their goals - In open platforms, governance costs can increase because of an increase in participants, and the need to govern their contributions. Standard interfaces may be used to curtail such costs by transferring some governance functions into platform features (e.g., quality control). - Data governance and decision rights over data use need to be addressed early in IOPs to avoid conflicts that can lead to platform dissolution.	- Huber, Kude & Dibbern (2017) - Jarvenpaa & Markus (2018) - Lee, Zhu & Jeffery (2019) - Lis & Otto (2020) - Markus & Bui (2012) - Schmeiss, Hoelzle & Tech (2019) - Tiwana, Konsynski & Bush (2010) - Wareham, Fox & Cano Giner (2014)
3. Platform Openness & Control	Competing choices between opposites of openness and control each with its own benefits and drawbacks, and the extent of one choice affects the extent of the other.	- Deciding with strategy to follow between openness and control. - *Increasing openness* attracts contributors and consumers but exposes the platform to exploitations such as forking and envelopment. Less restrictions on providing contributions also exposes the platform to low quality contributions. - *Increasing control* repels contributors such as developers, content creators and innovators, but secures the platform from exploitation. - Tight control is associated with revenue streams from rents but loses out on the potential of ecosystem-wide innovation by limiting contributors. Whereas openness has very limited revenues from internal rents but cashes in on external innovation by "letting a thousand flowers bloom".	- Boudreau (2010) - Choi, Nam & Kim (2018) - Foerderer, Kude, Schütz & Heinzl (2014) - Ghazawneh & Henfridsson (2013) - Goldbach, Benlian & Buxmann (2018) - Karhu, Gustafsson & Lyytinen (2018) - Parker, Van Alstyne & Jiang (2017) - Tiwana (2015**b**) - Wessel, Thies & Benlian (2017) - West (2003)

Area	Key Issue	Explanations	Exemplar Papers
4. Collective organising	Challenges in cooperative organising involving competing actors with heterogeneous characteristics	- Organisational network relations can support cooperation in developing a platform but may create conflicts should competition become necessary. - Under ambiguous conditions of competition and cooperation (i.e., coopetition) having a common interest and interdependencies may not necessarily predict successful development of a platform ecosystem. - At launch, high competition between firms within a platform promotes creativity, innovation and spillovers but reduces cooperation and threatens interdependencies. - At launch, high cooperation between firms within an IOP creates opportunities for creating value through economies of scale but also creates the risk of free riding and other forms of moral hazards.	- de Reuver et al (2015) - Fürstenau, Auschra, Klein & Gersch (2019) - Markus & Bui (2012) - Nikayin et al (2013) - Ojala & Lyytinen (2018) - Saadatmand, Lindgren & Schultze (2017) - Saarikko, Westergren & Blomquist (2016) - Steinfield, Markus & Wigand (2005) - Wigand, Steinfield & Markus (2005) - Zhao, Xia & Shaw (2011)
5. Critical mass	Contradictions in the options available to create network effects and reach a critical mass of users.	- At conception, platform managers grapple with uncertainty about the userbase market for both contributors and targeted consumers and decisions on how to onboard each user type. - At launch, attracting contributors depend on the available consumers, and consumers join depending on the available contributors who can provide a variety of offerings (i.e., the chicken and egg dilemma) - Subsidising consumers can increase user turnover but requires high start-up costs and may discourage contributors if the cost is shared with them (e.g., if they have to initially provide free content, apps, or extensions)	- de Reuver et al (2018) - Evans & Schmalensee (2010) - Haurand & Stummer (2018) - Leong, Pan, Newell & Cui (2016) - Qiu, Gopal & Hann (2017) - Schirrmacher, Ondrus & Kude (2017)
6. Value system creation	Challenges that arise from the drive to create and capture value and the associated costs	- Differentiation and uniqueness can be used to create a convincing value proposal but inherently create a risk of imitation and disruption by incumbent firms and innovators in similar markets, respectively. - Proposing and demonstrating a unique value proposition creates a convincing platform core that attracts user attention and compels them to join but may not retain participation if the market is highly fluid, where disruptions, imitations are frequent, and if barriers to entry are low. - Demonstrating the selling point can be achieved by providing a solution to a persistent problem or by serving unserved users in the targeted market but is not enough to create network effects	- Aggarwal & Wu (2018) - Blaschke, Haki, Aier & Winter (2018) - Cennamo & Santaló (2019) - Hackney, Burn & Salazar (2004) - Howard, Powell & Vidgen (2004) - Jacobides, Knudsen, and Augier (2006) - Kapoor & Agarwal (2017) - Le Pennec & Raufflet (2018) - Lehtinen, Peltokorpi & Artto (2019) - NG et al (2017) - Schreieck, Wiesche & Krcmar (2017) - Tiwana (2015**b**)

2.4 Platform Architecture

Architecture is a conceptual structure that describes the logical organisation and interaction of components within complex systems (Tiwana, 2014, p.38). Here, we discuss platform ecosystem architecture which we define as a high-level description that specifies the connection and interaction of a platform's components (Tiwana, 2014, p.84). It also specifies how various artefacts (platform core, extensions, APIs, SDKs, integration engines, etc.) that coalesce into a platform and its modules function and change through interaction as the platform ecosystem evolves. We discuss the properties of platform architecture that enables such evolution to occur (Baldwin & Woodard, 2009; Tiwana, Konsynski & Bush, 2010, p. 676). Our view of platform ecosystem architecture here should be taken as conceptual building blocks rather than instances of working implementations.

Platform designers must balance between designing for stability and support of variation and unpredicted change; they must make choices about whether to design a more integrated or modular architectures; designing standardised elements versus supporting customisation; and choosing interoperable versus proprietary design options. Because of these multiple decision points, platform architecture is difficult to design when it involves multiple organisations with disparate choices as is the case in inter-organisational contexts. We discuss these areas of platform architecture with supporting evidence from IS research.

2.4.1 Stability & Evolvability

Fundamentally, platform architectures need to have both stable and variable (i.e., evolvable) components (Baldwin & Woodard, 2009, p.23). The platform itself has more stable components that are re-usable whilst its complements are variable. Tiwana (2014 p.94) provided a useful analogy of platform ecosystem architecture and that of the architecture of a city. Fundamental infrastructure such roads, railways, bridges, electricity grids and telecommunications must be stable and persistently reliable as are the base-level components of a platform such as its interface infrastructure, data storage centres and networks for data transmission (Constantinides, Henfridsson & Parker, 2018; Thomas, Autio & Gann, 2014; Tiwana, 2018). City architectures also have varieties of buildings offered by diverse real estate agents, and they evolve through re-designs, makeovers, and demolitions. Platform ecosystem architectures' most variable components are provided by third parties (e.g., their apps, modules, content, extensions, etc.), which continue to change as they compete for consumer attention (Kapoor & Agarwal, 2017; Tiwana, 2015**a**). The more stable components form the core of the platform. Such components are shared and reused – provided much in the same way as shared public facilities and infrastructure in cities, intended to facilitate interaction, growth, re-creation, and innovation.

Ensuring that the base infrastructure is stable enough to support evolvability when the platform scales is important (Constantinides, Henfridsson & Parker, 2018, p.389). This is because some architectural decisions are difficult or too expensive to reverse because of the infrastructure involved

(similar to decisions about changing the layout of a rail or road network) (Grisot, Hanseth & Thorseng, 2014, p.198). Consider for instance, the implications of the architectural decisions made by Google (search engine) and Skype (video conferencing). Google chose to provide a host-based architecture that supports functionalities on the server side (e.g., Google's need to run numerous servers to power its search engine) (Agarwal & Tiwana, 2015, p.477). This contrasts with Skype's initial peer-to-peer architecture, which shifted the hosting issue to the clients, enabling it an almost infinite ability to inexpensively scale, but limiting its ability to manage the quality of connections between clients. Such choices are reversible in theory, but the costs involved make it difficult to do so in practice (Agarwal & Tiwana 2015, p.477).

To exhibit 'platform' characteristics, architecture needs to be extensible, exhibiting such properties as malleability, and scalability whilst maintaining base-level stability (Baldwin & Woodard, 2009; Tiwana et al., 2010, p.683). Architectural extensibility is fundamental to platform ecosystems because it facilitates loose connections of modules that are autonomous enough to specialise and innovate within the platform's ecosystem (Tiwana et al., 2010; Tiwana, 2015**a**). At launch, the platform core starts as an early version of an artefact in continuous reconfiguration (c.f. Jha, Pinsonneault & Dubé, 2016). It is by adding new modules and components from third parties that it becomes a platform 'ecosystem' (Tiwana et al., 2010). Platforms thus often start with minimum functionalities and add new functions as they evolve because their architectures enable contribution and innovation opportunities (c.f. Tan, Lu, Pan & Huang, 2015; Jha et al. 2016; NG, Muthukannan, Tan & Leong, 2017).

Additionally, architecture choices about infrastructure have implications on cost and feasibility of implementation. Whilst Google could afford a host-based architecture requiring a very high start-up cost to implement multiple servers and data centres, Skype followed a leaner peer-to-peer approach that was scalable yet inexpensive in comparison (Agarwal & Tiwana. 2015). Some architectures such as those that are designed for national or global scale implementation may be too expensive to implement at one go. For instance, studying the development and deployment of a nation-wide platform infrastructure in Danish healthcare systems, Aanestad & Jensen (2011) found that architecture solutions that required all functionality to be in place from the very start were just too expensive and the project pivoted towards gradual, modular installation.

Designing an evolvable architecture is challenging. There are many options available, each with its own trade-off, and with a potential to 'lock-in' the platform to one developmental trajectory than the other. On one hand, some components such as foundational infrastructure remain fixed and reusable, which stabilises the platform and enables economies of scale as the number of users utilising the same components increase (Constantinides, Henfridsson & Parker, 2018). On the other hand, some components vary over time as new features are added, removed, or tweaked. This capability for reconfiguration is sometimes referred to as a platform's 'evolvability' (c.f. Gawer, 2011, p.24). Evolvable architectures foster a 'survival of the fittest' amongst components – highly performing components are retained, those that fail to compete are easily removed without affecting the rest if the

platform. This is common in software ecosystems such as web browsers, and app markets (Parker, Van Alstyne & Jiang, 2016). As a result, evolvable architectures encourage innovative and best performing components, which in turn sustains platforms (c.f. Um et al., 2013).

2.4.2 Modularity & Integration

Platform architecture determines the divisibility of innovation work among contributors and the platform provider, and also influences its subsequent re-integration (Tiwana, 2014, p.76). Platform architectures need to balance modular and integrative design options in order to utilise advantages of both dependence and interdependence between components (Hukal, 2017). Whilst modularity enables the partitioning of components such that there is minimal dependence between two components, integration enables tight coupling of components such that there is high interdependence (Baldwin & Woodard, 2009). Some degree of both modularity and integration are needed in order to guide third party contributors into a development path desired by the platform sponsor (Tiwana, 2018, p.843).

Highly modular architectures have sub-systems that can be connected and re-connected easily without affecting the rest of the platform ecosystem (Baldwin & Woodard, 2009). They permit loose integration that enables the layering of digital technologies from various specialisations. For example, in software platform ecosystems, operating systems support applications such as web browsers and word processors, they in-turn support browser/app extensions which can also support additional addons, and so on) (Um et al., 2013; 2015; Tiwana, 2018). Modular architectures also enable third party developers to customise and refine their own 'extensions' which creates a conducive environment specialisation and innovation to flourish (Tiwana, 2015**a**; Boudreau, 2017). Some studies have also made conjectures that modularity fosters an "architecture of participation", particularly in collective development processes of a platform (Baldwin & Clark, 2006). This is because architectures with modular codebases increase option values that attract developer contributions than those that are monolithic and have low option values (Baldwin & Clark, 2006, p.1126).

Whilst modularity fosters contributions, architectural integration generates benefits from a synergistic perspective (Hukal, 2017, p.7; Tiwana 2018). It fosters modular interdependencies which enables a platform provider to solve the coordination problem as well as achieve oversight amongst numerous of external complements, which reduces the governance burden (Boudreau, 2017, p.12; Huber, Kude & Dibbern, 2017, p.568; Hukal, 2017, p.7). Granger (2017) found that integration of the core structure of templates on Wikipedia simplifies the platform curators' tasks for managing content contributions from millions of contributors and avoid template creep. Kude (2017) also found that integration of API connection rules was an effective way for a Mozilla Firefox's browser platform to manage millions of extensions and addons whilst reducing costs of implementing governance rules. As observed by Parker, Van Alstyne & Choudary (2016) most platforms launch with a tightly integrated architectures because there is significant work involved in carefully specifying sub-system interfaces –

even in simply documenting them (Parker et al., 2016, p.57). When firms are pursuing narrow market windows and have limited engineering resources for architecting decomposable systems, they can be easily tempted to develop simpler integrated options. However, overtime, the tight coupling of components and limited value options that results from monolithic designs makes it difficult to mobilise external contributions from third parties (Baldwin & Clark, 2006).

Platforms seek to inculcate both capabilities for modularity and integration to co-exist, but this poses a challenge because of the stated fundamental differences of each of the two design properties. Modularity and integration are thus properties of architecture that platform providers grapple with. Having high modularity does not necessarily translate to benefits. Studies show that high modularity can increase the autonomy of external contributors over the platform and create a risk of inversion of control (Parker, et al., 2016). It can create enormous costs for governing widely different platform complements, and it can drift the platform from strategic direction and control (Parker, van Alstyne & Jiang, 2017; Constantinides et al. 2018; Ojala & Lyytinen, 2018). Thus, the benefits of modularisation materialise only in combination with some degree of integration in order to achieve control and guide evolution towards the platform provider's strategic goals. On the flip side, having high technical integration of modules complicates specialisation and innovation by reducing the autonomy of external contributors, and can trigger migration from a platform especially if vertical control as a result of integration becomes excessive (c.f. Choi, Nam, & Kim, 2018; Goldbach, Benlian & Buxmann, 2018).

Where loose coupling can facilitate greater generativity (Baldwin & Woodard, 2009; Um, Yoo, Wattal, Kulathinal & Zhang, 2013), it risks greater fragmentation, inefficiency, inferior user experience, and overcrowding. By contrast, tightly coupled architectures tend to be closely nested or fixed, with closed product-specific interfaces that protect the market position of the product via lock-in and asset specificity (Wareham, Fox & Cano Giner, 2014, p. 1198). High levels of cohesion and integration with core components can increase an intrinsic protection from appropriation, as well as a more holistic and seamless user experience. However, this can stifle innovation and constrain the level of platform evolvability (Parker and Van Alstyne, 2005).

2.4.3 Generativity of Architecture

Platform architecture also exhibits self-organising characteristics – a concept referred to as generativity (Foerderer, Kude, Schütz & Heinzl, 2014; Leong, Pan, Newell & Cui, 2016; Um et al., 2013). Um et al. (2013) defined this as, "a reproductive capacity to produce unprompted and uncoordinated changes in its structure and behaviour without the control of a central authority by utilising existing software modules that can be recombined in novel ways" (p.4). Thus, to exhibit generative capabilities, platform architectures need to enable the occurrence of unprompted change from numerous loosely connected components (Foerderer et al., 2014; Um et al., 2013; Woodard & Clemons, 2014). What this means is that just by creating conditions that enable components to interact

loosely and innovatively, incredibly complex systems can emerge in unpredicted ways. Examples here include architectures that support such platforms as WordPress, Wikipedia, and Android OS. Studies observed that by interaction and function, modular architectures of source codes, in these platforms can self-organise (e.g., Um et al., 2013; 2015). Such an insight might provide a theoretical basis of explaining how complex systems are developed, and how competition occurs at the code level in complex ecosystems such as those provided by Apple, Google, and Microsoft Windows.

The key feature of generative architectures is that they can themselves evolve endogenously without the need for central authority coordination and can be able to satisfy diverse consumer preferences (e.g., how Wikipedia satisfies consumer preferences) (Um et al., 2013, p.12; Woodard & Clemons 2014, p.3). This however can clash with business level control and strategic oversight, especially if base level changes occur too quickly or radically change the platform, for instance, by shifting a strategically significant innovation to a third-party organisation (Foerderer, Kude, Schütz & Heinzl, 2014). The ownership of a platform becomes irrelevant if other firms control strategic elements of the platform (Um et al., 2013, p.12; Ojala & Lyytinen, 2018). Thus, although inculcating generative capabilities in platform architectures may be desirable, it can be risky if it subverts strategic oversight or causes drift from a provider's strategic control (Tiwana, 2014). Thus, platform providers need to balance between designing generative architectures, and aligning them with strategic oversight. If complex architectures can emerge and generatively evolve without necessarily having a centrally authoritative core design (Um et al., 2013; Woodard & Clemons, 2014), aligning how such artefacts and their underlying design properties interact with business level strategies remains a balancing act, especially as there is abundant advice to co-evolve design decisions with business level strategy (Tiwana et al, 2010; Agarwal & Tiwana, 2015).

2.4.4 Interoperability of Architecture

Platform designers also face contrasting architecture options between propriety and interoperability. The main core of the platform, its modular extensions, and interfaces for connecting external complements can be very different for platforms that retain high control and those that are open (we will fully discuss openness and control in the next section). Propriety enables authoritative control, for instance on the quality of contributions (West, 2003; Boudreau, 2010), it reduces the risk of imitation and exploitation (Karhu, Gustafsson, & Lyytinen, 2018), and generally fosters the strategic direction desired by the platform provider (Parker, Van Alstyne, & Jiang, 2017). Interoperability enables the platform to capitalise on external contributions through open standards and open interfaces but carries the risk of 'opening the floodgates' to poor contributions and exploitation through imitation and forking (Ruutu, Casey & Kotovirta, 2017; Wessel, Thies & Benlian, 2017). Whilst platforms that use proprietary solutions typically develop, own, and operate the platform core (e.g., Apple's iOS), those

that foster interoperability (e.g., Linux OS, Apache Servers, Android) rely on a core that is developed and operated by a collective group (Eisenmann 2008).

In summary, the range of choices in the design of a platform's architecture are critical. They harbour the possibilities of the platform's future developmental path. This is even more pronounced in inter-organisational settings. The outstanding questions identified are: How does IT architecture, enable a heterogenous group of organisations to replicate the coordination advantages of internal vertical control (within a firm) and the efficiencies of an open market to which the platform is exposed (Agarwal & Tiwana, 2015)? What determines whether architectural choices catalyse or stifle contributions, innovation, and growth? Also understudied is how architecture can be designed to promote active participation between autonomous, yet heterogeneous parties.

2.5 Platform Governance, Heterogeneity & Coopetition

Platform ecosystems are often characterised by many organisational actors and the use of inter-organisational systems such as shared infrastructures, data, and co-creation of resources. This creates the need for collaboration to share resources, but also competition for individual interests (Yoo, Roh, Cho & Yang, 2020). The ambiguous existence of both competition and cooperation (i.e., coopetition) presents a strategic management problem to platform sponsors. It makes platform governance particularly difficult as coordinating multiple and at times conflicting interests created by competition can negate cooperation efforts (Teixeira, Mian & Hytti, 2016). Studies have shown that the need to reach consensus in decision-making leads to greater difficulty in making major investment decisions when members differ considerably in their goals (Markus, & Bui, 2012), and in worst case scenarios can even lead to the disbanding of a platform (de Reuver et al., 2015). The governance challenge of managing the dynamics of coopetition thus squarely faces platform sponsors who are placed at the intersection of firm boundaries and need to play negotiating and facilitatory roles to coordinate actors encourage contributions whist limiting conflicts (Nikayin, de Reuver & Itälä, 2013).

Several ways to achieve collaboration under coopetition conditions have been proposed, but these do not always align neither do they fit in different platform contexts (Huber, Kude & Dibbern, 2017; Markus & Bui, 2012; Schmeiss, Hoelzle & Tech, 2019; Wareham, Fox & Cano Giner, 2014). For instance, to transfer information and resources more easily between multiple alliances that may be competing, developing transparency and weak intellectual property rights were shown to work well in open-source platforms (Teixeira, Mian & Hytti, 2016), but difficult to implement in closed platforms because IP protection forms the core revenue model of such platforms (Parker & Van Alstyne, 2018). Creating smart business networks and interdependencies through technology and process alignment was shown to foster cooperation (Fürstenau, Auschra, Klein & Gersch, 2019) and still give room for individual firms to pursue their competitive paths (Guo et al., 2014; de Reuver et al., 2015), but diverted

the platform agenda towards more distributed IS-based socially embedded relations (c.f. Guo et al., 2014, p. 233). What this evidence suggests is that competition and cooperation can be dealt with, first by acceptance of the co-existence of the polar yet interrelated conditions in inter-organisational platforms and choosing appropriate responses that consider differences in platform context and through tactful leadership.

There is more knowledge about influencing factors but less about how each factor manifests itself, that is, how in specific contexts, it can be used to drive platform architecture and governance, or how it hinders it. For instance, how can inter-organisational dependencies be used to foster collective organising of IOPs and in what situations can such dependencies be detrimental (c.f. Jha, Pinsonneault & Dubé, 2016; Nikayin, de Reuver & Itälä, 2013; de Reuver, Verschuur, Nikayin, Cerpa & Bouwman, 2015)?

The inter-organisational settings of platform ecosystems are characterised a lot of heterogeneity in the participating firms. There are differences in their size, differences in industry sectors, and whether they are private or public institution, and so forth. Such heterogeneity means that participating firms inherently have diverse incentives and interests that may be difficult to reconcile (Markus, & Bui, 2012; Wigand, Steinfield & Markus, 2005). Most IOPs become necessary because pooled resources such as data, services, or infrastructure become more valuable when aggregated than when used separately (de Reuver et al., 2018; Jarvenpaa & Markus, 2018). However, the expectation to share the 'collective' good is complicated where some actors contribute more than others, where some actors emphasise social responsibility over profits, or where some actors see the collective good as a public good whilst others seek exclusive protections (Teixeira, Mian & Hytti, 2016). Such conflicting interests make network effects difficult to achieve despite the joining and participation of many firms (de Reuver, Nederstigt & Janssen, 2018).

In summary, collective organising is problematic, and empirical research provides inconsistent and somewhat limited evidence regarding how to address it in platform development. Some findings suggest that in order to promote cooperation amongst actors from diverse sectors, it is important to reconcile divergent interests of the different groups (Wigand et al., 2005). However, such reconciliation is difficult to achieve without sacrificing one group over another. Differing interests, conflicts, and governance choices resulting from this can be so acute as to cause discontinuances in platform development projects (c.f. de Reuver, et al., 2015). Determining what form of governance options emerge from this and how platforms providers negotiate these differences and assume a leadership role towards the desired direction of the platform remains an open question (Jha, Pinsonneault & Dubé, 2016). To achieve cooperation and effective contribution from each member, hybrid arrangements often arise between the platform sponsor and the participating member firms, as well as between the firms themselves (Markus and Bui, 2012). Future theoretical development and empirical research is needed that explain how such leadership is practised at work level to achieve strategic goals within coopeting groups (Peppard, Galliers, & Thorogood, 2014). An empirical gap remains about how platform

managers address coopetition and associated heterogeneous interests and resources in the mobilisation required in IOP development.

2.6 Platform Openness & Control

The openness of a platform ecosystem refers to the extent of restrictions set on accessing and contributing to any of its layers, such as code, data, and content, including the associated physical infrastructure (Boudreau, 2010; Ondrus, Gannamaneni & Lyytinen, 2015; Wessel, Thies & Benlian, 2017; Parker & Van Alstyne, 2018, p.3018). The opposite end of openness is 'closedness' which often relates to proprietary control over a platform by the platform sponsor or provider who exercises rights of access and use, usually by means of restrictions, guidelines, standards, and intellectual property rights (Ghazawneh & Henfridsson, 2013; Parker, Van Alstyne & Jiang, 2017). Trying to balance the extent and level of openness and control is challenging to platform providers because: (i) it affects the level of competition faced by a platform, (ii) it can disrupt platform monetisation, (iii) it affects the level of innovation occurring on a platform, (iv) it underlies the threat of forking a platform, and (v) it is a critical aspect of the architecture of a platform (Boudreau, 2010; Parker & Van Alstyne, 2009; 2018; West, 2003).

The openness and control of a platform is mainly implemented at two levels: governance and architecture (see Figure 1, p.27). At governance level, platform owners need to decide which level of openness they should allow or concede for governing their platform profitably, for instance, through guidelines, standards, and policies, without exposing it to exploitation (Boudreau, 2010; Parker & Van Alstyne, 2018). At architecture level, control and openness mechanisms are embedded in the design features of the platform (Tiwana, 2014). Control can be enforced by using, proprietary designs and standards, sealed codes, and restrictive input measures. Openness is promoted by creating open-source code libraries, using open data standards, providing extensive SDKs, and minimising input restrictions. Open platforms have limited restrictions to both access and contribution to the platform core (e.g., open standards, Linux OS) or via its boundary resources such as APIs and app stores (Eaton, Elaluf-Calderwood, Sørensen & Yoo, 2015; Ondrus, Gannamaneni & Lyytinen, 2015; Parker, Van Alstyne & Jiang, 2017).

Empirical research suggests that openness may contribute to attracting a critical mass by appealing to contributors to use openly available resources (Eisenmann, Parker & Van Alstyne, 2009; Nikayin, de Reuver & Itälä, 2013; Parker, Van Alstyne & Jiang, 2017). These contributors can extend the platform's utility to end users and can create revenue streams that the lead firm can tax (Parker & Van Alstyne, 2018). However, openness needs to be carefully implemented to manage the risk of exploitation. Platforms that open up strategic parts of their platform can be 'forked' out by external parties and risk being 'enveloped' into adjacent or well-established platforms (Eisenmann, Parker & Van Alstyne, 2011). Thus, openness should not be equated to losing control over the platform.

Platform providers need to carefully decide which compromise they can survive with depending on their strategic intent at specific phase(s) of platform evolution. For instance, to launch platform ecosystems, there are two typical strategies regarding openness and control identified in empirical research. One approach is to provide a very open platform at codebase, device and/or content level that allows developers to easily provide their offerings and thereby attract end-users and create network effects through which a critical mass may be reached (e.g., Google's Android OS platform) (Ondrus, Gannamaneni & Lyytinen, 2015). Another approach is to provide a tightly controlled proprietary technology that addresses a niche market that compels developers and users to join and then gradually loosen control over time (e.g., the initial version of Apple's iOS platform) (Ghazawneh & Henfridsson, 2013). Empirical findings from the two approaches show that both approaches can be highly successful if applied well or disastrous if not (Ghazawneh & Henfridsson, 2013; Ondrus, Gannamaneni & Lyytinen, 2015; Parker, Van Alstyne & Jiang, 2017). In the following sections we discuss the different effects of emphasising either openness or control at first in platform development.

2.6.1 Emphasising Openness at First

It is common for platforms, particularly consumer-facing ones, to launch through an open strategy. Openness allows faster developer traction which compels end user consumers to also join, and thus quickly generating network effects required to create a critical mass (Parker, Van Alstyne & Jiang, 2017). Open-source technologies and standards associated with higher platform openness allow platform providers to follow a 'let the thousand flowers bloom' strategy, and only start encapsulating and enfolding some features of the platform that show strategic and competitive advantage as use patterns emerge (Ondrus, Gannamaneni & Lyytinen, 2015). An open strategy incurs low costs to the provider because they do not need to subsidise end consumers as they are easily attracted by developer activity induced by openness. The provider transfers the cost to developers who at times may have to provide free products to sustain consumer participation with the hope that over time, a critical mass of consumers will make it possible to charge for complementary products.

However, a challenge with an open strategy is that it gives developers some degree of control over the platform, and if unchecked, can have unintended consequences (Tiwana, 2015**b**). Without a measure of control, developers can assert their influence and invert control in strategic parts of the platform (Parker, van Alstyne, & Jiang, 2017). External developers can organise themselves to fork out new innovations or split the platform by creating a parallel imitation that can become a stiff competitor (Karhu, Gustafsson, & Lyytinen, 2018). Additionally, a very open platform can easily evolve to support millions of developer activities that still require some degree of oversight. This may raise the cost of governance (Huber, Kude & Dibbern, 2017), and poor quality of contributions can lead to platform desertion (Tiwana, 2015**b**).

2.6.2 Emphasising Control at First

Platform ecosystems can also launch as highly controlled proprietary platforms, and only respond to user demands by reducing control and accommodating user-desired features as the platform grows. Initial offerings are often first party content developed by the platform sponsor and a limited number of third-party products. For example, Apple started by offering its own apps in iOS run devices and a few complementary apps from third parties, maximising in internal rents from its proprietary resources (Karhu, Gustafsson, & Lyytinen, 2018). Often this model is followed because there is a niche market that compels consumers to join. Closing the platform increases the sponsor's ability to charge for access and control for quality (Parker, Van Alstyne & Jiang, 2017). However, as the platform and its associated market evolve, niche market value and uniqueness can be eroded by imitations and competing platforms such that the 'compelling factor' is worn. For example, having a few apps on iOS app store could no longer satisfy iPhone users especially when a competing platform, Google's Android, had opened 'floodgates' to developers with a wider range of complementary apps and services for its users leading to user discontent and migration from iOS (Karhu, Gustafsson, & Lyytinen, 2018). Market forces thus compel the provider to reduce restrictions and allow more third parties to contribute and innovate in order to retain consumers and sustain innovation and hence the platform's survival.

Research on control and external contribution in platform ecosystems has revealed that there are cycles of resistance and accommodation that arise from excessive and ceding of control by platform providers (Ghazawneh & Henfridsson, 2013; Karhu, Gustafsson, & Lyytinen, 2018). Apple's Safari web browser had strict restrictions for offering extensions and addons. Over time, developers began to resist this control over their complementary products (e.g., app installation procedures) such that they 'jailbreaked' the iPhone, a practice that made it possible to install third party applications on Safari via an unofficial installer (Ghazawneh & Henfridsson, 2013, p 181). Apple responded to third-party developers' resistances by accommodating their calls and resourced the platform with a SDKs and resource libraries that supported third party developers.

In many platform contexts, reducing control creates positive network effects between third-party developers and end users (Boudreau, 2017; Ghazawneh & Henfridsson, 2013). This is generated first, by expanding value options that induce developer participation and contributions to build on the platform (Baldwin & Clark, 2006; Parker, Van Alstyne & Jiang, 2017); and second, by the subsequent increase in digital offerings (e.g., apps, extensions, addons etc.), which attract users, creating a reinforcing network effect between developer and user participation (Choi, Nam, & Kim, 2018). Openness also enables third party developers to feel autonomous, with some degree of self-control over their contributions (Kim, Kim, & Lee, 2016; Goldbach, Benlian & Buxmann, 2018). This autonomy is necessary to drive specialisation, innovation, and continued participation of developers (Qiu, Hann & Gopal, 2013; Goldbach et al. 2018). Reducing control also allows architectural generativity, a form of

'unprompted change' (Foerderer, Kude, Schütz & Heinzl, 2014) that enables platform ecosystems to 'self-organise' (Woodard & Clemons, 2014; Um et al., 2013).

However, openness has its own challenges. Often, reducing control diminishes the quality of contributions made by third party developers because there is little input control to check for quality and enforce standards (Wessel et al., 2017). Unrestricted access also renders the platform and its shared resources vulnerable to strategic exploitation (Parker, Van Alstyne & Jiang, 2017, Karhu et al., 2018). Additionally, platforms that have a high technical risk of losing their IP to developers may benefit from a more closed option, with only cautionary openness to specific 'non-risky' toolkits (Parker, Van Alstyne & Jiang, 2017).

2.6.3 Summary of Key Points

Decision challenges regarding the extent of openness and control are not once off but persist as the platform evolves, and constantly need reframing by understanding at which moment of its development, a platform benefits more from being open or from being tightly controlled. Despite having a positive effect on the performance of developers and other platform contributors (Choi et al., 2018; Goldbach et al., 2018), platform openness is rather difficult to balance during the developmental phases of a platform's growth. This is because openness itself appears to be on a sliding scale between the extremes of being tightly closed by the platform owner and devolving control to third party contributors (see Figure 1, p.27). Growth in the value addition given by third party developers, re-usable resources available on the platform as well as an innovation absorption favours more open platform regimes than those that are closed (Parker, Van Alstyne & Jiang, 2017). However, there exists cautions for platforms with high technical risk, especially of losing their IP to developers, that they may benefit from a more closed option. Because a platform can either be tilting towards closedness or openness, platform providers mainly need to manage the effects of reducing either of the two as the platform evolves.

Trying to balance the extent and level of openness and control is challenging to platform providers for several reasons. First, the level of competition faced by a platform can increase especially if the platform is too open (Benlian, Hilkert & Hess, 2015). Second, platform value creation can be stifled if there is too much control of both joining and contribution (Lee, Lee & Hwang, 2015; Ondrus, Gannamaneni & Lyytinen, 2015; Parker & Van Alstyne, 2018). Third, the level of openness and control determines who can join, contribute, and has decision rights, which affects contribution and the level of innovation occurring on a platform (Boudreau, 2010; Choi, Nam & Kim, 2018; Tiwana et al. 2010). Fourth, widely open platforms can be difficult to appropriate value (Parker & Van Alstyne, 2009), and are exposed to exploitation threats such as forking and envelopment (Eisenmann, Parker & Van Alstyne, 2011; Karhu, Gustafsson & Lyytinen, 2018). Fifth, platform providers need to balance two axis of

platform architecture and governance in order to choose an appropriate degree of openness and control (Tiwana et al. 2010; 2014; Stefi, Berger & Hess, 2014).

As shown in Figure 1 below, openness and control are on a sliding scale. On the far left are proprietary, closed systems that are privately governed and controlled. If both the architecture and governance are closed, the system is essentially a closed product and not an open platform – platforms are seldom that far left. On the far right are systems that are completely open. Again, platform rarely reach this level of openness – which closely represents open standards than platforms (Parker, Van Alstyne & Choudary, 2016).

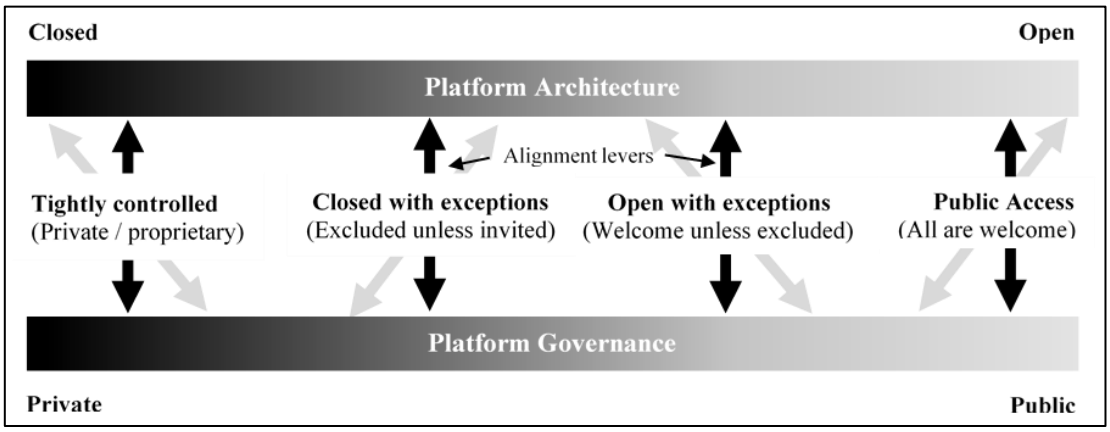

Figure 1: *Openness and control are on a sliding scale*

Source: *Developed by author*

Despite differences, platforms need to have some level of both control and openness – and this is determined by a platform sponsor of some sort (parent provider, governing body, consortium etc.). In Figure 1 above, each axis can have an independent choice, meaning that one can choose an open architecture and closed governance model or vice versa – but this risks misalignment between these two areas. Additionally, choices about opening or closing a platform are not necessarily fixed as the platform evolves. One can start with a more closed architecture (or governance) and gradually open up responding to evolutionary dynamics (Karhu, Gustafsson & Lyytinen, 2018). Open systems in danger of becoming forked or enveloped can close the key parts of their architecture or introduce restrictive measures to prevent exploitation. Google for example introduced some restrictive measures on Android once they sensed the danger of being forked by Asian handset suppliers (Parker & Van Alstyne, 2009). Likewise, closed systems losing competitiveness can decide to open up their ecosystem to attract contributors. For instance, since 2007, Apple gradually eased control and allowed a steady growth of third-party developers on their ecosystem so as to complete with the large numbers that were flocking to Android's much more open platform – a direct competitor to Apple's iOS (Karhu, Gustafsson & Lyytinen, 2018).

2.7 Critical Mass

At launch, platform sponsors or providers are concerned about how to generate network effects and reach a critical mass of users, which enables it to become self-sustaining (de Reuver et., 2018; Evans & Schmalensee, 2010; Schirrmacher et al., 2017). Platform managers grapple with how to onboard users, and to attract more users to join either on the same side (e.g., developers attracting other developers) or across (e.g., developers attracting consumers). What makes this challenging is that it needs to be addressed quickly. Lagging hinder user adoption leading to failure to create a critical mass, and if this is missed the platform fails to take off.

In platform research, the theory critical mass is often used to explain collective behaviour amongst individuals using common pool resources (CPR) generated from or via the platform (i.e., the common good) (Evans & Schmalensee, 2010; Steins & Edwards, 1999). The theory explains how reciprocity amongst individuals is initiated until it is self-sustaining (Markus, 1987; Oliver, Marwell and Teixeira, 1985). Granovetter (1978, p.1420) referred to critical mass as a "threshold" of actors who must 'show an interest' or 'make a decision' before other actors follow suit. To warrant reciprocal behaviour, not only is the 'amount' of initial interests or decisions important, but also who makes those decisions (e.g., firm type and size), and the nature of their decisions (e.g., reputation and influence). This in turn determines whether other parties will be triggered to follow. Applied to platforms, the theory proposes the issues and conditions that must be addressed to attract participation of a sufficient number of users or contributors to make the platform self-sustaining (Evans & Schmalensee, 2010).

In the stages of platform development and launch, platform sponsors grapple with how to attract contributors to the platform and users of the products and services generated by its contributors (Parker, et al., 2016). Developing and launching inter-organisational platforms is particularly challenging because of existing conflicting interests and goals between organisations (Schirrmacher et al., 2017; de Reuver et al., 2018). If there are few firms participating, economies of scale may not be reached, transaction costs remain high, and it becomes difficult to justify switching costs for those firms that already have an existing solution. Therefore, practices for coordinating firms to create a critical mass are vital for its successful development and eventual launch (Evans & Schmalensee, 2010).

Unlike consumer-facing platforms that can attract individual users at a global scale, inter-organisational platforms often have a limited scope of targeted firms, usually within the same organisational field (de Reuver et al., 2018). Thus, if major firms, for instance in the adoption of standards, were to reject the initiative, such a standard would not take off (Markus & Bui, 2012). Where there are a mix of firms, some may wait to see if their allies, competitors, or influential firms are participating (de Reuver et al., 2018). This gives rise to the 'chicken-n-egg' problem. To attract firms to join, the platform needs to have a significant number of other firms that have already joined (Evans

& Schmalensee, 2010). Platform providers in an inter-organisational setting must break this paralysing dynamic where prospective firms wait for other firms to participate prior to making a commitment.

2.8 Value System Creation

To successfully launch, platforms need to provide a unique value proposition which forms the core of the platform (i.e., core interaction c.f. Parker, Van Alstyne & Choudary, 2016, 61-4) and carves a niche in a market or industry (de Reuver et al., 2018). Before launch, the value proposition should be compelling in order to attract to investors and venture capitalists (Schirrmacher, Ondrus & Kude, 2017). At launch, the value proposition should compel contributors and users to join because it benefits them (i.e., it satisfies their self-interests more than those of the platform) (Evans & Schmalensee, 2010). At strategic management level platform providers must decide how to address a three-pronged challenge: (i) how to create a convincing value proposition at ideation or conception stage, (ii) how the value will be created on the platform once it is launched, and (iii) how to leverage the value created once value creation activities become fully operational. We discuss these three areas here.

Platform sponsors must demonstrate that their value proposition works by generating network effects and a critical mass (Evans & Schmalensee, 2010). One of the most common mistakes by platform providers and platform technopreneurs concerns how they determine platform value creation and leveraging. This is because these two need to be planned early before launch, and at times things change on the market or in the organisations participating that disrupts the predicted ways of generating and appropriating value (Parker, Van Alstyne & Choudary, 2016). Value leveraging in platforms is particularly challenging because: (i) traditional ways of extracting value are not applicable or difficult to implement in IOPs, (ii) it can be difficult to predict and determine which side to subsidise and which to appropriate value from, and (iii) in IOPs, the 'sides' of the platform are blurred because participating organisations can represent both end users (i.e., consumers) and contributors (i.e., developers and producers) at the same time.

The value creation process changes after platform launch because it becomes a negotiated activity between platform providers and contributors who generate value through contributions (e.g., through providing new content, applications, addons, data, services etc.) (Fürstenau, Auschra, Klein & Gersch, 2019). Platform providers need to be tactful to notice where innovation and future promise of competitive advantage is emerging from within the ecosystem of the platform, and to ensure that they continue to wield overall influence otherwise external contributors can either desert or invert the platform (Tiwana, 2015**b**; Parker et al., 2017). Resources such as software libraries, APIs and SDKs can be used to promote activities that generate new value and innovations as well as to continuously attract and retain external contribution. Platform providers often go through cycles of resourcing and securing that enable them or orchestrate value creation and capture emerging strategic elements of the platform (Ghazawneh & Henfridsson, 2013).

Value creation activities can stretch governance costs especially if coordination (Markus & Bui, 2012) needs to be negotiated amongst a group of diverse organisations that are disparately distributed. Platform managers need to balance the costs of governance such that they do not supersede the value created on the platform (Huber, Kude & Dibbern, 2017). Value creation is more difficult to achieve in IOPs because of different governance mechanisms per institution and achieving commonalities in value is also challenging because of different business models and goals per organisation (de Reuver, et al., 2015; Nikayin et al., 2013). Greater firm variety can also lead to greater variance in the way members contributions satisfy user needs, and this complexifies the platform's value creation (Cennamo & Santaló, 2019). Whilst researchers reiterate the need for strong business-to-business interdependencies (Blaschke, Haki, Aier & Winter, 2018) and smart business networks (Vervest, Preiss, Van Heck & Pau, 2004), theoretical insights are still needed to explain *how* value creation may be successfully designed.

Additionally, creating value on platforms involves design choices related to the roles of the actors using or joining the platform, the value proposition(s) of those actors, value creating network effects, and the revenue model of the platform. Participants need to fill certain actor roles within the platform for value to be created (Fürstenau, Auschra, Klein & Gersch, 2019). These roles should be identified early in the platform design by a participatory process (e.g., Fürstenau et al., 2019; Bosch-Sijtsema and Bosch 2015; Jacobides, Knudsen, and Augier 2006). However, the roles may shift rapidly, and participants may have multiple roles (Van Alstyne et al., 2016). Thus, there needs to be some level of congruence between the value to be generated by the platform and the value proposals each participating organisation anticipates fulfilling when they participate (Cennamo & Santaló, 2019; Le Masson, Weil, and Hatchuel 2009). Research is still needed that clarifies how such congruence is achieved, and the impact of incongruence on commitment to participation and contribution.

2.9 Summary

This chapter provides a review of related literature focusing on the first problem space: development of platform ecosystems with special emphasis on inter-organisational platforms. The chapter presented various perspectives on platform development covered by previous research in IS. We specifically focused on six areas: (i) platform architecture, (ii) platform openness & control, (iii) platform governance, (iv) collective organising to manage heterogeneity and coopetition in inter-organisational settings, (v) critical mass, and (vi) value system creation (see Table 3, p.14). The following chapter lays the theoretical foundation of the study by exploring the second problem space: platform development that occurs through collective action.

Chapter 3: Theoretical Foundation

Problem Space 2: Development of Platform Ecosystems Through the Lens of Collective Action

> It is often taken for granted, at least where economic objectives are involved, that groups of individuals with common interests usually attempt to further those common interests.
> **— *Mancur Olson, The Logic of Collective Action, 1965***

Collective action provides a holistic framework to view the challenge of developing and managing platform ecosystems that both architecture and governance levels – positioning it as broader challenge of designing a collective institution (Öström, 1990). It helps us recognise that the design challenge for IOPs is at abstract level, essentially about designing and managing collective action or commons. The challenge for developers of IOPs thus is primarily how they can develop institutions of collective action that support common endeavours.

For the reason that they require participation and cooperation between multiple organisations, collective action endeavours often have underlying tensions arise from differences in interests and incentives between members (Olson, 1971; Öström, 2009). Thus, addressing collective action is a challenge that underlies efforts to work together between heterogenous entities, mirroring inter-organisational challenges of platform development and management (Markus & Bui, 2012; Saarikko, Westergren & Blomquist, 2016). Such conflicts can present themselves in various ways and at different points during platform development. They may also co-exist and persist over time in dialectical cycles (Van de Ven & Poole, 2005) of conflict and resolution (e.g., openness *vs.* control, integration *vs.* modularity, competition *vs.* cooperation, collective interests *vs.* individual interests, and so on).

IOPs are a typical example of the commons in so far as they are developed to serve the interests of those who contribute to their development. Thus, the collaboration for developing an IOP can be studied though the lens of collective action since (i) it requires several organisations to collaborate to realise the common goal (Oliver et al., 1985; Poteete & Öström, 2004), and (ii) the common goal cannot be achieved individually (de Reuver et al., 2015). Taking a collective action approach to viewing IOPs provides a fresh perspective by adding a perspective that strongly considers the social characteristics of platforms, a processual view on how they can be developed and managed; and has a potential to shed light on some of the outstanding challenges in platform architecture and governance. The following discussion introduces collective action theory.

3.1 Background to Collective Action Theory

Collective action theory explains the characteristics and interaction of groups of individuals entities such as people or organisations seeking to achieve a common goal (Olson, 1971; Öström, 1990).

Such entities may have been brought together voluntarily or involuntarily (e.g., because of shared interests or conflicts) but have a need to create a common goal. Collective action becomes necessary when collaboration is required from several entities to realise a common goal, which cannot be achieved individually (Oliver et al., 1985). The 'common goal' in collective action is sometimes referred to as common good, shared goal, shared interest, common interest, collective interest, or collective goal (c.f. Hardin, 1982; Oliver, 1993; Olson, 1971; Öström, 1990).

Although ideas about collective action date far back into the 1930s[5] collective action as a formal group theory was first published by Mancur Olson in 1965 in his seminal book *'The Logic of Collective Action: Public Goods and the Theory of Groups'* (Olson, 1971). Over the years, the theory has been widely applied to study collaboration for common goals by groups in different fields. For instance, in agriculture and environmental management, the common goal is often to preserve 'common-pool resources' from depletion (Steins & Edwards, 1999). The sustainable development goals (SDGs) in global development are an example of 'common causes' within a collective action framework. In the economic theory of alliances, Olson & Zeckhauser (1966) defined the common good as 'common defence'[6] and participation centred on attaining a 'collective good'. These are just but a few discipline-specific examples that highlight the use of 'common goal' in collective action, in terms of a shared interest, common cause, common resources, or shared goal. Thus, what the common goal is depends on the group and the context that ties members of the group together.

3.1.1 Olson's Logic of Collective Action & Group Theory

Olson's observations were that groups of individuals attempting to provide a common good face challenges in doing so efficiently because of their rational behaviours and the characteristics of groups (Olson, 1971, p.2). He made key arguments about public goods (common good), self-interests, groups size, and incentives, that laid the basis of the theory. Here we summarise the key arguments made by Olson (1971):

- ***i.*** ***Public goods:*** Groups are formed to create *public goods* that are either inclusive or exclusive. Public goods, if provided at all, have to be, or are best, supplied to all members of a group (i.e., inclusive). In that case, a rational individual takes a free ride; to enjoy the benefits of the collective goods without contributing.
- ***ii.*** ***Self-interests:*** Nobody is interested in bearing the expenses for the improvement of the larger group, instead everyone tries to profit from the public good following selfish interests. Unless there is some form of coercion, rational self-interested individuals will

[5] For example, Grace Coyle's investigations about group organisation: Coyle, G. 1930. *Social process in organised groups*. Washington DC, Publisher: RR Smith, Inc.

[6] An example of a common alliance with a common defence goal is the North Atlantic Treaty Organisation (NATO)

not act to achieve group interests. Thus, self-interest is not enough for collective action to be started.

iii. ***Group size:*** Olson categorised groups in to small, intermediate, and large groups (Olson, 1971 p.48-50) and considered that group size has a strong influence on collective action. Small groups possess the tendency of suboptimal provision of a collective good because of limited numbers, whilst large groups become latent and fail to provide themselves with a collective good at all because individual benefits are low and organisation costs too high (i.e., there are diminishing returns for each member as the group gets bigger). Thus, larger groups are less efficient compared to smaller groups.

iv. ***Incentives:*** According to Olson (1971), incentives are the key to solving the collective action challenge when benefits of the common goal are not excluded from non-contributors. Incentives can be provided selectively by controlling the access to the collective good between contributing and non-contributing individuals. Incentives for collective action can be various, such as economic and social incentives. Incentives can also be negative (when individuals are forced to cooperate through sanctions to gain a public good, such as to pay tax to gain social welfare), or positive (such as rewards).

3.1.2 Criticism of Olson's Group Theory

Key elements in Olson's 1965 version of the theory such as free riding, group size, and incentives have been extensively studied (Öström, 2009). As empirical evidence in testing the theory mounted, there are notable criticisms regarding Olson's assumptions of the theory as framed in the original theory. Here we discuss some of the prominent criticisms particularly regarding self-interests, group size, and costs:

i. ***Self-interest:*** Olson argued that self-interest was not enough to initiate collective action, especially in large groups. However, even by his own admission (Olson, 1971 p.159-165), Olson's logic of collective action is constrained by (i) his assumption of 'rationality' in individuals, and (ii) by assuming an economic stance to collective action. In real life collective groups often have individuals with complex pursuits (e.g., economic, social, religious, cultural, etc.) and their endeavours are not always rational. As such, when applied to 'non-economic' endeavours with social, political, religious, or philanthropic interests, Olson's assumptions about self-interest are limited (Udéhn, 1993).

ii. ***Group size:*** Olson's arguments about group size have largely not been supported by empirical evidence (c.f. Hardin, 1982; Oliver & Marwell, 1988). For example, Olson argued that individuals' net benefit decline as the group becomes larger, but many collective endeavours exhibit increasing returns to scale (Udéhn, 1993). For example, groups driven by social persuasions such as political activism, demonstrations, and strikes depend on groups size – i.e.,

individual benefits increase as groups size increases (Medina, Sierra & Medina, 2007). Also, as discussed (later) in this thesis, collective groups in institutions driven by network effects such as those developed by platform ecosystems experience increased returns as their collective communities grow (Katz, & Shapiro, 1994; Parker, Van Alstyne & Choudary, 2016).

iii. ***Heterogeneity:*** Olson's group theory has also been criticised for presupposing homogeneity in individuals, particularly regarding their interests and resources. Members of a collective endeavour are more likely to possess complex characteristics rather than being uniform. For instance, they could have diverging interests, be exposed to imperfect information, and unequal resources (Öström, 2009). According to Udéhn (1993), *"It is a serious lack of realism, therefore, to assume, as does the Olson's theory of collective action, that individuals are homogeneous and interchangeable"* (p.244).

iv. ***Costs and the shape of the cost function:*** Olson argued that in order to start a collective action, fixed costs will be high, and marginal costs will eventually decline, and finally rise again, so that the cost function will be U-shaped (Udéhn, 1993, p.242). The only costs he explicitly discussed are organisation costs, which he considered to be greater in large groups than in small groups, at least in the start-up of an organisation (Olson, 1971, p.8-9). However, empirical research shows that cost function cannot be arbitrarily determined in the way Olson proposed. It is largely dependent on the *production function* (discussed below) of collective groups such that (a) those with an accelerating production function start off with high costs, which subside as production increases, and (b) those with a decelerating production function can offset start-up costs because of a higher initial pay offs – but the costs increase as production starts to dwindle (c.f. Markus, 1987; Oliver & Marwell 1988).

3.1.3 Collective Action Theory beyond Mancur Olson

As shown by the criticisms of Olson's initial theorisations, research and scholarship on collective action has moved beyond the theory's initial set of assumptions and concerns. There is a shift from trying to understand how rational actors can coordinate themselves because in various contexts findings show that they can, but what makes coordination happen, how it is maintained, as well as the variables affect it remain key questions in different contexts where collective action occurs (Öström, 2020; Medina, 2013). Here we discuss areas of research that have emerged beyond Olson's initial theory and remain crucial in addressing the collective action challenge. Considering that collective action literature is very broad, we do not claim to be exhaustive but to pick the prominent areas that current research on IOPs is grappling with.

i. ***Critical Mass:*** Studying the free-rider problem described by Olson, researchers (e.g., Markus, 1987; Marwell & Oliver, 1993) found that successful groups can be started by a core of highly interested and resourceful contributors whose efforts encourages other contributors to join and

support the action instead of free riding. They referred to such an initial core group as a *critical mass*. Essentially, the challenge of starting a collective action is thus framed as a challenge to achieving a critical mass (Oliver & Marwell, 1988; Marwell & Oliver, 1993). Subsequently, although critical mass and collective action are two separate theories, many IS scholars link them together.

Briefly, critical mass theory postulates that what matters for collective action is not necessarily the contribution of all group members, but a core subset whose resourcefulness and high interest sparks reciprocal behaviour from others (Markus, 1987; Marwell & Oliver, 1993). In this way, collective action has two major challenges: (i) how to get that core group (i.e., critical mass) of contributors to start collective action (a formation or start-up issue), and (ii) how to sustain the collective action (a continuance or sustenance issue) (Markus, 1987). Determining which challenge is relevant depends on the shape of the production function of the collective good, which is another challenge we discuss next.

ii. ***The Shape of the Production Function:*** The production function of collective action describes the relationship between provision of a collective good and contribution of resources – a key area unclear in Olson's initial theory (Oliver and Marwell, 1985; Markus, 1987; Öström, 2009). Collective actions can have (i) a decelerating production function or (ii) an accelerating production function (Öström, 2009). In a decelerating production function, there are higher benefits for early contributors and lower benefits for late contributors (i.e., production of benefits decelerates). This leads to the sustenance issue of collective action because despite high incentives for initiating collective action, there are diminishing returns as over time for later contributors (Öström, 2009, p.6-7). In an accelerating production function, there are lower benefits to early contributors, which increase over time as other contributors join. This is when a 'critical mass' of highly interested and resourceful actors is needed to pay the start-up costs and provide conditions for less interested parties to join (Oliver and Marwell, 1985). Thus, future research is needed that explicate this production function as it is important in determining the strategies needed to generate a critical mass needed to collective action.

iii. Design Principles for Collective Action

Öström argued for a third approach to resolving the collective action challenge: the design of durable cooperative institutions that are organised and governed by the resource users (Öström 1990; 2010). Through conducting various studies and synthesising research from various fields, Öström observed numerous occasions in which common pool resources (CPR) were managed successfully with neither centralised governmental control nor privatisation (Öström 1999, 2009, 2010). Öström thus determined that there must be principles underlying the design of collective action that makes some institutions successful in achieving collective action whilst others fail. Öström attempted to determine the institutional regularities among collective groups that were sustained over a long period of time and were absent in the failed groups. Her work

which comprises of half a century of research and synthesis culminated into design principles (summarised in Table 4 below) – a set of core underlying lessons that characterise long-sustained regimes of collective groups (Ostrom 2010). The design principles synthesise core factors that affect the probability of long-term survival of collective institutions developed by the users of a resource. It is important to consider Ostrom's principles as a heuristic to develop critical questions about starting and curating collective groups as 'polycentric' institutions (Frey, Krafft & Keegan, 2019).

Table 4: *Ostrom's design principles (extracted from Ostrom 2010, p.653).*

Principle	**Description**
User boundaries	Clear boundaries between legitimate users and nonusers must be clearly defined.
Resource boundaries	Clear boundaries are present that define a resource system and separate it from the larger biophysical environment.
Graduated sanctions	Appropriators who violate operational rules are likely to be assessed graduated sanctions (depending on the seriousness and the context of the offense) by other appropriators, by officials accountable to the appropriators, or by both.
Collective-choice arrangements	Most individuals affected by the operational rules can participate in modifying the operational rules.
Conflict-resolution mechanisms	Appropriators and their officials have rapid access to low-cost local arenas to resolve conflicts among or between appropriators and officials.
Minimal recognition of rights to organise	The rights of appropriators to devise their own institutions are not challenged by external governmental authorities.
Nested enterprises	Appropriation, provision, monitoring, enforcement, conflict resolution, and governance activities are organised in multiple layers of nested enterprises.
Appropriation and provision	The benefits obtained by users from a common-pool resource (CPR), as determined by appropriation rules, are proportional to the amount of inputs required in the form of labour, material, or money, as determined by provision rules.
Monitoring users	Designated monitors who are accountable to the users monitor the appropriation and provision levels of the users.
Monitoring the resource	Designated monitors who are accountable to the users monitor the condition of the resource.
Congruence with local conditions.	Appropriation and provision rules are congruent with local social and environmental conditions.

3.2 Collective Action in Platform Ecosystems

The theoretical foundation above provides multiple lenses to interrogate research on the development and management of platform ecosystems. This generates new paths for research. Here were take a look at each of the key areas from the review and highlight these news research paths.

3.2.1 Platform Architecture

Platforms are constituted of designed artefacts (i.e., the core, modules, extensions, APIs, etc. c.f. Um, Yoo, Wattal, Kulathinal & Zhang, 2013), governance aspects such as rules of economic interactions (Boudreau & Hagiu, 2009), and social aspect such as designed activities of people using the designed artefacts, and abiding by the economic rules (Thomas, Autio & Gann, 2014). All these elements are interrelated and inseparable and always need to be aligned in the platform's architecture (Tiwana, Konsynski & Bush, 2010). Thus, an adequate theory of platform architecture must explain it as a complex, multi-level construction with an internal unity determined by relations at and among these three elements (i.e., designed artefacts, governance, people). Whilst there is much written about the 'material' construction of platform architecture (e.g., extensibility, decomposability of modules, interdependencies, etc., c.f. Baldwin & Woodard, 2009; Tiwana et al., 2010; Um, Yoo, Wattal, Kulathinal & Zhang, 2013), governance, and value interactions on platforms (e.g., transactions, rents, costing, network effects) (Parker, Van Alstyne & Choudary, 2016), there is limited knowledge about the *collective construction* of platform architecture where heterogenous organisations need to work together to develop and IOP.

Collective action provides a lens to view platform architecture as a collective construction formed by the organisation of people to achieve a common endeavour (e.g., sharing resources such as infrastructure, data, and technical capabilities). This is a fresh stance from economic (Parker, Van Alstyne & Choudary, 2016) and engineering (i.e., material) perspectives (Baldwin & Woodard, 2009) often used to describe and specify the functions of platform architecture. Collective action presents collective interactions as the starting point of architecture design because such interactions produce organisation and structure reflected in the material configuration of the group's resources. Thus, a collective action lens suggests that platform architecture can be viewed as a material representation of a social phenomenon of collective organising and structuring. Collective action provides a lens to view platform architecture as not just as a materially built artefact, but as a social phenomenon that start from the social interactions and construction of collective action. This view resonates with the socio-material arguments about physical constructions in general – which consider materialised structures as social constructions (c.f. Steets, 2016). Drawing attention to the social construction of platform architecture necessitates questioning the existing emphasis on its materiality.

In addition, thinking of IOPs as collective goods means that their architecture needs to support multiple needs of individual actors and opens questions to the design and coordination required to

achieve this. Collective action theory leads us to ask questions about the *coordination challenge* in architecture design that involves disparate actors with diverse interests. This enables us to ask associated 'process' questions such as, *how* platform designers achieve congruence between competing design choices from members, contributors, and users with different (and sometimes conflicting) interests (Saadatmand, Lindgren & Schultze, 2017). By focusing on the organising processes in collective groups, a collective action lens provides us with a *process* perspective to architecture design, and to consider how the design process may be structured and the key elements at each stage of development.

There is limited knowledge within IS that explains early-stage design, composition, and infrastructure elements of IOP architecture (Saadatmand, Lindgren & Schultze, 2017). For instance, what key architectural elements should an early-stage prototype of a digital platform be composed of? How do organisations participating in the *architecturing* of an IOP come to an agreements about the various components, that coalesce into a stable platform? How does the design process itself unfold as well as how architectural properties interact and change over time? Because architectural properties largely represent the technology frames of participating actors (Davidson, 2006; Orlikowski & Gash, 1994; Puri, 2006) how is congruence of such frames arrived at in collective designing of platforms? These questions present fertile avenues of future research on platform ecosystems – particularly those in inter-organisational settings.

3.2.2 Platform Governance: Heterogeneity & Coopetition

A key feature of IOPs is the existence of numerous actors with widely different attributes and interests. A governance regime for IOPs needs to consider ways to coordinate these actors to achieve desired interactions and value creation. By exploring human behaviour in collective groups, collective action provides a lens to explain how platform sponsors deal with collective organising in IOPs with such heterogeneous participants. It provides a lens to explain how platform sponsors harness the contradictory yet interrelated attributes of users. This has a potential to provide insights into the ways in which platform sponsors practice governance to coordinate and balance self-interests and the incentives between heterogenous actors and firms.

Collective action theory goes at length exploring conflict and cooperation (i.e., coopetition) within collective groups. It provides insights about the nature and persistence of conflict arising from collective endeavours. A key learning from it is that conflict is not ephemeral, but a persistent characteristic of coopeting groups. Taking this collective action lens helps us notice that the persistence of coopetition in platforms means that conflict is not necessarily a short-lived period that can be easily resolved, but rather, a stable and unchanging phenomenon of platforms. This creates fertile research questions on how platform managers deal with conflict in each platform scenario, and the ways in which they can exploit the conflict to benefit the platform's endeavours.

3.2.3 Openness & Control

Collective groups have different degrees of openness and control (sometimes referred to as excludability) – some groups are more open whilst others tend to be very restrictive (Medina, 2013; Österom, 2010). Notably, the dynamics of openness and control manifest through four key fronts: people, resources, boundaries, and sanctions (Olson, 1971; Österom, 1990; 2010). A collective action lens to viewing openness and control in platforms enables us to *specify these multiple fronts* through which IOPs as collective endeavours can either be open or closed (see Table 5, p.39). It enables us to ask questions about the role of each front in determining platform openness and control.

People – Platform openness and control can be determined by and have an impact on people as actors in platforms (Lee, Lee & Hwang, 2015; Menon, Kärkkäinen & Wuest, 2017; 2020; Wang, Guo, Wang & Lou, 2020). The meaning and measurement of openness and control may be different if taken from the perspective of platform sponsors (Stefi, Berger & Hess, 2014), contributors, or end users (Benlian, Hilkert & Hess, 2015; Choi, Nam & Kim, 2018). *Resources* - Mechanisms to solve the paradox of openness and can also be embedded at resource front, in the technical architecture of the platform (Schmeiss, Hoelzle & Tech, 2019). Design configurations of hardware and software may have an effect on platform openness and control (Boudreau, 2010; West, 2003). Platforms can be opened and controlled though resources such as APIs, toolkits, libraries, Appstores etc (Eaton et al., 2015; Ghazawneh & Henfridsson, 2013; Karhu, Gustafsson & Lyytinen, 2018). *Boundary* – The extent to which a platform can be open may also be controlled by its geo-location (Inoue & Tsujimoto, 2018) and its size (Fürstenau & Auschra, 2016). Openness and control may also differ within different life cycle phases of the platform (Gawer, 2015; Menon et al., 2017, p.96).

Thus, a collective action lens provides us with a way to organise and specify the fronts though which openness and control is determined, practised, and influenced. This also opens new avenues for future research, for instance (i) regarding alignment of these fronts and the impact that misalignment has on openness and control (ii) how platform managers can sway openness and control within different phases of platform life cycle, and (iii) the influence of external pressures to these fronts such as geo-location (context) national laws, regulations, and field level industrial organisation (e.g., highly institutional, or not) (see Figure 1, p.27).

A key question that arises from this is how openness and control can co-exist. Previous research tends to propose that platform managers need to find an optimal degree for platform openness (Setzke, Böhm & Krcmar, 2019). Unpacking how platform openness and control are practised brings out the complexity and ambiguity that exists in choices made by platform sponsors about platforms. Openness and control may be beneficial or detrimental to platform success depending on how the platform is governed. For instance, openness can repel users and control may attract them depending on specific circumstances.

Table 5: *The multiple fronts of platform openness viewed from a collective action lens.*

Front	Collective Action	IOPs
People *(who)*	- Who is allowed in the groups? - Openness or closedness of a group is determined by both the individual interests and collective 'emergent' interests of the group.	- Who is allowed in the platform? - What does openness and control mean from the perspectives of distinct actors (sponsors, complementors, contributors, users, etc.)
Resources *(what)*	- What is allowed in the group? - The nature of common pool resources can either foster or hinder the extent to which the group can open or restrict resources for exploitation by external parties.	- What resources/innovation can be created (or not) on the platform? - Technical openness and control
Boundaries *(Where and when)*	- Where is the group allowed and where is it not? - When are specific rules applied and when are they not? - Collective groups are exposed to external boundaries of geographic space and time which control their reach and access - Group dynamics about who and what should be kept in and outside the group change over time	- Where are the platform's offerings be allowed and where are they restricted? - When are platform rules applied and when are they not?
Sanctions/Rules *(how)*	- *How* (guidelines and rules) are contributions to the group allowed/disallowed?	- How can the platform be used? How can contributions be made? What is allowed and what is not permitted?

3.2.4 Critical Mass

In collective action, the concept of critical mass pertains to the conditions under which reciprocal behaviour gets started and becomes self-sustaining (Oliver, Marwell & Teixeira, 1985; Markus, 1987). Critical mass is often seen as an outcome variable of collective action because it is the threshold at which such self-sustenance is achieved (Evans & Schmalensee, 2010; Granovetter, 1978). Platforms draw entities together around shared goals, but many platform endeavours never reach critical mass (Cheng & Bernstein, 2014; Evans & Schmalensee, 2010). Empirical studies show that more often than not, participants gather to start IOP initiatives that never get off the ground (de Reuver, Verschuur, Nikayin, Cerpa, & Bouwman, 2015; Markus & Bui, 2012). Collective action provides a lens to understand the nature of critical mass and can shed light into how IOPs can deal with the challenge of generating the reciprocal behaviour needed to generate critical mass.

Collective action provides insights into the differences in critical mass for different types of collective endeavours (i.e., why critical mass is not fixed for all types of collective endeavours) (Marwell and Oliver, 1993; Oppenheimer, 1994). For instance, we learn that the shape of the production (and cost) function of a collective group has an influence on how to start reciprocal behaviour needed

to generate and sustain a critical mass (Oliver, Marwell & Teixeira, 1985). Thus, as collective endeavours, different types of IOPs may require a different threshold and 'type' of critical mass in order to start the reciprocal behaviour needed to sustain a platform. All these are fertile areas for future research, for instance, to compare the nature of critical mass between different types of platforms, and to explore those different thresholds as well as how to develop critical mass in specific platforms.

3.3 Research Framework

There remain many gaps in current research regarding how to deal with the issues raised above. For instance, whilst some studies emphasise the need for a central leadership in initiating, facilitating, and encouraging collaboration among different parties (Nikayin, de Reuver & Itälä, 2013), other studies raised concerns that if a central leadership role is taken by participating firms, other potential participants may fear that the lead organisation would raise the price of services exorbitantly; or that resources (e.g., data) shared by means of the platform will be used for individual competitive purposes (Markus, & Bui, 2012, p.177). Similarly, some studies suggest the use of selective incentives to balance collective interests and individual interest (de Reuver, et al., 2015), but this can result in limitations in the extent of participation once a firm realises that their benefits are far less than other participants (Markus, & Bui, 2012). More so, there are inconsistent findings regarding whether interdependencies can be used to create synergies that support collective action (Nikayin, de Reuver & Itälä, 2013; Guo, Reimers, Xie, & Li, 2014). For example, Nikayin et al. (2013) found that when trying to achieve a common service platform for independent living, interdependency among the organisations was not necessarily important for collaboration.

We have also observed that available literature on strategies for launching platforms largely takes a variance approach rather than examining the full length of development processes that lead to launch success or failure (for a process view see Langley, 1999, p.693). Platform launch itself is often treated as an *event* rather than a *process* (Evans & Schmalensee, 2010, p.3-4) with limited inquiries into how platform sponsors manage collective groups and coordinates them throughout the development process before a launch is possible – when the platform itself is still an aspirational goal.

In addition, strategies proposed to address platform development are often built either on conceptual work or on ex-post studies of successful platforms. For instance, previous research has considered opening the platform to users and providing extensive boundary resources to contributors (Eaton et al., 2015; Ondrus et al., 2015), using pricing strategies and first party content subsidies (Hagiu & Spulber, 2013), as well as user onboarding and side switching strategies (Schirrmacher et al., 2017; Stummer et al., 2018). Empirical studies that longitudinally investigate the ways in which a platform sponsor enacts practices and manages developmental processes, and how such practices inform design activities, decisions, and actions as a platform is being developed are still largely sparse. Limited research had been done to investigate the processes, practices, and inter-organisational aspects of

platform development, to understand why failures are prevalent and what makes success possible. This has a potential to generate new understandings that will fill this gap and also provide practical insights to platform developers and managers in inter-organisational settings.

Recent studies have noted that much of the literature on platforms are typically studies of platforms as "a snapshot in time" (c.f. de Reuver, Sørensen & Basole 2017, p.128). Thus, there is a call for longitudinal work on platform development processes that details its intricacies within longer time-horizons. There is also a call for new research in platform ecosystems that assesses real-time (rather than retrospectively) platform development projects that involve multiple institutions taking part, with an inter-organisational standpoint that covers an entire organisational fields.

Therefore, the goal of this research was to make a longitudinal examination of processes and practices in the real-time development of an inter-organisational platform, and importantly, ***to work towards developing a nascent theory of IOP development processes that occurs through collective action.*** To achieve this goal, we broke down areas to investigate into a framework of research questions which are detailed in Table 6 below.

Table 6: *Research framework*

Category	Constructs	Research Questions
Desired outcomes	Platform Architecture	**RQ1:** *What is the form & characteristics of architecture that emerges out of collective action to develop an IOP amongst a varied group of firms within the same industry?*
	Governance	**RQ2:** *What governance options emerge out of collective action to develop an IOP amongst a varied group of firms within the same industry?*
Options	Openness & Control	**RQ3:** *What are considered options for openness & control in the design process for an IOP?*
	Value Creation & Leveraging	**RQ4:** *What are the considered options for generating and leveraging value in the IOP?*
Context conditions (i.e., fixed parameters)	Heterogeneity & Coopetition	**RQ5:** *As context conditions, how does **(a)** heterogeneity of interests, **(b)** heterogeneity of resources, and **(c)** coopetition dynamics affect collective organising in IOP development?*
IOP development processes & practices	Activities & actions	**RQ6:** ***(a)** How does an IOP development process involving multiple organisations working together through collective action unfold? **(b)** How is management practised in the process of IOP development that happens through collective action?*
	Socio-cognitive process	**RQ7:** *How do different technology frames between organisations influence collective action design process and practices during the design process of an IOP?*
	Critical mass	**RQ8:** *How do critical mass issues arise, manifest, and are managed in phases of development that occur before platform launch?*

Chapter 4: Research Approach & Design

Investigating Processes & Practices in IOP Development

We need more process thinking in research on strategic organisation.
— Ann Langley, 2007

This chapter discusses the research design employed to investigate the questions in the research framework (***Chapter 3,*** Table 6, p.42). The chapter starts with a brief explanation of the process approach taken, explaining why this was suitable in addressing the type of questions asked, as well as how this addressed the main goal of the thesis. Motivations and justifications for the longitudinal case selected are given. In brief, the case provided a unique opportunity to observe IOP development processes and practices in real-time as members of 46 organisations worked together though collective action. Next, data collection procedures are explained, describing how rich data was obtained from multiple sources. Procedures for data analysis are also described. This includes specifying the unit(s) of analysis, building a case database and a chain of evidence, illustrating how the coding process was carried out, and the iterative process of building explanations, identifying concepts & patterns, and developing process models. Findings from the case are presented in subsequent chapters.

4.1 Research Approach

The approach of this research anchors on a process worldview (Langley, Smallman, Tsoukas & Van de Ven, 2013). The fundamental view is that elements of observable reality are essentially processes rather than static objects. In this view, observations made in the case primarily focused on how process occurred as connected activities and actions rather than as static objects or single events. We anchored our views on Pettigrew's (1992) arguments that:

- *Social reality is not a steady state but, rather, a dynamic process: it occurs rather than exists.*
- *The social process is constructed, created by human agents-individual or collective through their actions.*
- *Social life is a process of structural emergence via actions, and the tension between actions and structures is the ultimate moving force of the process.*
- *Action occurs in the context of encountered structures, which it shapes in turn, resulting in the dual quality of structures (as both shaping and shaped) and the dual quality of actors (as both producers and products).*
- *The interchange of action and structure occurs in time and is cumulative, such that the legacy of the past is always shaping the emerging future.*

(Pettigrew, 1992, p.8).

Thus, whilst we used case data to present findings on contexts, the primary focus was to reconstruct the unfolding of processes in IOP development that occurred through collective action of organisational actors (see Table 19, p.101). Ongoing interactions between these organisations, and between heterogenous contexts, resources, and interests permeated and influenced what and how

processes occurred (Langley et al., 2013). In summary a process approach was important in this study for the following reasons (Van de Ven & Huber, 1990; Langley et al., 2013):

- The significance of time to fully comprehend real-world experiences in events, activities, and actions.
- The practical importance of understanding how decisions were made to move from **A** to **B** over time (i.e., process).
- Understanding the activities and actions that drive processes in collective action in a real-time IOP development project.
- Understanding the multiplicity and temporality of consequences (short-term *vs.* long term; intended and unintended consequences etc.).

4.2 Case Study: Selection, Justification & Limitations

A case study design was chosen as it provided a framework to investigate context-specific and revealing the subtleties of the IOP development phenomena our research questions sought to examine. The questions about 'how' and 'why' a phenomenon operates the way it does and the behaviour of the actors driving it in its context are well founded justifications of IS case study inquiries (Benbasat, Goldstein & Mead, 1987; Eisenhardt, 1989). A case study was also seen as useful in achieving the theory development goal of this research (Eisenhardt & Graebner, 2007) and to explore theoretical boundaries of such problems as critical mass in a new context (Walsham, 1995).

There are more specific reasons for the choice made to use a ***single*** case in this study. These are discussed here. To investigate collective action issues and processes in IOP development, this study used longitudinal research data from a single, revelatory case study (Barley, 1990; Pettigrew, 1990). Although this was a single case, it was a big programme of research that span a two-and-half-year period (end of August 2017 to end of February 2020) and involved 46 organisations operating in the tourism sector in New Zealand (see ***Appendix 4***). We had a unique opportunity to closely document the unfolding of events as the organisations in the tourism sector in New Zealand worked together to develop an IOP for sharing data services and resources. This single case was considered sufficient for various reasons. We considered the sheer amount of data to be collected and analysed (Gustafsson, 2017), the potential contribution of insights to be gained from the data to the IS community (Davis, 1971; Gregor, 2006), and the time and logical plans needed to complete the research (Darke, Shanks & Broadbent, 1998).

The case presented a unique perspective (Benbasat et al., 1987; Davis, 1971) to the development of platforms in inter-organisational settings, with an opportunity to track real-time events covering a large number of organisations. Previous studies noted that research on platforms has so far not revealed much direct design knowledge because the secrecy of most platform-owners makes reliable first-hand data on design and governance decisions almost impossible to ascertain (de Reuver et al., 2017, p.129).

In this study, the researcher had a unique opportunity to access and observe the platform development project from inception. This enabled semi-immersive observation of the nuances of collective action and platform development processes and practices that is revelatory (Davis, 1971).

Thus, we considered the scarcity of such an opportunity to investigate IOP development *in-situ* with participants willing to be interviewed, to allow the researcher to participate in their meetings and workshops, and also, to avail detailed data in a project that involved an entire organisational field of tourism. Recent studies (e.g., de Reuver, Sørensen & Basole, 2017) note a dearth of research in platform ecosystems that assesses real-time platform development projects that involve multiple institutions taking part, with a perspective that covers an entire industry sector. They have called for longitudinal work on platform development processes that details its intricacies in real-time projects rather than in retrospect. In summary, this case was chosen as a revelatory exemplar, in which researchers had an opportunity for unusual research access (Eisenhardt & Graebner, 2007).

The scientific method and legitimacy of case studies in IS research is often challenged because some scholars argue that case findings are not readily generalisable, the method is fraught with bias, and that there is lack of rigour (Lee, 1989; Tsang, 2014; Yin, 2013). The researcher considered ways to address these criticisms. Whilst statistical generalisability was not possible, the researcher strived for theoretical validation by exploring theoretical boundaries (***Section 6.4.2***) and illustrating how theoretical assumptions manifested using rich data from the case (Darke, Shanks & Broadbent, 1998).

To address reliability and validity, multiple data collection methods and data sources were used (Dubé & Paré, 2003). This enabled rigour and triangulation of evidence gathered to the point that a rich dataset was amassed that provided a consistent representation of the dynamics of processes and practices in the investigated case. To address possible biases that can creep in during data analysis, processes such as coding and development of themes was an iterative process (Miles, Huberman & Saldaña, 2018). The primary researcher who is a graduate student and a supervisory team of three faculty mentors conducted several meetings to consider the codes, memos, themes, and models that emerged. To overcome any possible bias, we followed the advice by Miles et al., (2018) and conducted parallel independent assessments the results of which were discussed in multiple rounds of meetings. The analyses produced in this report are thus a result of many rounds of revisions spanning a two-year period since data collection began. In the following section a brief description of the case is provided.

4.3 Case Description

Tourism is a major business in New Zealand. In 2019, it generated a direct contribution to gross domestic product (GDP) of NZD$16.2 billion, or 5.8 percent of GDP[7]. Data services have increasingly

[7] https://www.stats.govt.nz/information-releases/tourism-satellite-account-2019

become central to supporting tourism services. According to the Main Trade Association (MTA) for tourism in New Zealand, the country has trusted and reliable elements of data systems in the tourism sector (e.g., International Visitor Arrivals and Monthly Regional Tourism Estimate), but others are less trusted due to data reliability, methodological, continuous change, or coverage issues (e.g., Commercial Accommodation Monitor and International Visitor Survey). There are also a number of significant data gaps (e.g., domestic tourism activity and regional tourism data).

There have been standing concerns that there was an ad hoc approach to accessing the data and a lack of clarity or systemic response, around data standards and classifications (e.g., definitions and terminology). Additionally, organisations in the tourism sector generally find the data available hard to access and use, despite the efforts of the Ministry of Business, Innovation & Employment (MBIE) and Statistics New Zealand with their dissemination platforms. There is no one place to source the wide body of tourism data available from multiple sources. Furthermore, there seemed to be no sense of a cohesive or strategic approach being applied to tourism trends, with no process available to address limitations, to define industry priorities, or to facilitate the undertaking of these priorities.[8]

Organisations identified same datasets differently and with various degrees of confidence, reliability, and trust. They reported challenges such as multiple yet inconsistent datasets from various sources, a limited industry-level view about domestic tourism, and problems regarding quality and consistency in key data such as tourism spending, visitor volumes and visitor flows.

A data services platform would therefore be valuable if it would integrate data from different information systems and provide and consistent and coherent source of up-to-date raw data, as well as forecasting and reporting options. In November 2017, the MTA established an initiative to create an inter-organisational data platform that would enable the sharing of data resources and services amongst organisations in the tourism sector. It needed to interconnect a diverse range of organisations, including airlines, airports, train and bus services, regional tourism organisations (RTOs), local authorities, private corporates, attraction centres (providers of skylines, ziptreks, cycle trails, museums), and government departments. As the main trade association for tourism in New Zealand, it would facilitate this through coordinating its members in a nation-wide project dubbed the "Tourism Insight Project". More than 50 different organisations joined MTA's project. The graduate student together with a team of three faculty supervisors were fortunate enough to be allowed to both collect data and observe the evolution of the project from the onset.

[8] https://www.mbie.govt.nz/immigration-and-tourism/tourism-research-and-data/tourism-data-overview/2018-tourism-data-domain-plan/

4.4 Unit(s) of Analysis

In case study research, it is critical to identify the unit or units of analyses. These are based on the research questions (Benbasat et al., 1987). Determining a unit of analysis helps to make decisions on case study design, data collection strategies and reporting (Benbasat et al., 1987, p. 372-3).

In this research, the units of analyses were at three points. First, the focus was on the firms involved in the project to jointly develop an IOP. We were especially interested in the reasoning and actions of organisations engaged in the project, and how those decisions and actions evolved. These decisions and actions combined illustrated why collective action arose and was sustained as well as the product of such collective action. Secondly, data was collected about the intended collective goal, i.e., the IOP. As this was mainly an aspirational goal, the emergent aspects of the platform such as its architecture design and governance rules formed the main part of the unit of analysis. Thirdly, the interactions between the participating firms and the intended platform such as the impact of decisions about the platform on both the participating firm and the platform sponsor (e.g., a disagreement or a decision to quit) were also analysed. For an illustration of the units of analyses, see Figure 2 below).

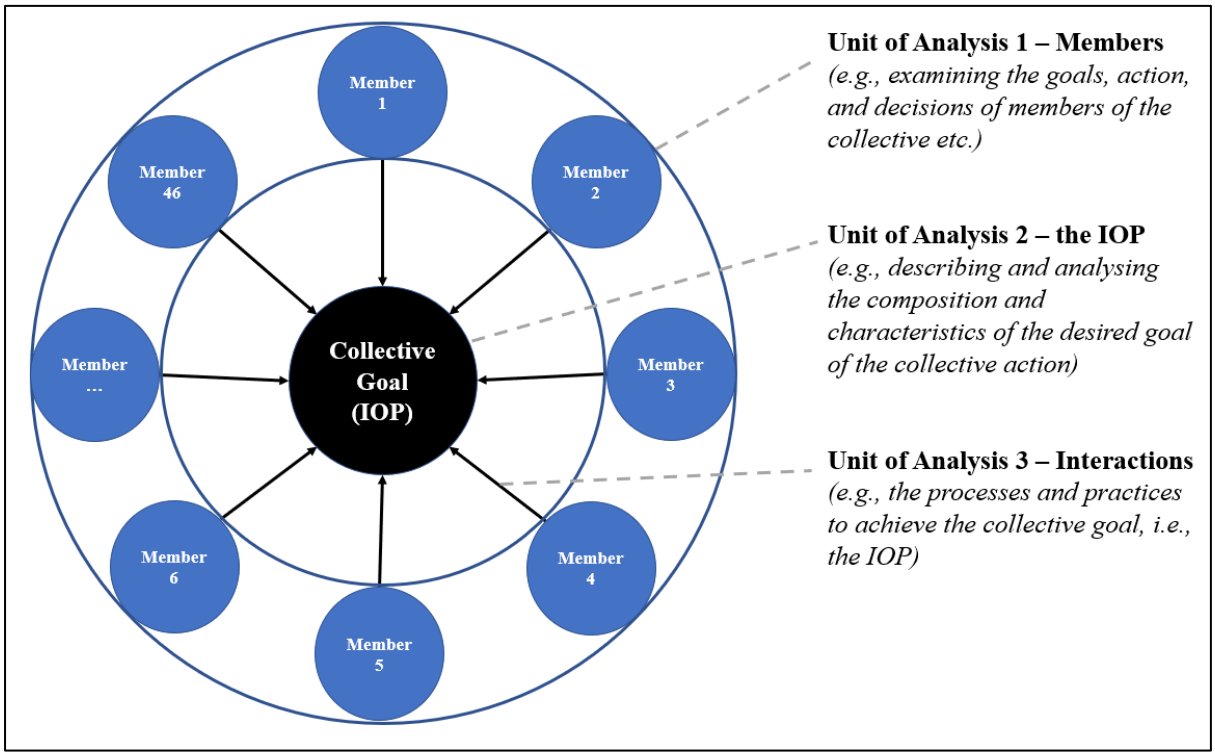

Figure 2: *Case structure and units of analyses*

Source: *Developed by author*

4.5 Data Collection

This research relied on multiple data collection methods and data sources. Data was collected through interviewing key informants, reviewing documents, and observing various proceedings of

meetings and workshops that took place as the project evolved. The intention throughout the data collection phase was to be as close and engaged with the project as possible (Nandhakumar & Jones, 1997, p.113, see Figure 3 below) so that key decisions, actions, and events were not missed, and to ensure that data collected could be used to reconstruct the processes and dynamics in the case. Although observations and interactions with research participants were made, an action research approach was not employed in this study because the graduate student's involvement was limited to observation and a limited degree of participation by providing informal input.

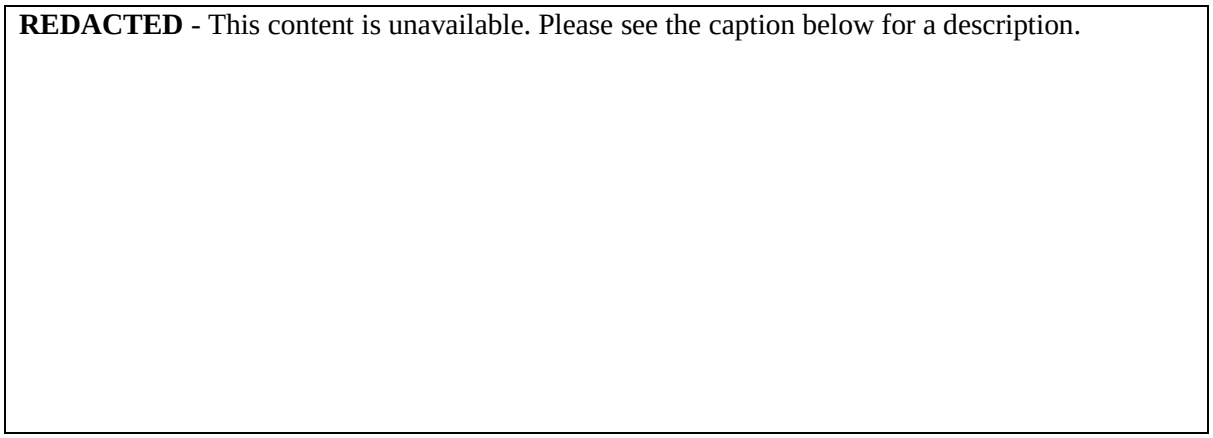

Figure 3: *Distance & engagement between the researcher and the phenomenon*
Source: *Adapted from Nandhakumar & Jones (1997, p.113).*

4.5.1 Interviews & Selection of Participants

Interviews were conducted with representatives of 46 organisations that were participating in the IOP development project. All interviews followed a semi-structured protocol with mostly open-ended questions developed from the research questions (see ***Appendix 8 & 9*** for the Interview Guides). The protocol was flexible and adapted to the interviewees' position and occupation in the organisation. Interviews lasted 30-75 minutes and were recorded and transcribed. Interviewees included providers of visitor experiences (skylines, ziptreks, canyon swings, etc.) airlines, airports, hotel chains, bus and tour operators, cycle-trail operators, restaurants, museums, and government departments. See ***Appendix 4*** for a full list of all the participants.

To select interviewees, it was considered that they should be from an organisation collaborating in the development of the IOP (i.e., a member of the collective). Second, the interviewee needed to be a high-level decision maker, project manager, technical expert, and/or data expert, involved in making strategic decision for the member organisation represented (see ***Appendix 4***). This made it possible to ask the interviewees about why and how decisions and actions on collaboration are made, and what factors influenced those decisions and actions. Third, interviewees needed to have basic technical knowledge to discuss design issues in data systems, data collaboration, architecture, and governance in

platform technology. The *de facto* project manager from MTA who was a key informant provided a list of the participating organisations from which interviewees from each organisation were selected. In addition, interviewees were also asked to suggest other relevant informants within their organisations.

Interviews were conducted between November 2017 – February 2020. In-between, there were follow-up interviews for the second and third time as these were needed to understand developments that would have transpired since conducting the first and second interviews (see ***Appendix 4***). Additionally, the follow up interviews were used to clarify missing or unique information from initial analyses. Interviews were stopped once it became clear that no new information was being conveyed by additional informants and from our reading of associated documents in the phases of development processes observed. This indicated that we had reached data saturation of responses to the questions we were asking (Yin, 2018).

Table 7: *Summary of sources of evidence*

Primary Sources	**Explanation**	**Interviews**
Interviews with representatives of the 46 org. & the MTA	Interviews included CEOs, Heads of Departments, Data & Insights specialists, owners, and representatives of organisations participating in the project.	70+
Secondary Sources	**Explanation**	**Documents**
Steering Committee Notes	Meeting agendas and notes with action items, discussion, and decision actions	500+ pages
Meeting Notes	Meeting agendas, presentations and notes from general and other MTA led Platform Development meetings	
Web Page Content	Content from MTA's official website. Includes content from related government websites such as Ministry of Business Innovation and Employment (MBIE) and Statistics New Zealand	
Press Releases articles	Official press releases and news/journalistic content about the platform development project	
Key Field Events[9]	**Explanation**	**Participants**
Tourism Data Workshop (Design Workshop I)	Workshop facilitated by MBIE, Wellington and Auckland	50+
U of Canterbury Tourism Research Team Meeting	Facilitated by the MTA, Christchurch	10
West Coast LH Meeting (Design Workshop II)	Facilitated by the MTA, West Coast	25
CECA & RTOs Meeting	Facilitated by the MTA, Palmerston North	11
Tourism Data Hui (Design Workshop III)	Workshop facilitated by MBIE, Wellington and Auckland	50+

[9] For a detailed list of events see Table 21, p.122.

4.5.2 Observations & Documents

To complement and triangulate interview data (Benbasat, Goldstein & Mead, 1987; Nandhakumar & Jones, 1997), the researcher participated in key workshops and meetings, which enabled observation of events, activities, actions, and decisions during the project (see Table 7, p.49). Observational data collected during the meetings and workshops includes:

(i) **Notes:** These were notes taken by the researcher, capturing such information as who participated, what where their key activities, decisions, roles, and responsibilities.

(ii) **Agendas and minutes of meetings:** These documents contained detailed plans, and what transpired at meetings, e.g., at the Insight Leadership Panel (ILP) meetings.

(iii) **Photographs**: Photographs captured activities and deliberations at workshops. For instance, these includes pictures of activities such as gathering and discovering information (Figures 10, 11 & 12) voting (Figures 4 &15) and designing architecture (Figures 13 & 14). Photos were either taken by the graduate student or provided by MTA through printed reports resulting from the workshops. Acknowledgements of sources and permission declarations are given to all photographic materials used in this thesis.

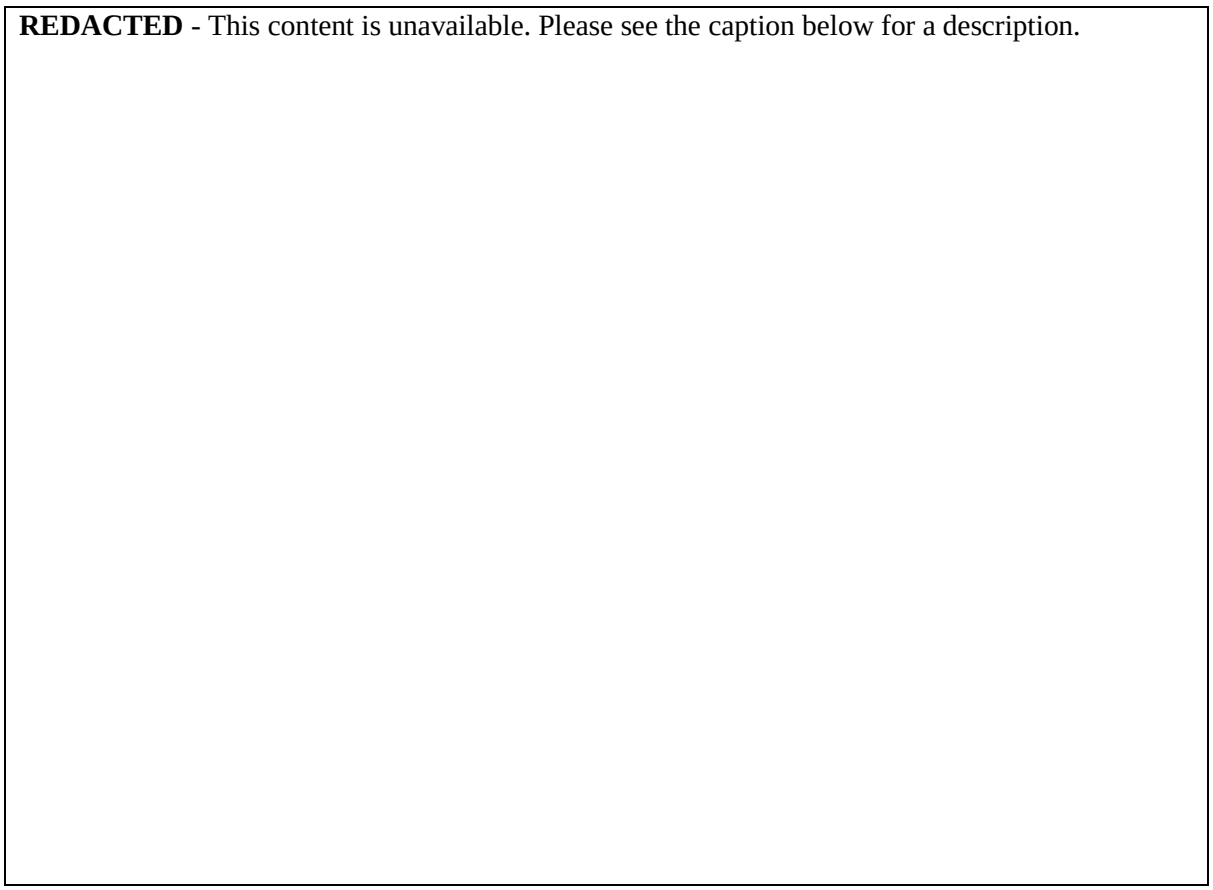

Figure 4: *An example of observational photographic data generated at workshops*

(A member voting on a Governance issue)

Source: *Case data from workshop deliberations – permissions by MTA*

(iv) **Tacit observational data:** This included unspoken observations of group dynamics (e.g., which organisations tended to support each other, disagree, had higher influence than others etc.). Such data was documented as maps (e.g., stakeholder maps), models, memos, and other representations of case phenomena.

(v) **Reports & other documents**: The researcher also consulted documents about each participating organisation. This included their websites (e.g., for information about their resources, capabilities, and technologies), as well white papers, reports, and related journalistic content about the project. These documents were mainly used for factual description of the case, and in some cases to ensure the reliability of insights from interviews. Overall, we collected over 500 pages of documents, meeting notes, minutes, reports, and related records (see Table 7, p.49).

In summary, we developed a rich database of the case data described above on NVivo 12 software and through linked Microsoft Excel data spreadsheets. This database contains specific references to interviews, documents, workshop meeting notes, pictures, and drawings that form the dataset used in this research. It maintains a traceable chain of evidence and the foundational source materials for which this research is based (Dubé & Paré, 2003 p.618).

4.6 Data Analysis Procedures

At high level, analysis of the data collected was broken down into two parts: First, a descriptive analysis was conducted that focused on outlining the range of options (i.e., in designing architecture, governance, value systems, openness & control, etc.) faced by members of the collective during IOP development **(RQs1-4)**. This included descriptive discussions of the outcomes (e.g., the architecture that was developed, the governance option that the group gravitated towards, and why). It also included how contextual issues such as heterogeneity of resources and interests, and coopetitive dynamics were dealt with **(RQ5)**. This is presented in ***Chapter 5***. Second, a process analysis was conducted to address substantive questions about how IOP development processes occurred, and how management practices were enacted, the results of which are presented in ***Chapters 6-8*** **(RQ6-8)**. Whilst these two areas of analysis are logically presented in this order, the actual activities of data analysis were iterative and fluid.

In detail, to prepare all the various forms of data that was collected for analysis, an NVivo[10] case study database was created. In it, transcripts of the interviews, memos, notes, minutes of meetings, photographs, and other sources of information were stored. The database also contained other

[10] https://www.qsrinternational.com/nvivo-qualitative-data-analysis-software/home/

administrative data such as contact information for all participants and their signed consent forms (see ***Appendix 6 & 7***). Coding schemes and their multiple revisions were also stored in the database together with spreadsheets of codes and their linked source data which were printed-out for discussions at meetings between the graduate student and a supervisory team of three faculty members.

Table 8: *An example of coding structure*

Design Domain	Technology Frames	Definition & Explanation	Example of Evidence
IOP Architecture	Structure of data output *(Raw Data Output)*	*Definition:* Raw data that is unaltered from source, for instance, in the form of database extracts and spreadsheets. *Explanation:* Larger firms wanted to access raw data because they found it more useful and had the capacity and capabilities to perform their own internal analyses.	*For us, we would like data in basically raw format. The other users of data are the ones who may have a specific project in mind, and the pre-set templates won't just work for them. And that's one of the challenges that a lot of people have, for instance with data from the MBIE site where MBIE have said, "well, we think that people want to see these graphs, and so that is what we'll give them". But actually, what we want is access to the granular level data, because we want to cut and dice it for a particular purpose. For instance, there's a segment of customers, or a mode of travel or whatever that we're interested in, and probably no one else is interested in it, but we're interested in, and we want access to that raw data that allows us to make our own internal analyses.*
	Structure of data output *(Statistics and Reports Output)*	*Definition:* Aggregated statistics that show trends and flows as well as distribution maps *Explanation:* Most small firms had little capacity to work with large raw datasets. They preferred analysed statistical data and reports as an output of the platform.	*I am operating a fairly small enterprise here and I think it's more useful for me and probably speaking for many other small companies, that we have simple but effective reports that give us an analysis of our markets, starting from local, regional to the national trends. This is what we expect from an effective data system, the ability to reduce all that complexity by compiling, analysing, and presenting to use easy to use reports that give us the insights we need to do our businesses effectively.*

In more detail, data analysis started off with descriptive coding. This was done by applying labels or codes (i.e., nodes in NVivo), to qualitative data. Such analysis was not done on a *tabula rasa* because prior theorising from the literature provided a guiding research framework (Table 6 p.42) on which the research questions were based, and therefore the resultant data (Miles, Huberman & Saldaña, 2018). Thus, some terms from platform ecosystems and collective action came out because of the line of questioning that had underlying theoretical foundations (Paré, 2004). These were used in conjunction

with those terms and phrases that uniquely came out of the data (i.e., *in vivo* codes). Definitions were developed for all codes used (for an example, see Table 8 p.52). To ensure reliability in the coding process, frequent meetings with the supervisory team was useful in revising codes and re-thinking initial ideas as more data was coded. Descriptive codes were then used to find patterns, themes, and 'interesting' issues (Davis, 1971).

The same process of routine iteration between the graduate student and the supervisory team was used in the explanation-building exercise. This included multiple thought experiments through card-sorting and holding 'mini-workshops' at which alternative explanations were the debated. At times, parallel independent assessments of the emerging patterns were done enabling comparisons and debates at meetings. We revised and discarded some models, making sure that any abstractions, emerging concepts, and process models made were supported by the data. Ultimately, descriptive discussions were written that addressed the first five research questions (***Chapter 5***). These discussions were supported by direct quotations that captured the voices of interviewees (Yin, 2018). Tables, displays of relevant photographs, and illustrative extracts of the coding schemes were also used (see Table 8, p.52). This was followed by a more detailed refinement of process models which are presented in ***Chapters 6-7***.

4.7 Summary

This chapter discussed the research design employed to address the research questions on how processes and practices in IOP development that occurred though collective action between 46 organisations in the tourism sector in New Zealand. The research was a longitudinal case study covering a two-and-a-half-year time period. The case was selected for its unique and revelatory potential by presenting an opportunity to observe real-time IOP development processes and practices with a perspective covering an entire organisational field. These characteristics were required to address the main research goal of developing a nascent theory of IOP development processes that occurs through collective action. More than 70 interviews were conducted with 46 organisational representatives. The study also included more than 500 pages of documentary sources. Procedures for data analysis by building a case database, developing descriptive codes, and iterative development of abstractions and explanations are also outlined in this chapter. In the next chapter, descriptive findings on the range of options (i.e., in designing architecture, governance, value systems, openness & control, etc.) faced by members of the collective during IOP development **(RQ1-4)** are presented. This includes descriptive discussions of the outcomes (e.g., the architecture that was developed, the governance option that the group gravitated towards, and why); and how contextual issues such as heterogeneity of resources & interests, and coopetitive dynamics were dealt with **(RQ5)**.

Chapter 5: Descriptive Findings on IOP Development

Zooming into IOP Domains

A contextualist writer needs to use descriptive contexts
to reveal nuances and subtleties that support process analysis.
Paraphrased from — ***Andrew M. Pettigrew, 1985***

In this chapter, descriptive findings on the range of options (i.e., in designing architecture, governance, value systems, openness & control, etc.) faced by members of the collective during IOP development **(RQs1-4)** are presented. This includes descriptive discussions and illustrations of the outcomes (e.g., the architecture that was developed, the governance option that the group gravitated towards, and why). Additionally, the chapter discusses how contextual issues such as heterogeneity of resources and interests, and coopetitive dynamics were dealt with **(RQ5)**. The discussions are supported by tables, architecture diagrams, photographs, and direct quotations that give detail of the supporting evidence. At the end, an overview of the platform development journey is to set the scene for the next chapter (***Chapter 6***), which goes into detail in uncovering processes and practices. The following questions from the research framework (Table 6, p.42) are addressed:

RQ1: *What is the form & characteristics of architecture that emerges out of collective action to develop an IOP amongst a varied group of firms within the same industry?*
RQ2: *What governance options emerge out of collective action to develop an IOP amongst a varied group of firms within the same industry?*
RQ3: *What are considered options for openness & control in the design process for an IOP?*
RQ4: *What are the possible options for generating and leveraging value in the IOP?*
RQ5: *As context conditions, how does (a) heterogeneity of interests, (b) heterogeneity of resources, and (c) coopetition dynamics affect collective organising in IOP development?*

5.1 Platform Architecture, Openness & Control

This section presents findings on the inter-organisational platform (IOP) architecture that emerged out of the collective design process. This includes components of architecture considered, and the options for which design choices had to be made by the collective group. From the case data, seven key components of platform architecture were considered. These are summarised in Table 9 (p.55), followed by the composite architecture (see Figure 5, p.60). The main goal for all participating firms was to develop an architecture that would enable rapid delivery of new capabilities and vastly simplify existing data systems. The seven components cover data services such as acquisition, processing, storage, and analysis. In general, there was an interest in modular and customisable options on the base of a stable foundational infrastructure.

Table 9: *Architectural components and considered options*

Components & Features	Options
Overall modular architecture	Modular *vs.* integrated Centralised *vs.* decentralised Private *vs.* public
Base-level infrastructure	Centralised *vs.* decentralised In-sourced *vs.* outsourced Single host *vs.* peer-to-peer
Core processing systems	Host-based *vs.* client-based & hybrid options Real-time *vs.* batch processing
Data repository	Centralised data lake *vs.* distributed siloes Domain based *vs.* an integrated option
Data formats, structure, models & analytics	Multiple options centred on individual member preferences *vs.* options that would support the collective
Standards	Open standards *vs.* proprietary standards (multiple decisions on components) Standard formats *vs.* support for open/variety
API management system	Proprietary *vs.* open APIs Exclusive *vs.* inclusive options

5.1.1 Overall Modular Architecture

The main preference was to move from pre-integrated commercial solutions to modular, 'best-of-breed' solution for different aspects of the intended data platform. To scale applications, organisations indicated their need to go beyond boundaries of legacy data systems tied to solution vendors. They sought an architecture that could connect 'best-of-breed' elements at layers such as data storage infrastructure, data processing, analytics, connection, and reporting. As detailed in the objectives of the leadership panel meeting on the goals of the platform:

> *We have to be clear that we have multiple layers to address here. Infrastructure, storage, networking, processing, analytics and so forth. We should strive for an architecture that uses 'best-of-breed' open-source components that can be replaced or changed easily should we need to. And that should be done without having to negotiate with one large vendor that would lock us in.* **[ILP Minutes of Meetings].**

There was a clear sense that data-heavy digital services from numerous of customers would require applications that scale. For example, some of the functionalities sought included accurate monthly views of tourism spending, flows and volume broken down to granular level insights for each region in New Zealand, as well as relevant to each participating firm in the project. Commenting on this, MTA's project manager indicated:

> *We will need a system that can connect multiple datasets from all of the participating players. For it to work, it should be possible to easily plug-in to the platform and connect all sorts of data. APIs will be a key enabler for this.* **[Insight Specialist, MTA].**

API-based interfaces were sought to simplify integration between disparate tools and systems. Such interfaces would enable easier replacement of individual components as the platform evolved. Thus, an underlying theme regarding the overall architecture of the platform was that it should be modular, supported by tools that would connect with a large variety of underlying databases and services from various organisations (see Figure 5, p.60).

5.1.2 Base-level Infrastructure

There were many preferences on how infrastructure could be deployed, (i) on-premises server within MTA's premises (or government)), or (ii) a cloud-based solution through a reliable provider. Large corporate organisations favoured a cloud solution because they were already using similar solutions internally and saw that it was an attractive option. A representative from a major airliner indicated:

> *Cloud is probably the most disruptive driver of data design. It offers a way to rapidly scale tools and capabilities. Major cloud service providers such as Amazon Web Services, Google Cloud Platform or Microsoft's Azure have revolutionised the way we source, deploy, and run data infrastructure, platforms, and applications at scale. From our perspective, it is better to outsource infrastructure to such players because they've been in the game for a while. They will likely provide a better infrastructure service than we can if we try to dabble with developing this from scratch.* **[Data Systems Engineer, Air New Zealand].**

Thus, cloud infrastructures were also seen as attractive option, with an opportunity for scaling whilst offsetting the hassle of configuring physical hardware and networks onsite. Examples of serverless solutions came up at various workshops on architecture design, such as Amazon S3 and Google's BigQuery, which would allow organisations to build and operate data-centric applications with 'infinite' scale without the hassle of installing and configuring solutions or managing workloads (Design Workshop I).

The second option was to build base level infrastructure on-site either centrally managed by MTA or an elected member with reliable capacity and capabilities. Government through the Ministry of Business, Innovation (MBIE) & Employment and Statistics New Zealand were considered as such candidate actors for this role. However, there was hesitancy amongst private sector actors, who indicated that once the government holds infrastructural control, it might limit their willingness to contribute certain types of data, and also, that the project might stall as had previous government projects related to tourism data. For instance, they cited MBIE's Tourism Data Domain Plan (TDDP Reports 2011, 2018), which was initiated in 2011 and revived in 2018, *"but still had not clearly provided any concrete solutions to the data challenges in the tourism sector"* **[CIO, Tourism Holdings Limited].**

Another possibility was to build the infrastructure onsite within the sponsor's premises at MTA. Deliberations in two leadership panels considered that this would be too expensive, and that MTA had limited staff capabilities to manage such a huge infrastructure. Smaller players such as BnBs, restaurants and visitor experience providers (at times represented by their associations, see ***Appendix 4***) vied for the cloud option because it shifted labour and capability issues to the provider. They were also concerned of the possible monopoly that a nominated member might have over the platform should they be given the responsibility to centrally manage such infrastructure.

Apart from deliberations on whether to outsource or build onsite infrastructure, there were also concurrent discussions about control of such infrastructure. Whether onside or cloud, there was a general sense that base level infrastructure needed to remain closely guarded. As the backbone of the platform expected to sustain all activities by the collective, tighter control was seen as favourable in protecting contributions, and ensuring trust for future contributions by actors. There was a tendency to draw towards tighter control of the base-level infrastructure of the platform. Discussions about the high investments needed to procure and maintain such infrastructure often triggered comments about how such resources needed protection to avoid exploitation, and undue access by non-contributors. A representative from one large commercial tourism services corporate commented that:

> *We will have to foot the bill in some way and that makes me think that we should have the ultimate say in controlling access to those resources. This is what sets us apart from the rest of the industry.* **[Data & Business Analyst, Tourism Holdings Limited]**.

However, the decisions to control infrastructure were tied to the architecture option that would end up being chosen to support the data platform. In the first option, a (i) **centralised core infrastructure** 'in-premises' of the chosen central institution would be used. In this option, organisations tended to call for tighter control of the infrastructure considering the investment to be involved in its development and deployment. In the second option, (ii) **existing government infrastructure** would be used through relevant government agencies, particularly Statistics New Zealand and MBIE whose pre-existing role in providing tourism data services meant that they already had stable infrastructures to support data resources and services for tourism. This option created a lot of tensions because, government departments were vying for open data services through their plan for open government data (OGD) whilst larger private institutions wanted safeguards to protect some of their data – otherwise, they would heavily censor their contributions. The default position of smaller businesses was to support open access as much as possible. The national executive director of regional tourism organisations explained this tension:

> *We* [government agencies] *already provide data such as the Monthly Regional Tourism Estimates and in the Accommodation Data Programme. Statistics New Zealand provide the Tourism Satellite Account, and data on a wide range of tourism activities, including visitor spending in New Zealand. This data is publicly available. It's called open government data.*

Open data drives innovation. It helps to build new business and encourages more strategic investment. Now, I know this concept is a bit challenging if you are a private sector corporate. Data is your asset, right? So, we have to come to a situation that allows us to keep providing open data via that platform but also, consider some protections for our industrial partners. Information in brackets added to give context. **[Executive Director, Regional Tourism NZ].**

The third option was to outsource base (iii) **infrastructure as a service (IaaS)** from a reliable cloud services provider. Names such as Amazon Web Services, Google Cloud Platform or Microsoft's Azure came up in these deliberations. In this case, openness and control would be co-decided between the platform provider(s) and the cloud services company (i.e., the extent to which its services would deliver the desired openness). The tendency again here was to ensure that such services were exclusively controlled by the core group of firms whilst rights of access to any new entrants and complementors would be decided on a case-by-case basis. The fourth option was to (iv) use a **peer-to-peer architecture** that would distribute hosting services (and therefore infrastructure) amongst the participating organisations. This option was considered to be the most inexpensive way to deal with exorbitant costs of centralised infrastructure. Additionally, it would by default 'distribute' the decisions on rights of access to each of the participating organisation forming the nodes in the P2P architecture.

5.1.3 Core Processing Systems

Organisations were aligned with two ways of data processing – batch processing and real-time processing. Organisations with **long established data systems** preferred a batch processing system for several reasons. It would be easier to **control data outflows** by extracting data from existing and legacy systems and upload data it in batches. This would **significantly lower switching costs** by adapting existing batch processing systems to upload data on the platform's repository. Batch processing was also seen as a reasonably inexpensive option by smaller firms.

However, larger corporate organisations were vying for **real-time processing** arguing that the costs of real-time data messaging and streaming capabilities have decreased significantly. They also put forward that start-up costs would be off-set in the long term. For instance, a representative from an airline provider pointed out:

Yes, there are costs to be met, but there are also durable benefits. These technologies enable a host of new business applications. We as a transportation company are already using this. For example, we can inform our customers as their aircraft approaches with accurate-to-the-second arrival predictions, our manufacturers can predict infrastructure issues based on real-time sensor data. **[Data Systems Engineer, Air New Zealand]**.

Other arguments made for real-time streaming functions were that:

> *With real-time streaming, we can have subscription services that allow data use as both producers and consumers of data to subscribe to "topics" so that we can obtain a constant feed of the transactions we need. One of the problems we want to address is stale data. It would be ideal to have a common data repository from which we can receive constant feeds rather than historical data only.* **[Chief Executive Officer, Horwath HTL Ltd]**

Citing third party offerings from vendors, data specialists who were part of the design team from MTA pointed in their recommendations that:

> *Messaging systems such as Apache Kafka provide fully scalable, durable, and fault-tolerant publish-and-subscribe services that can process and store millions of messages every second for immediate or later consumption. This allows for support of real-time use cases, bypassing existing batch-based solutions, and a much lighter footprint (and cost base) than traditional enterprise messaging queues. Streaming processing and analytics solutions such as Apache Kafka Streaming, Apache Flume, Apache Storm, and Apache Spark Streaming allow for direct analysis of messages in real time. Often, analysis integrates historic data to compare patterns, which is vital in recommendation and predictive analytics*. **[2nd Design Workshop Notes].**

5.1.4 Data Repository

Data analysists and data team leaders pivoted from organisational silos of data warehouses toward a more ubiquitous data repository. However, there was an argument that such as 'data lake' would hinder 'domain specific' specialisations in data needed especially considering that participants were mixed between such areas as visitor experiences, accommodation, and transportation (see Table 19, p.101 and ***Appendix 4***). Those supporting the second option pushed for "domain-driven" designs that could be customised and "fit for purpose" to these specific areas within tourism. With this approach, the modular layers of the platform's data repository would be logically organised to provide specialised data services. "Product owners" in each tourism domain (for example, accommodation, airlines, hotel chains, or tour services) would then be tasked with organising their datasets in an easily consumable way both for users within their domain and for downstream data consumers. This was also seen as a *process solution* to the design stages as it would logically lead to 'development clusters' around those domains. Another benefit of a 'domain approach' was that it would 'mirror' the federated inter-organisational structure of the collective group participating in the project. Commenting generally in support of the approach, the project manager stated:

> *We want to remove from our data producers, the burden of building individual silos of data warehouses. A data repository that we can store incoming flows preferably on a reliable infrastructure will be useful here. It should also be able to provide search and retrieve functions that enable exploration of data.* **[Insight Specialist, MTA].**

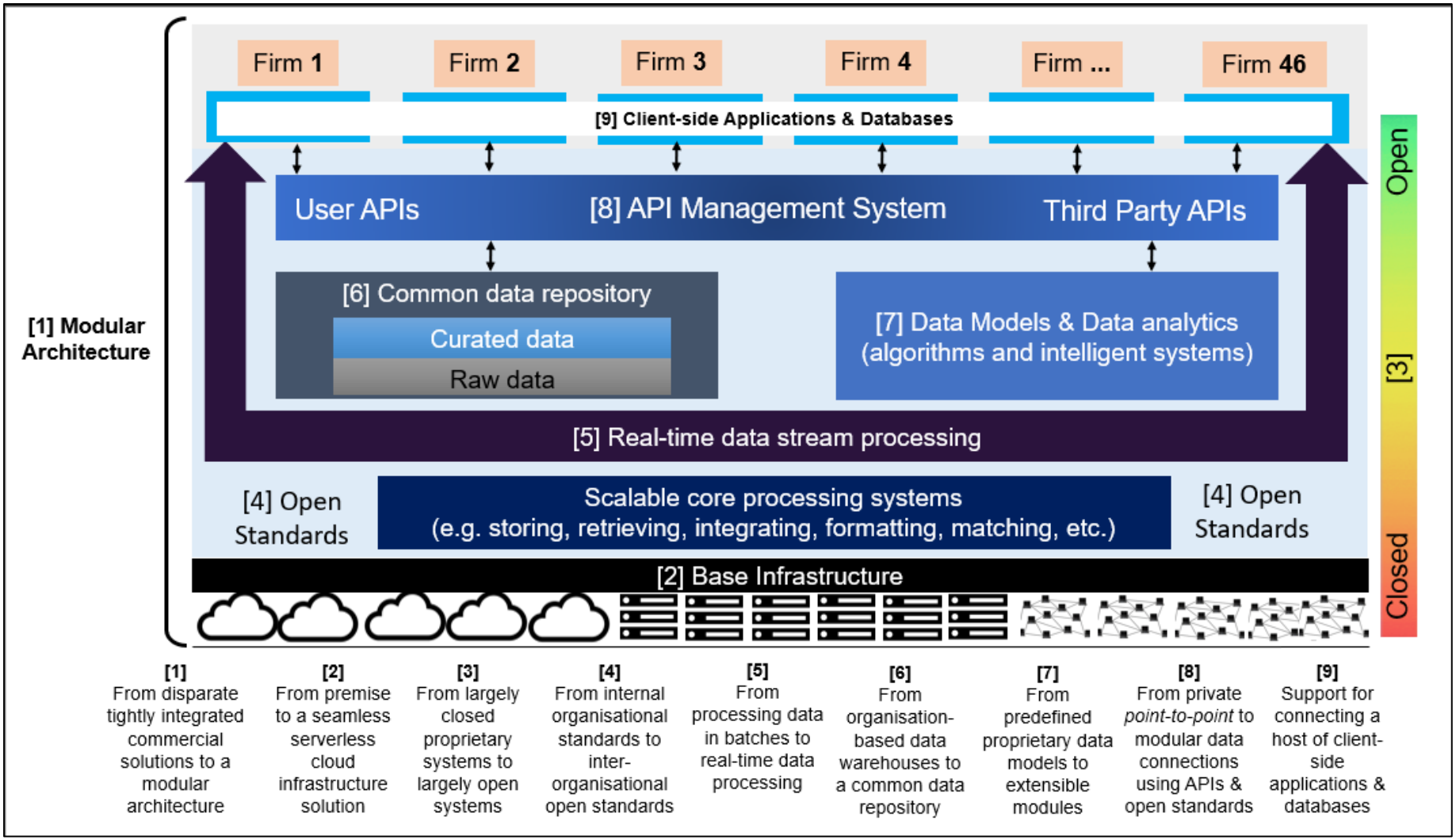

Figure 5: *IOP architecture model*

Source: *Developed by author based on case data*

5.1.5 Data Formats, Structure, Models & Analytics

Regarding data formats, models and analytics, there were several options considered, which suited firms in different ways. In terms of output, larger corporate organisations were in favour on raw, granular data. They had capabilities to explore such data within their organisations, therefore outputs that would primarily feature raw source data were an attractive to them. Smaller firms preferred that data modelling and analytics services be part of the platform, so that outputs could feature analysed data in the form of reports and statistics that they could readily use without having to conduct further analyses.

In terms of input, predefined data models from software vendors and proprietary data models that serve specific business-intelligence needs in participating organisations were seen as a challenge as they are often built in highly 'normalised' schemas with rigid database tables and data elements that fit with specific organisational needs. An API that would connect such 'normalised' and organisation-specific data was needed. This would enable organisations to input data in various formats or structures, which would be processed using an open standard into 'de-normalised data' that would form part of the stream to be received by other collaborators or go through platform analytics services to produce reports and statistics (an option that most smaller organisations were vying for).

While this approach meant that organisations needed to do very little to their own internal systems (a benefit) to produce standardised data, there was a risk that attempts to de-normalise various data structures, and to incorporate new data elements or data sources, would affect data integrity. A data expert from a major transport and tour services firm pointed out that:

> *To gain greater flexibility when exploring data or supporting advanced analytics, companies will need to move to a "schema-light" approach, which have fewer physical tables, to organise data for flexible use. This approach offers a host of benefits: agile data exploration, greater flexibility in storing structured and unstructured data, and reduced complexity, as data leaders no longer need to introduce additional abstraction layers, such as multiple "joins" between highly normalised tables, to query relational data.* **[Founder & Director, HH Tours]**.

This meant that collaboration was needed towards developing a 'common way of producing data' so that it would fit well with the platform. In other words, instead of organisations coming together to design a platform for data and resource sharing, a further step, towards organisations **collaborating** to produce data in desired formats was needed. There was a clear need for **converging towards common solutions** in areas such as the standards to be followed and practical feasibility for firms with limited capabilities. A data expert from a transport and tour services company explained why, at a technical level, such collaboration was necessary:

> *Companies will need to move toward a common data structure such as NoSQL databases because they are ideal for digital applications that require massive scalability and real-time data-sharing capabilities that we are talking about. That way data serving applications from*

disparate members can tap into unstructured data. Graph databases, in particular, offer the ability to model relationships within data in a powerful and flexible manner, and many companies are building master data repositories using graph databases to accommodate changing information models. If we are aiming for a robust system of combining and sharing data, this is what we should be aiming for. **[Data Lead, InterCity Group]**.

5.1.6 Standards

Several data standards were discussed at design workshops resulting in recommendations for formats that would enable data sharing and reuse by participating organisations. Table 10 (p.62) provides a detailed list of these standards. There was a general agreement that these standards would promote data access and re-use on the platform. There still existed an option for organisations that preferred to keep their data exclusive, to enable necessary protections for limiting access whilst adhering to these standards.

Table 10: *Compilation of the standards recommended by participating organisations*

Data format	Data re-use	Standard	Uses
JavaScript Object Notation (JSON) Data Interchange Format	Yes	European Computer Manufacturers Association (ECMA-404)	Data interchange and is commonly used as part of RESTful API services
Comma Separated Variable (CSV)	Yes	RFC 4180	Tabular and statistical data
Spreadsheets (XLSX, ODS)	Needs to be converted to CSV-format	ISO 29500 (XLSX); ISO 26300 (ODS)	Tabular and statistical data
Spreadsheets (XLS)	Needs to be converted to CSV-format	Proprietary (maintained by Microsoft Inc.), but widely supported	Tabular and statistical data
Hypertext Mark-up Language (HTML)	Needs to be converted to CSV-format	W3C Recommendation	Web documents
Extensible Mark-up Language (XML)	Yes	W3C Recommendation	Documents / data structures conforming to published schemas
Resource Description Framework (RDF) and Linked RDF	Yes	W3C Recommendation	Any data
iCal	Yes	Proprietary (maintained by Apple Inc.), but widely supported	Used for sharing events and calendar-based information
Open Geospatial Consortium (OGC) standards (e.g., WFS, WCS, WMTS)	Yes	Open Geospatial Consortium (OGC) Standard	All geospatial data
Keyhole Mark-up Language (KML) &	Yes	Open Geospatial Consortium (OGC) Standard	Geospatial data; has limitations but convenient

Data format	Data re-use	Standard	Uses
Geography Mark-up Language (GML)			for non-geospatial specialists
GeoPackage	Yes	Open Geospatial Consortium (OGC) Standard	Sharing geospatial data, modern alternative to Shapefile
GeoJSON	Yes	Publicly developed, freely available specification.	Geospatial data; has limitations but convenient for non-geospatial specialists
Shape Files (SHP)	Yes	Proprietary, but specification published and maintained by ESRI.	Geospatial data; has limitations but convenient for non-geospatial specialists
Sensor Observation Service (SOS)	Yes	Open Geospatial Consortium (OGC) Standard	Sensor data, generally associated with a geospatial location.
CityGML	Yes	Open Geospatial Consortium (OGC) Standard	Storage and exchange of virtual 3D models (e.g., city architecture models)

5.1.7 API Management System

In the architecture design workshop, a major call from most actors was to use APIs as **boundary objects** for accessing the platform. In some respects, organisations were already using APIs to access various data from government and between each other. API use was seen as a driver of both access and security. For instance, accessing data via platform APIs would ensure that only sanctioned users have direct access to view and modify data. This would also offer agile, and up-to-date access to common data sets.

> *We should think of our solution as leading towards a 'data marketplace' for all participants, via APIs to simplify and standardise access to the lower-level data assets we have been talking about. And those lower-level assets can be protected by controlling access to APIs. We will need to deploy an API management system to expose the APIs to companies, making it easy for them to connect to the platform.* **[Data Systems Engineer, Air New Zealand].**

Thus, an API management system was not only presented as a necessary 'gateway' to the platform, but also as a conduit through which the platform would be governed, for instance, by implementing usage policies, control access, and measure usage and performance. There were extensive deliberations regarding governance (these are fully discussed in ***Section 5.2***). For instance, because APIs provide capabilities for connecting external parties, there were deliberations how the platform would allow access to third party developers and researchers (outside the collective group of participating organisations), and how such access would be granted. Similar to other layers, the API management system would also be built as a separate layer within the broader modular architecture of

the platform (see Figure 5, p.60). Data transactions with external parties would thus occur outside of core systems of the platform, again signalling a preference to protect lower layers of the platform.

The project manager stated that as more companies providing tourism services joined the platform, an open approach would allow those new entrants to join the platform easily than if closed interfaces and proprietary standards were used. He stated that openness would enable data sharing to occur seamlessly, support future engagements and joining by new entrants, and make it easy to add new functions and resources. Access to data resources on the platform would ultimately be controlled via APIs. The standards chosen for those APIs and who would be granted access to them was also important. A data systems lead at a major rail system operator pointed out:

> *Look, I think open interfaces are key to any project that seeks B2B and B2C connections. At KiwiRail we are working hard to offer our customers easy, simple, efficient ways to build innovative connections with us. KiwiRail's APIs use the RESTful interface and JSON format to allow our customers to seamlessly interface with our systems. We provide the ability to test the API with mock data before going into production with real, live data.*
>
> *The Freight Bookings API provides 24/7 connection between our customers system and KiwiRail's system allowing customers to send automatic electronic messages to create, update and cancel unscheduled bookings with KiwiRail. This provides an opportunity for B2B integration without the need for any manual processes delivering, improved processing time, reduction in errors, integration of business data, and process optimisation. These are the kind of open interfaces that lead to B2B contributions and innovation.* **[Data Systems Lead, KiwiRail].**

In summary, this section presented descriptive findings on the range of options for designing architecture that were faced by members of the collective. These options present the 'platform context' faced by the members, the decisions they needed to make, and areas of tensions that needed to be resolved before designing the platform. This contextual description sets a background to the processes and practices that ensued and will be referenced in the following chapter (***Chapter 6***) when explaining how deliberations, actions and decisions transpired.

5.2 Platform Governance

There were five main governance options or decision-making structures for the platform under development proposed by various organisations in the collective group. Although MTA played an overarching governor role of the development project, decisions about governing of the platform once operational were contested. Debates about who should lead and govern the platform brought up nuances of the governance arrangements that arise in collective action for IOP development.

The initial steps are probably around having some sort of governance or board agreement about who will own the data or where it's going to be located. But yes, that's where that governance discussion will be important because whoever owns and maintains that dataset will need to have good, strong relationships with the hotel industry that is providing the data and with Statistics New Zealand that are linked into the arrivals, etcetera, etcetera. So that's where governance kind of comes in. **[General Manager, Hospitality NZ].**

Apart from governance in the form of member coordination, specifics of governance in a data platform were also relevant in this case. Platform governance options could also be distinguished by special provisions for the management of data. There were tensions regarding data governance, with organisation posing key questions such as: Who will own the data on the platform? How will the data be processed? Can private data be combined with government data or other data? (This is also discussed under platform architecture). Who will have access to the data? What are the decision rights of members? (This is also discussed in the five government arrangements discussed below).

Choices about who would successfully deliver good leadership and governance were many (see Figure 7, p.71 & Figure 15, p.97), but they can be grouped into the five main options discussed here.

Option 1: *Lead organisation as coordinator (MTA)*
Option 2: *Participant collective governance*
Option 3: *Separate organisation set up as a 'parent provider'*
Option 4: *Sub-group arrangement*
Option 5: *Government as central leader*

5.2.1 Option 1: Lead Organisation as Coordinator

As the initiator of the project, the lead organisation, MTA had already been playing a leadership role recruiting members, coordinating them to participate, and facilitating meetings and deliberations of key activities. From the perspective of MTA, once the platform was developed, they would assume a sponsor role, overseeing the overall governance of the platform, but with some checks from funding partners, the government, as well as through the support of its diverse network. MTA's network included universities, private training organisations, industry training organisations, both public and private tourism organisations, and a range of government institutions (see Figure 6, p.67).

The project manager from MTA pointed out that MTA already provided consortium leadership for over 500 organisations (directly or through their associations), it had influence and a mutual relationship with the government, as well as multiple special arrangements with industrial businesses in tourism. MTA would thus essentially mirror its current governance role over its association members to that of the IOP. Figure 6 (p.67) shows MTA's governance option. Therefore, MTA's view was that

as the initiator and lead organisation in the project, it was positioned well to provide governance to the platform once operational.

> *We provide industry-led leadership. MTA is the only independent association that represents all sectors of New Zealand's large and diverse tourism industry. We accomplish what no single member or sector group could achieve by themselves. Our members range from SMEs to large, publicly listed corporates. Collectively, they represent around 85% of total tourism industry turnover. They come from across the industry and range from small owner/operators to large publicly listed tourism corporates and international hotel chains.* **[Insight Specialist, MTA].**

In its proposed governance role, MTA would provide industry linkage to its vast network (Figure 6, p.67), which would benefit the platform by generating network effects. As the initiator of the project, MTA would transition from the project management role into platform leadership by setting priorities, goals, and the strategic direction of the platform that evolved from the initial vision. According to the MTA's chief executive officer:

> *MTA, with the support of industry, has led development of the Tourism Insight Framework. It aims to drive changes so that tourism businesses and stakeholders have the quality knowledge needed to make better informed decisions and achieve better outcomes. Leadership sits at the heart of the Tourism Insight Framework that initiated this project. We are determined to overcome the many significant challenges and seek solutions to ensure the industry benefits from the trusted, accessible, and relevant data and insight services it needs to support sustainable tourism, driving an open and sharing platform ecosystem and championing the framework elements to industry and government. Determined and effective leadership will ignite the industry's data and insights agenda, galvanise resources, guide prioritisation of effort and enable accessibility. Leadership will also drive a culture change that sees the tourism industry widely understanding and valuing data and insight, and consistently applying it to decision-making in order to improve performan**ce.** **[MTA's Tourism Insight Framework Leaflet – Chief Executive Officer, MTA]**

In the governance arrangement described and advocated for by the MTA, its role would also involve sourcing for funding to sustain the platform until it became self-sustaining.

> *There is a compelling need to establish funding streams for the data* [platform] *ecosystem because it will not start by generating any profit to sustain itself. At present, a sustainable funding model does not exist, despite tourism directly and indirectly contributing 10% of GDP and 20% of annual exports. In the current public funding system, the Ministry of Business, Innovation & Employment (MBIE) has responsibility for core tourism data and analysis produced by the public sector. MBIE's programme is guided by the Tourism Domain Plan, with an estimated budget of $3.19 million in 2017/18. The tourism industry is virtually absent from*

the government's $1.4 billion science and innovation system and is not included in the National Statement of Science Investment. The only identifiable link to tourism is through the non-quantifiable benefit from government-funded university research. There have been several industry collective efforts to fund data projects, but these are ad hoc with no overarching industry plan and leadership. **[Extracted from MTA's Tourism Insight Framework Leaflet – Chief Executive Officer, MTA]**

Thus, as a platform sponsor, MTA offered to identify all potential public sector funding sources, particularly the government's science and innovation funds, and develop and implement a plan to access this funding to support the platform's continuous development until it was sustainable. MTA would also investigate options to develop funding mechanisms that enable the industry to meet more of its own needs as the platform ecosystem would eventually evolve into a bigger technology ecosystem.

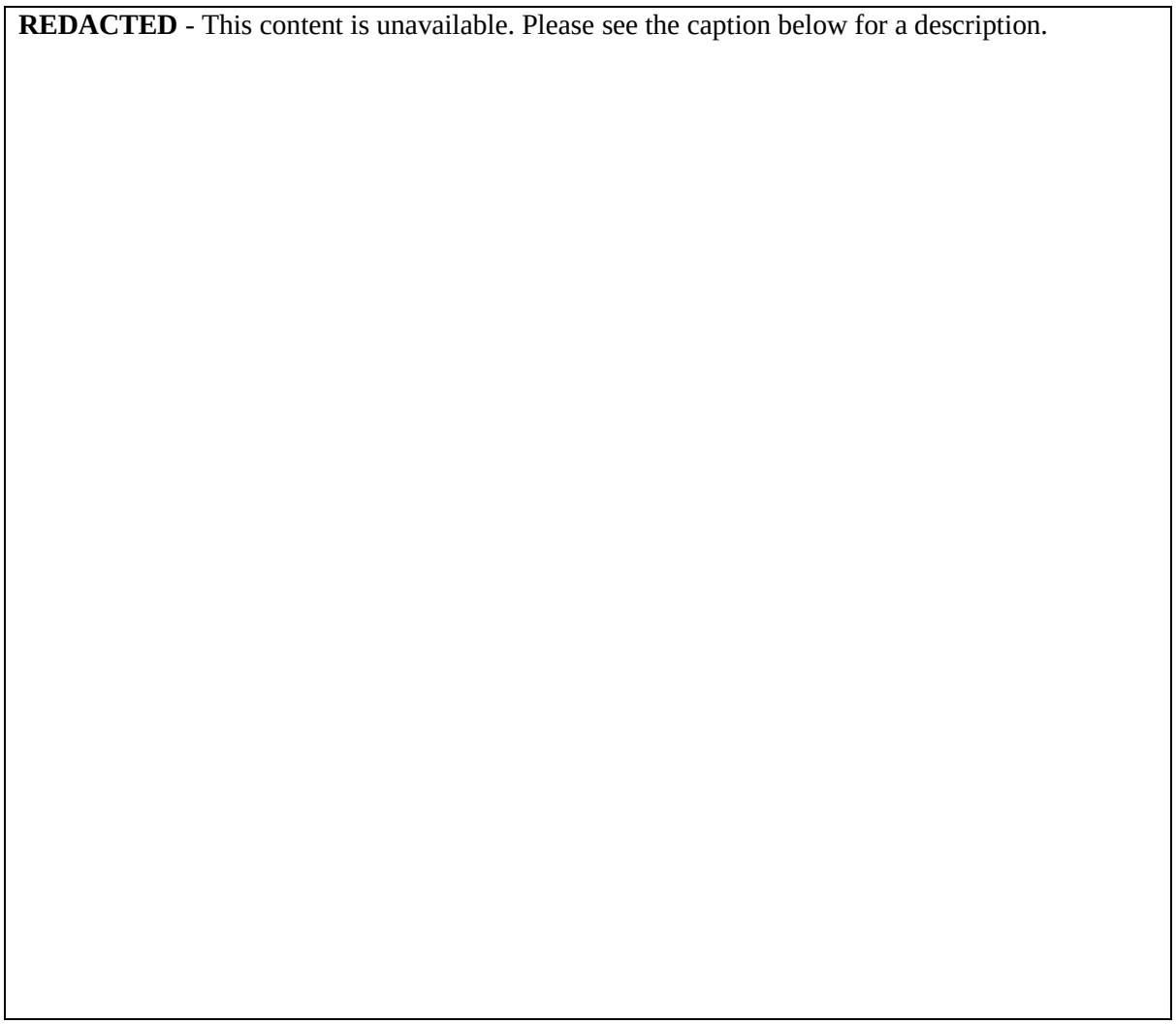

Figure 6: *Governance arrangement option offered by MTA*

Source: *Extracted from MTA web resources by permission from MTA*

However, MTA's option was not favoured by all organisations. Reliance on government funding was seen as a risk, particularly by private consultancies. A representative from a private consulting firm that uses government data to create targeted reports for its clients discussed the challenge with such an arrangement.

> *The challenge with MTA leading this data ecosystem once created is that it will heavily rely of funding from government and other investors. So, in effect they [the funders] will be in control over what can and can't be done. It's worrisome because the government systems for data currently are what we want to address. If they were doing a fine job, organisations would not be doubting the data coming from RTOs, MBIE, Stats or TNZ. So, unless there is that clear demarcation between MTA and the government as the ultimate funder, we will still have the same challenge five years down the line.* **[Chief Executive Officer, AB & Associates].**

Another challenge with the MTA's option was that it did not signal any explicit focus on the technology itself but on organisational-level administrative management, sourcing for funding, and coordination of members. Organisations with data-heavy systems were not convinced that MTA had institutional capacity and capabilities to oversee technical issues that would arise and require *"…data governance solutions that are beyond business level arrangements"* **[Airline Development Manager, Wellington Airport].**

5.2.2 Option 2: Participant Collective Governance

Despite MTA's preference to retain governance responsibilities once the platform was launched, some organisations were opposed to this. Smaller organisations (some of them represented, e.g., restaurants association, bed-n-breakfast association, NZ cruise association) raised this concern in particular. They argued that, although MTA was a membership association representing tourism organisations, it was not a collective owned by its members. Thus, if the same 'membership association' arrangement was to be adopted for the platform, it would leave much less **decision rights** for participants on the platform., and this would be more disadvantages to smaller, less prominent organisations. They preferred a participant governance arrangement that was more 'collective' "…*so that we can maintain a bargaining leverage over the larger corporate firms*. **[General Manager, Canyon Swing]**. Restaurants for instance, indicated that there was a risk that if the IOP was centrally governed by MTA, it would lean towards the preferences of MTA's funding partners or the *"…larger well-resourced firms with enough influence to decide on rules that will not necessarily be favourable to everyone but them."* **[Chief Executive Officer, Restaurants Association].**

> *You know, we all have something to contribute. All businesses will have something to contribute to the data in the ecosystem. The task to control that needs to be distributed across all businesses big and small. That way the needs of all businesses will be delivered. The MRTEs, the IVS, CAM, TSA, IVA, and other datasets are all delivered by different organisations. If we*

leave that responsibility to one institution, how can they achieve this without comprehensive knowledge of datasets? And can they achieve that at all? Right now, we have given each other responsibilities to work on various things. I am in the Insight Leadership Panel for example. So, it's possible to have the same kind of arrangement for the [platform] *ecosystem.* **[Business Owner & Director, Aotearoa Ziptrek].**

However, disagreements with this approach were raised by MTA and other government institutions. A major argument was that a lack of some form of formal corporation would expose the platform to a leadership vacuum, as well as possible liabilities should a shared technology or data be abused by either participating members or third parties (for a summary of the concerns see Table 11, p.75). Speaking at a workshop on setting priorities, MTA's project manager explained his concern:

There will be real commitments to this data ecosystem if it is to operate the way we think it will. That means a reasonable investment in resources by participating businesses. Now, if there simply exist some loose connections at business level, who will deal with specific decisions regarding technology, security, and possible liabilities should something go wrong? It's hard to imagine how such a plan can be achieved without formal and representative leadership. Unless we are just talking about strengthening current business relations only.

Some of the concerns raised here do not consider the technology set up [architecture] *needed to operate the system at industrial level. Companies have advocated for centralising data resources, but they call for divided management on top of that. If we commit to building a central data repository, then we will also need some centrality in managing it. Also, legally, we will need to have an agency such as MTA, that represents and defends the interests of its members.* **[Insight Specialist, MTA]**

5.2.3 Option 3: Separate Organisation as a 'Parent Provider'

There was also a call for forming a separate institution that would play the role of 'parent provider' for the platform. Even as the project evolved, calls for better representation at leadership panels, experts group caucuses and design teams led to heated discussions about the model of governance that would be representative for the platform under development. *"Such an institution would be purposefully created to oversee the data system by setting guidelines for businesses providing data and accessing data via the system."* **[CEO, AB & Associates]**. Members of the parent provider would be selected from the participating organisations through proportional representation aimed at ensuring that all members are represented. Members would also have voting decision rights on priorities, actions and choices made by the organisation. Voting rights were already practised during the design stages on aspects such as who would lead the platform, and how would governance choices be decided (see Figure 7, p.71 & Figure 15, p.97, for an example of voting).

The call for a separate institution came from concerns about fairness and potential monopoly of power, specifically with respect to the ownership of the platform, and the use of data resources if a lead organisation such as MTA or any chosen private organisation was to assume control and governorship of the platform. Such concerns were explicitly raised both at interviews and during workshops. Key voices were from three organisations: (i) Real Journeys, a private visitor experience provider, (ii) AB & Associates, a provider of research, market intelligence and strategic business planning services for the tourism and leisure industry, and (iii) Horwath HTL Ltd, a hotel, tourism & leisure consulting firm. The chief executive officers at AB & Associates and Horwath HTL Ltd were clear that they sought a formal business institution that was incorporated and autonomous:

> *This is business. What we are talking about here is business. For a business to be managed effectively it needs to be formally set up, incorporated and autonomous. All of us in that business will of course need to be represented. But the main point here is that if we imagine a system of governance that is not formalised and managed as a business then it's hard to see how it will be successful.* **[CEO, AB & Associates].**

> *Tourism used to have a private body called the Tourism Research Council which existed for about ten years. The TRC managed innovation projects such as this. As a separate entity it worked quite well. I think that's the kind of institution needed here. A separate company specifically set to deal with data and innovation,* **[CEO, Howarth HTL Ltd].**

Even for government departments that were vying for a government-led approach to overseeing the IOP, the need for representation at least in as far as the setting of priorities and initiatives was recognised. They referred to such an institution of governance as the "Tourism Insights Council" (see Figure 7, p.71) that would oversee governance needs of the IOP ecosystem jointly covering the government agenda and industry needs. In a report on the Tourism Data Domain Plan, MBIE's Evidence & Insights Manager pointed out:

> *Things are evolving in the tourism dataspace. A key difference between the 2011 and 2018 domain plans is the move from a government only, 'official statistics' domain plan, to something broader that encompasses aspects of industry focus. A new governance structure will determine the sequencing of work. Following the completion of the 2018 Tourism Data Domain Plan, governance arrangements will be put in place to agree on the sequencing of work and how it may be funded. That governance structure needs to be blended. This means that while the actions of the plan will be the responsibility of government agencies to complete (to the extent they are adopted in the action plan), there may be other initiatives identified by industry for action by industry.* **[General Manager – Evidence & Insights, Tourism Data Domain Plan, 2018].**

Key resolutions of the TDDP also included "the development of a new and separate governance arrangement that involves government agencies and industrial businesses actively involved in developing technological solutions for data in tourism" **[Tourism Data Domain Plan, 2018]**. There was thus a recognition from both private and government agencies, that a separate entity for governing the platform would provide better governance. Emphasis was placed on representation, voting rights, and co-development of priorities.

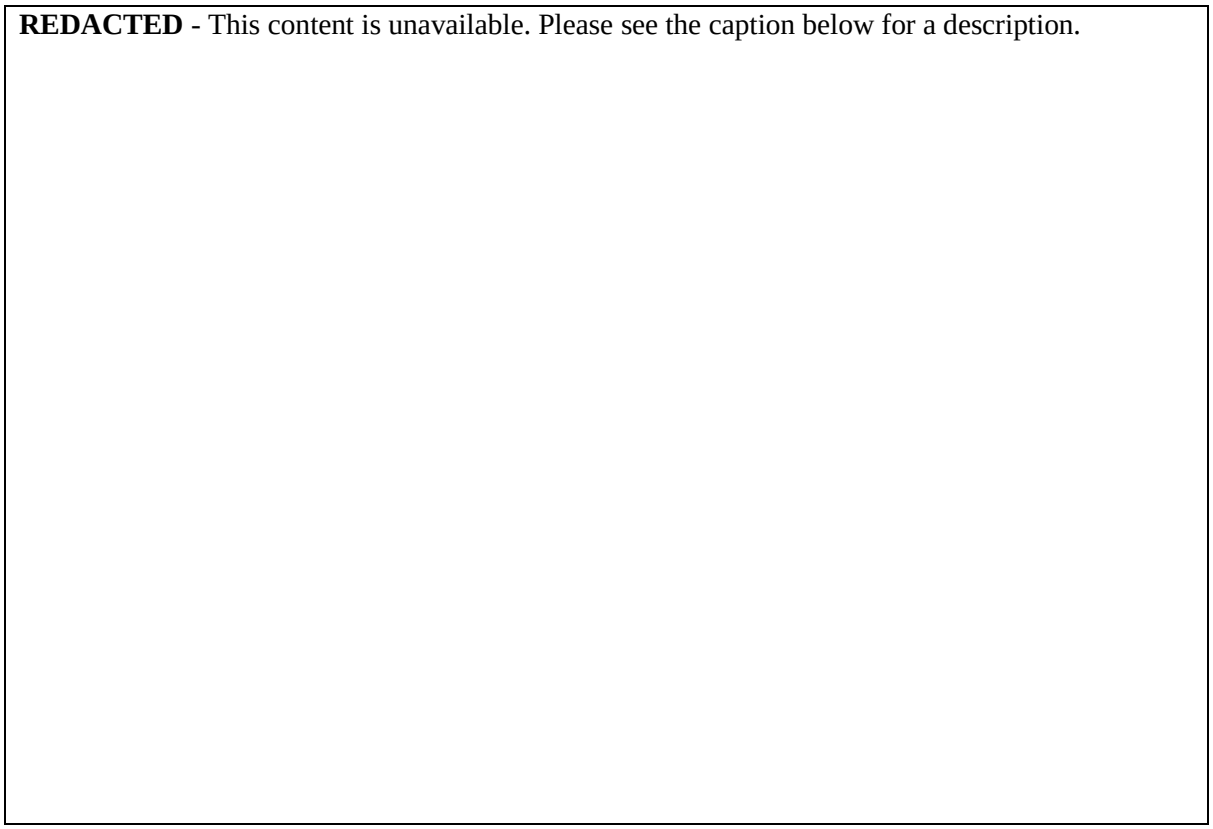

Figure 7: *A governance option preferred by government institutions*
Source: *Case data from workshop deliberations – permissions by MTA*

5.2.4 Option 4: Subgroup Arrangement

Another proposed option was to govern the platform in sub-parts according to the key business and industrial sectors represented in the project. Although converging on the same collective endeavour of developing an IOP for sharing tourism data resources and services, participants in the project came from different business and industrial sectors. This mirrored the nature of the tourism industry in general in that it was composed of businesses from various environments – as long as they served tourists at different stages of travel and tourism. As shown in Table 19 (p. 101), representatives in the project were from such sectors as accommodation, transportation, government, museums, private corporates, restaurants, universities, and trade associations (also see ***Appendix 4***).

Thus, a 'domain specific' governance arrangement for the future platform was seen as a strength in so far as it would mirror the already existing sub-groups. According to MBIE's Principal Analyst on tourism, *"government is already organised that way. We have transportation, statistics, hospitality, and business & innovation all organised separately, but with mutual connections and cooperation."* **[Principal Analyst – Tourism, MBIE].** For the private sector, such an arrangement was also seen as a strength because it would also prioritise and promote the already existing business relationships and synergies amongst organisations within similar fields of work such as between hotel chains, holiday homes and BnBs **[General Manager, Hospitality NZ]**.

A key challenge with the sub-group arrangement was that its proponents did not specify how the different sub-groups would be coordinated via the platform once implemented. MTA's Insight Specialist described how a coordinator would still be an important part of governing the platform. He also expressed concern that unless under one clear leadership, a decentralised approach would disintegrate the notion of a platform into multiple data systems that were developed according to the different needs of those sub-groups. Whilst the idea seemed attractive, it would retain the same challenges that the current project wanted to fix, that is, disparate data sources, redundancies, inconsistencies, and a general lack of cross sector collaboration.

5.2.5 Option 5: Government as Central Leader

Government agencies such as MBIE and Statistics New Zealand already had major central resources for tourism data. They had their own parallel agenda on how the platform for data sharing in the tourism sector could be governed. Their governance option was extensively explained in the Tourism Data Domain Plan in 2018. A key component of the TDDP was that:

> *The rapid changes in tourism data are expected, but data governance needs to remain within the framework of national laws and standards. We expect that data governance would occur per data set, not at a system-level. Data would be governed according to New Zealand legislation and the policies of the entity that collected it. Data sharing can be challenging due to discrete data governance arrangements. Data coverage will be the hands of many organisations (fragmented). A system-level governance arrangement that takes a view of the whole tourism information and data in the system and is unlikely. Data sharing agreements will also be key to better enable trusted data sharing between agencies and organisations.* **[Tourism Data Domain Plan 2018].**

Despite assurances for collaboration, private sector opinions regarding the governance option led by government agencies were cautious.

> *My thoughts right now would be that there are some people in the government who understand what organisations like us are looking for and have similar aspirations. But that I don't feel*

that it's joined up across all of the different government departments. So, I don't feel like the government is actually utilising all of its ability across all of its departments. I don't see how they will immediately start to deliver what we need. A heavy consultation with industries will be required for that. 'Cause what, you also can imagine that in some instances, you do get, or you could get a government department that have a view of what they think the industry would need, but ultimately the industry needs to determine what it needs. **[Managing Director, Horwath HTL Ltd].**

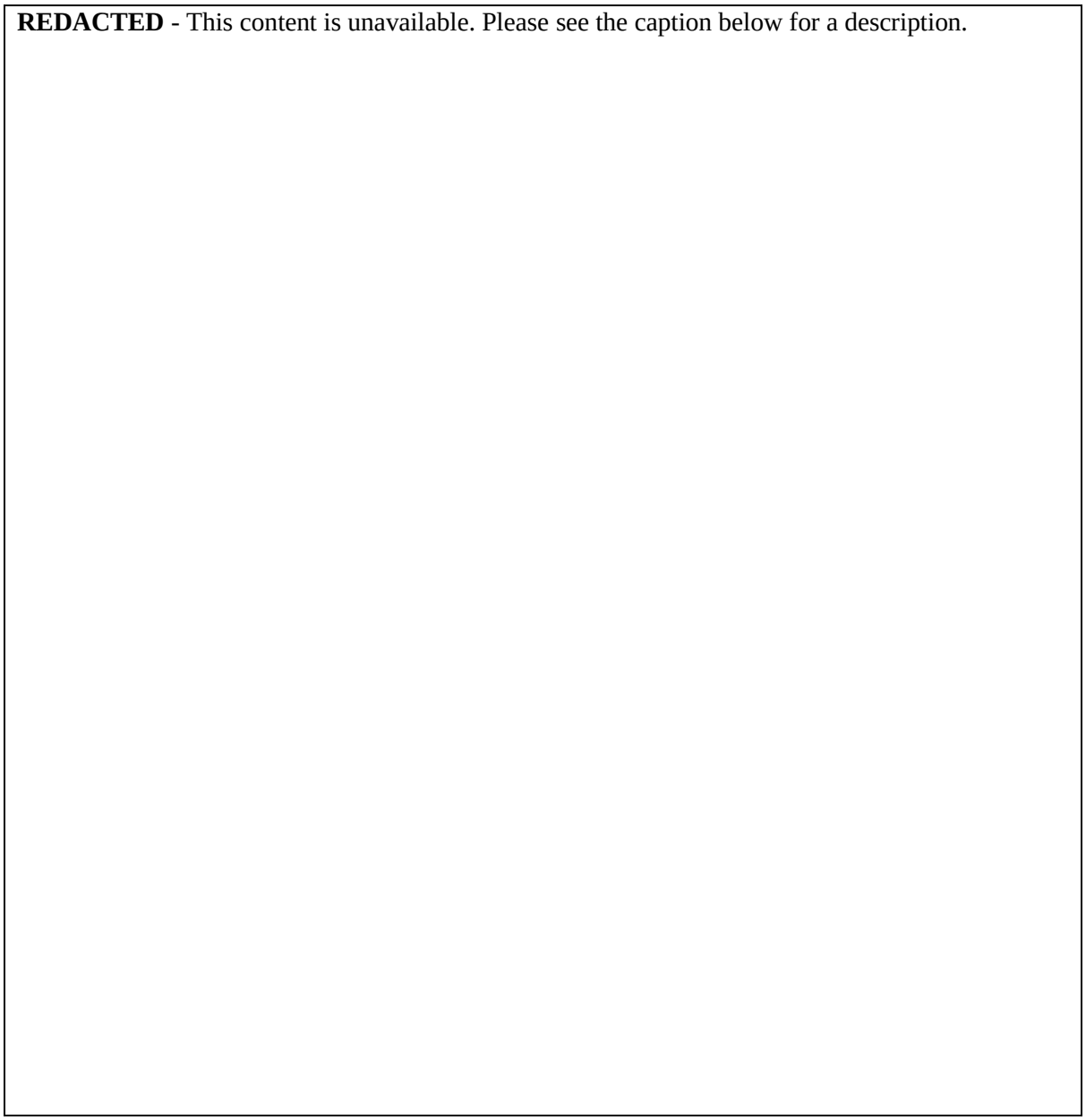

Figure 8: *An example of deliberations on governance options considered by participants*

Source: *Case data from workshop deliberations – permissions by MTA*

A government-led option would also seek to extend its open government data (OGD) endeavour. This was seen as a 'public option' that would turn the collective good into a public good by most private institutions. This led to resistance of this option by private firms. As for government agencies, as they have already been providing public data about tourism via their websites, they were vying for a more open platform through which open government data would be provided not only to participating institutions but to the wider tourism industry. This would also align with government policies that sought to broadly enhance access to data and information from public institutions.

Commenting on this, a senior manager of data systems at Statistics New Zealand pointed out that the platform would be useful if it promoted current government efforts to provide open data resources and services. He explained that:

> *At Statistics New Zealand we are promoting an 'open by design' approach data management and governance. This means the ability to release open data is embedded as an integral part of the process from the beginning. Currently more than 5,250 open government-held datasets are available at data.govt.nz. And that number is growing steadily, so our contribution is significant. To maximise the re-use and value of open data, we release it in both machine and human readable formats such as CSV, JSON, XML, PDF, XLS and so on. This also ensures that we comply with the NZ Government Open Access and Licensing framework (NZ GOAL), as required by the 2011 Declaration on Open and Transparent Government.* **[Senior Manager, Data Standards & Design, Statistics New Zealand].**

Therefore, the tension that arose here was that whilst government considered the intended IOP to be a public good, industrial members considered it as exclusive and private.

Table 11: *Proposed IOP governance options*

Governance options	Roles and responsibilities	Membership type & decision rights	Data governance	Key benefits for members	Key challenges and potential risks for members
Option 1: Lead organisation acts as coordinator Governance type: *Association governance, based on legitimacy. The lead organisation, MTA had already been playing a leadership role and had intentions to do so after development stage*	**Industry linkage** – through members from its vast network **Leader** – setting priorities, goals, and strategic direction **Coordinator & Facilitator** – facilitating meetings, workshops, seminar, and conferences **Arbiter** – resolving conflicts and disagreements **Investment sourcing –** sourcing for resources to sustain the platform	- **Membership type:** Association - **Decision rights:** centralised and controlled by the lead organisation (i.e., MTA). - Members have limited decision rights as association members rather than co-owners of the platform	- Members would have limited control over their data once uploaded on the platform - Data uploaded on the platform may be combined with data from other firms (possible loss of provenance) - Full membership would be required to access data - Association members would have full access to platform data (all contributed data)	- **Legitimacy –** MTA already representing over 500 tourism organisations in NZ, therefore it has proven coordination capabilities, and representation of members	- Central governing of the platform could result in MTA wielding too much control through decision rights. - Because MTA was not directly funding the project, it would be at the mercy of investors and funders – i.e., decision rights and financial control could be conflated. - Representation in the platform could be swayed toward larger firms likely to be prominent than smaller organisations. - The governance option described by MTA does not have an explicit technology focus
Option 2: Participant governance, i.e., collectively governed Governance type: *Shared governance based on co-ownership. Smaller organisations preferred a more 'collective' arrangement with distributed roles and responsibilities.*	No data. (There is mention that roles would be distributed according to the strengths and interests of participating members, but it is not clear what those roles would be and who would play what role)	- **Membership type**: co-ownership - **Decision rights:** democratic decision rights were proposed through voting and peer-to-peer arrangements (voting was already taking place at the design stage) - Members would have decision rights as co-owners of the platform not just contributors or association members	- Members would own/control their data with responsibility for its input on the platform. - Peer-to-peer exchanges via the platform would be possible through private member-to-member arrangements. - Members would not have access to all data on the platform. Access would be controlled through peer-to-peer arrangements	- Possibility of greater representation of the needs of all participants including the smaller less prominent organisations. - High possibility trust between organisations with little need for formal arrangements	- Leadership vacuum would make it difficult to reach consensus in most governance decisions. - Disagreements would be difficult to resolve without an arbiter - Does not address how financial and administrative services would be delivered and managed - Does not have an explicit technology focus
Option 3: Separate & representative org. Governance type: *Re presentative governance though a purposefully created institution composed of reps from the participating firms.*	**Representative parent provider of the platform** – Would take responsibilities for directly governing the platform, setting platform rules for joining, participation and sanctions.	- **Membership type:** representative - **Decision rights:** representative composition would mean that all members can influence decisions made on governance - Proportional representation and voting were proposed	- The parent provider would make ultimate decisions on data governance - Full representation would be required to access data - Represented members would have full access to platform data (all contributed data) in various formats	- Has an explicit technology focus - Would likely be highly competitive and profit oriented as a separate institution, which would attract more actors (i.e., generate positive network effects)	- A risk that the separate institution might evolve into a separate organisation and move/evolve from lateral to hierarchical control. This would create the "lead organisation" challenge already contested in MTA's option - High competitiveness might hinder collective action and tilt towards commercial interests only
Option 4: Subgroup arrangement Governance type: *De-centralised, poly centric governance of loosely connected subgroups. Organised by sectors.*	'Federal governor' of loosely connected groups Coordinator of groups	- **Membership type:** sub-group membership - **Decision rights:** de-centralised or poly-centric, members would have greater decision rights at sub-group-level	- Domain specific	- Promotes specialisation - Explicitly considers existing business relationships and different forms of interdependencies amongst organisations	- If implemented alone, it still leaves an overall leadership vacuum
Option 5: Government as central leader Governance type: *Government-led though agencies such as MBIE, Statistics New Zealand, Tourism NZ, TRC & RTNZ (see Figure 8).*	**Government-led**	- **Membership type:** contributor or stakeholder - **Decision rights:** centralised, government wields control over decision rights through policies. - Stakeholders can vote on priorities & initiatives.	- Members have a responsibility to contribute data, but govt. has control over access - Access to data would be mostly public with exceptions as per government policy on freedom of information	- Government departments had the capacity to handle complex data systems and had already been doing so (e.g., Statistics New Zealand) -	- Government control over data on the platform would likely repel participation and contributions from private actors -

5.3 Value System Creation & Leveraging

Defining the value system of the platform was a key step in identifying the possible options for generating and leveraging value for the many actors in the platform development project. After multiple deliberations on the subject, the collective group adopted a definition of the value the platform to the participating firms. This was focused on 'enduring benefits' after costs, that each organisation had a potential to derive through inter-organisational sharing of data services and resources and through collaboration enabled via the platform and its anticipated broader ecosystem. As stated in the key value areas (KVA) summary of the Data Domain Workshop, *'Value' is intended to encompass the net value after costs and benefits have been considered, and also to include non-financial and intangible aspects.* It is also important to note here that there were two streams of value discussed, (i) value of the platform to tourism in the broad sense, and (ii), value of the platform to specific businesses represented in the project. As for the first overall value, the KVA document clearly outlined it as follows.

> *What value is in a broad sense, is tourism adding to New Zealand, both directly and indirectly, in financial and non-financial terms, and regionally as well as nationally. Specifically, the* [data platform ecosystem] *should:*
>
> ***(i)*** ***Promote sustainability:*** *Promote understanding and responses to environmental, economic, and social impact of tourism so as to encourage sustainable practices and consider community attitudes and social license.*
>
> ***(ii)*** ***Tourism business workforce:*** *Enable tourism businesses to measure & benchmark their performance and enable them to become more innovative and productive.*
>
> ***(iii)*** ***Visitor experiences (behaviours and characteristics):*** *Enable tourism businesses to track and visualise the movements and choices of visitors. This includes where NZ visitors travel to and from; how do they travel; for how long they stay; what do they do; what influences their decisions; and how much they spend in specific localities.*
>
> ***(iv)*** ***Usability and capability:*** *Data is only valuable if it is usable, accessible, and understandable by a wider audience. Whenever required and applicable, it should be possible that government-sourced and private data can be combined and re-used. Granular, source data is an important asset for tourism businesses.*
>
> **[Key Value Areas - Data Domain Workshop Summary, 2018]**

These four key value areas were considered to cover the major business areas in tourism. The **data usability and capability** areas were considered to be the **core value proposition** of the IOP which would enable the attainment of other values across all four of the other areas. The planned 'value system' (see Figure 9) would continuously consider new and additional areas proposed by participating organisations. In this way the value system would not be fixed but fluid as the platform evolved.

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Figure 9: *Proposed 'value system' within the platform ecosystem*

Source: *Extracted from the Tourism Data Strategy conversation starter – permissions by MTA*

A data system that connects all players will create an ecosystem of knowledge transfer with sustainable benefits to the industry. It's a long-term solution to the perennial challenges in the dataspace within tourism. We hope that it will also generate innovation and creativity needed to adapt to the increasing demand in the sector. **[Insight Specialist, MTA].**

Apart from the collective definition of the overall value and 'value system,' expected from the IOP, interviews with representatives of the organisations yielded a set of value options that **each member expected to gain** by joining and participating in the platform (including its early development stages). These value options were sometimes stated as 'expectations to gain' from the IOP. The options included having a single point of access to tourism data, complementarities, data integration, co-creation of resources, reuse of resources, and knowledge transfer. The following findings focus on these areas.

5.3.1 Single Point of Access (SPA)

The platform was considered to become a *'one stop shop'* for accessing disparate data sources. The value derived from this would be the accumulation and organisation of data sources *"into a central access point."* **[Business Analyst, Data Ventures].** This was seen as a major benefit in that it would cut the cost of data search, which most organisations, particularly the smaller family-owned companies reported to be prohibitive. According to the director and founder of HH Tours:

We only have two personnel dedicated to our data systems and they are good at what they do. We have upgraded our technology systems and now they can do clever things like tell when there is a peak demand, routes that are safer, quicker depending on local conditions and so forth. But there are still some gaps, and this is mainly because we also have to depend on data from outside our organisation. We are always seeking to find out what the visitor spending is like, mood on the region on social licence, especially on the hot topic of freedom camping using our camper vans. But we end up having to hire consultants to gather such data because it is in numerous places. The cost of data search and translating it into usable insights is insane. **[Founder & Director, HH Tours]**.

I guess from my perspective, the Insight Framework for a digital platform for sharing data and insights in the industry, that gives the industry access accurate, timely data is a good thing and at the moment we seem to have to sort of jump from many sources, different websites, the Stats, MBIE website or anything. In our institution, we've got about six different places where we go and look for data. And unless you're collecting it yourself, which of course is incredibly expensive and sometimes not that accurate, you are heavily reliant on government data and that government data is often two, maybe three months behind when you actually need the information. **[General Manager, Hospitality NZ]**

This was not limited to small organisations; government departments were also seeking value from accumulating data sources into a 'common place' from which easy access was possible. Discussing about this, Statistics New Zealand's representative explained that *"Piecing together information from Qrious, MBIE, Statistics New Zealand and other research consultants or providers is a fulltime job in itself. We need a common place where this data is easy to access."* **[Senior Manager, Data Standards & Design].** Statistics New Zealand particularly presented their own current challenges in data systems, and areas they thought value could be derived for their agencies. As shown in Table 12 below, value would be derived from the platform if it would incorporate multiple data sources and tools into single access point. This included access to third party contributions such as tools for performing analytics. With numerous and disparate data sources existing in the sector, a commonplace for data access would also help to reduce redundancy for firms collecting the same data set, enabling them to instead make joint efforts, which would reduce costs for data creation and collection whilst increasing consistency and coherence in data analysis and reporting.

Table 12: *Areas where the platform could provide valuable contributions.*
Source: *Extracted from Statistics New Zealand Report – permissions by Statistics New Zealand*

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According to MBIE's General Manager of Evidence and Insights, the value of the platform data ecosystem would be derived from accessible for all users, which would increase the number of users joining the platform (i.e., generate network effects). MBIE's immediate priority was to complete the project so that they can start publishing all MBIE's tourism data *"…to better meet the needs of general analysts and economic agencies seeking flexible access to aggregate data for which data access is mission-critical."* This was also expected to increase synergies between tourism businesses and

economic agencies such as the New Zealand Institute of Economic Research (NZIER), and the Business and Economic Research Limited (BERL).

Additionally, there was an expectation that the regular publication of data via the platform would make the data reliably available to third parties. *"We hope that they* [third-parties] *will take the data, feed it into their database, and add value by creating new, user-friendly presentations and tools."* The value therefore lay in the capability expected of the IOP, to accumulate, integrate and provide easy access to data. MBIE's General Manager of Evidence and Insights explained this:

> *Tourism datasets are generally available, but you need to know where to go. While all the data are listed and linked to from the MBIE website, there is no single format and new users would struggle to know which collection to use for what purpose. Some datasets are distributed in forms that allow easy manipulation by mid-level users (e.g., the pivot tables for the Regional Tourism Estimates) but most are not. For instance, there is limited availability of the microdata. A few innovative and well-regarded interactive tools have been built but with only limited coverage of the data.* **[MBIE General Manager – Evidence & Insights].**

5.3.2 Data Integration

The IOP was also expected to have capabilities for integrating disparate data systems and data sources. Such integration was expected to enhance reliability of methods of data aggregation, and consistency in data collected from disparate sources, and to provide insights that a single or few members alone could not otherwise produce. The datasets that often came up at workshops, include commercial accommodation monitoring, sector level cash-and-spend analyses, near real-time tourism flow estimates nationally and regionally, domestic & international visitor analyses (see Figure 14, p.96).

Other values discussed by members were capabilities for (re)combining data, which would lead to the development of new knowledge and insights previously impossible to achieve by a single member. The capability to combine datasets was seen as valuable because it would enable construction of *"... a complete picture of visitor flows, spending, and experiences."* **[Chief Executive Officer, AB & Associates].** From the perspective of the government, this integration was needed not only between government institutions and business or industrial actors, but also within government. If the platform would provide the necessary conditions to enable data integration between government agencies, new valuable insights would be derived that would address perennial data gaps in the tourism sector.

> *There is relatively disjointed information on the volume, quality, and capacity of tourism based on the infrastructure available nationally. There is likely a lot of data held by a range of organisations, such as local government, the Department of Conservation, the New Zealand Transport Agency, and the Ministry of Transport, for example. A review of existing datasets would be required to understand what is available, and to identify gaps. Without integration, it is difficult to understand future needs through forecasting.*

Any forecasting would need estimates of regional volumes of tourists to be integrated. There have been several recent research reports that attempt to estimate the existing state and future requirements for visitor-related data, though the lack of an integrated national dataset means that the analysis inevitably requires significant assumptions and caveats. **[MBIE General Manager – Evidence & Insights].**

5.3.3 Complementarities

There was an expectation that complementarities would arise out of the platform when third parties started using boundary resources such as its APIs, data resources and network of businesses participating on the platform. According to MBIE's Evidence and Insights Manager:

We expect the good relationship with Infotools who sell their tools with pre-formatted versions of the MBIE microdata to continue. And, when the platform improves the dissemination of our microdata, other providers may also move into this value-adding space. MBIE also has plans to continue to experiment and significantly improve in its own use of interactive web tools, dashboards, and key statistics summaries. **[MBIE General Manager – Evidence & Insights].**

5.3.4 Cost Savings

Discussions of value in terms of cost-savings were wide-ranging depending on the perceived source of the cost saving measures. Smaller operators and their representatives such as restaurants, airbnb's, and tour service providers (canyon swings, ziptreks, campers, etc.) often saw cost-savings from the possibility of reducing the cost of data search, data integration, and analysis. A national representative of restaurants summed this concisely:

A direct value for us is cost saving, especially for the numerous restaurants that we represent. We pay consultants to perform data searches and analyses so that they produce reports. Our members pay fees for us to procure these consultants. So, if there is a one-off chance that we will have a sustainable source of data, that's good for us. I am sure that our clients will be willing to provide as much data as is possible to this system, as long as we tell of reductions in data and insight related charges. **[Chief Executive Officer, Restaurants Association].**

For medium sized organisations with already existing data systems, cost savings were expected when an organisation would switch from an expensive or inefficient data system to the platform. There were also expectations that cost savings would be attained from easier access to data than is currently possible. However, in most cases, all member expectations on the IOP's value were anticipated to be in the long term rather than immediately.

5.3.5 Knowledge Transfer

Members reported that they were already gaining benefits through knowledge transfer even before platform launch, through collaboration with other members in deliberations and design activities. Knowledge transfer was reported to be happening both actively when organisations brought in experts to discuss technical areas of the platform and the data systems needed; and passively when they gained new insights from workshops and meetings. Thus, by participating in IOP development, members benefited from exchange of ideas and ambient learning from other members during various touchpoints such as design workshops and leadership panel meetings. This value was expected to be reinforced and become systematic when the platform was launched. Knowledge transfer was seen as a 'by-product' of the initial goal of creating a platform technology to share data resources and services. According to a Business Intelligence Analyst from a major travel and tourism agency:

> *Although the initial goal is to share data resources and services, we anticipate that this collaboration will go beyond this objective. Currently, in the project we are already experiencing informal knowledge flows between participants. This occurs in workshops, at meetings and various forums when we debate subjects such as how we can define value, how we can perform useful analytics, best places to source for and report data and so forth.* **[Business Intelligence Analyst, Real Journeys].**

5.3.6 Resource Re-use

The IOP also offered a high potential for resource re-use between participating members. Such resources included the infrastructure for data storage, core processing systems, and data analytics tools. This particularly created a potential that smaller firms that could not otherwise have afforded to develop these tools in-house would benefit from collective contributions. However, as discussed earlier, the challenge was on how to amass the initial resources, as well as how to organise them into a stable platform without high contributing members feeling short-changed for the benefits that those with lease contributions would gain. These issues are fully discussed in ***Chapter 6*** when focusing on the processes and practices in the development of the IOP.

5.3.7 Co-creation of Resources

Apart from the initial goal to share data services and resources, another value source pointed out was through emerging areas of collaboration to co-create new datasets, new tools for data analysis, and technology resources. The slight difference between co-creation and integration (previously discussed) was that, with co-creation, members were discussing opportunities to create new resources and services via the platform. This would be a step further than just integrating existing data resources. The business analyst at Real Journeys provided a useful explanation:

We started off thinking about sharing datasets though this technology. But the opportunities we see now are endless. Particularly, we are all beginning to realise that we could combine and create new datasets. This will be useful than the separate silos we had. So, this goes beyond simple integration because we have the opportunity to work together to create new types of datasets. I can only imagine the benefits if we were, say creating and analysing the same datasets, between, say us, and InterCity. So, in the future this technology will likely link our data systems and create profitable synergies. **[Business Intelligence Analyst, Real Journeys].**

5.3.8 Innovation

The platform was also expected to attract third-party contributors such as developers and tech innovators. In fact, at the time of completing our observations, the collective group had organised itself into specialised sub-groups that attracted many third-party partners (This is fully discussed in ***Chapter 6***. See Table 18, p.99, for some of the sub-groups and third parties). Therefore, the opportunity for value creation and leveraging though innovation was quite noticeable. The collective group itself was also composed of highly innovative companies such as airlines, airports, large corporates, and university members who carried a promise to contribute though leading the development of technological solutions (See Table 19, p.101).

5.4 Heterogeneity of Resources

Analysis of the data resources that each member expected to share or contribute via the platform shows that all the participating members did not have the same resources. Table 13 (p.84) and Figure 12, p.92 shows that there was high resource heterogeneity in the collective group (for full table for all the organisations, see Table 19, p.101). Each group of organisations intended to contribute different types of resources (i.e., funding, unique datasets, expertise capabilities, and links to client networks).

The participants included hotel chains, BnBs, and holiday homes in the accommodation sector; airports; associations of other tourism services providers; the government; local authorities and regional tourism providers; museums; private sector corporates; restaurants; visitor experience providers; transportation service providers such as airlines, cruise ships and coach services; and universities. Overall, each group of participants had some, but not all of the resources required for developing the IOP. Therefore, there was high heterogeneity of resources as each organisation offered dissimilar resources.

Interviews with organisational representatives together with analysis of organisational documents, websites and other publicly available data of each participating organisation enabled us to assess the resources each group of participants was bringing to the project. There was high resource heterogeneity in the project as can be seen by the various resources and services that each firm expected

to offer (see Figure 12, p.92; Table 19, p.101). Each member (organisation) also had different resources to contribute to the platform development project and the eventual platform itself once built.

Table 13: *Resource heterogeneity*

Sector	**Resources**
Accommodation	Unique dataset
Airports	Unique dataset Technical design team
Associations	Inter-organisational relationships with potential clients Business and industry knowledge
Main Trade Association (MTA)	Pool of potential clients and members from its association Business and industry knowledge Partial funding Dedicated staff time Leadership
Government	Funding Government open data Big datasets Technical resources/ technical expertise
Local authorities	Local / regional datasets
Local tourism organisations	Local / regional datasets
Museums	Unique datasets
Private sector corporates	Technical experts in the design team Unique datasets
Restaurants	Unique datasets
Visitor experience providers	Unique datasets
Transportation (airlines, cruise, and land)	Technical design team Unique datasets
Universities	Technical expertise on tourism data Technical expertise on platform development

The resources needed when the project began were mainly in the form of staff time & labour from participating organisations. For instance, this included brain power at meetings at which experts were needed to discuss the technical design of the platform, leadership roles to coordinate members, and administrative duties beyond those that the platform sponsors (i.e., the MTA) could provide. Also, the resources were not equality distributed, which meant that there was a high chance that some organisations would contribute more than others.

Most interviewed participants regarded the diverse nature of resources brought to the table as a strength or benefit in that each organisation offers dissimilar technical resources all of which generates a rich common pool resource (CPR). Generally, each organisation had parts (not all) of required resources for the platform development project (i.e., both project resources, platform resources). The project manager from MTA indicated that having partners with dissimilar data, financial and technical

resources in the IOP would positively influence collaboration as the final platform solution cannot be developed without the complementary resources of partners.

> *We represent a diverse group of members. MTA is the only independent association that represents all sectors of New Zealand's large and diverse tourism industry. We accomplish what no single member or sector group could achieve by themselves. Our members range from SMEs to large, publicly listed corporates. Collectively, they represent around 85% of total tourism industry turnover. They come from across the industry and range from small owner/operators to large publicly listed tourism corporates and international hotel chains. As such there are natural connects between them when they have matching resources. That is to say when one member has data that is relevant for the other and the same the other way round.* **[Project Manager & Insight Specialist, MTA].**

Thus, it seemed logical at start, that organisations wanted to collaborate with parties that had complementary resource. Otherwise, having the same resources and overlapping technical and data contributions would defeat the idea of sharing and collaborating that was the basis of the whole collective endeavour. This spelt the need for MTA to strategically organise the collective during the design and technology development stages, such that members with complementary resources were aligned, and at the same time ensuring that all members would actively participate.

5.5 Heterogeneity of Interests

Heterogeneity of interests and resources also became a salient issue when architecture designing started. At this stage, organisations were mostly expected to contribute their technical capabilities. Decisions and recommendations made at this stage were crucial because they would determine how the platform would function and the value each firm would derive should the designs become implemented. Large corporates were influential here as they had many experts participating and contributing to the technical deliberations. This meant that they were making recommendations that would benefit other firms (those with less expertise were benefiting from those without).

Table 19 (p.101), and Figures 10 &11 (p.90-91) show the various business goals, expectations, and interests of each group of participating organisations. Interest heterogeneity among different groups of participants and the potential conflict were apparent to participants in the start of the project and influenced the initial decisions of organisations to become engaged in the project. Because there existed a potential conflict in the interests between the organisations, there remained a latent possibility of this such conflicts becoming salient in the subsequent stages of the project (e.g., when decisions had to be made) especially because some phases involved substantial costs to be incurred by the firms. These areas include interest-based complementarities and interdependencies.

Even though the project was initiated by the MTA, the question of who should lead it once it was built, and also of who should eventually manage the IOP, and its members soon became a bone of contention. At a workshop on deliberating governance issues, members voted for widely different choices on who should govern of the IOP. What emerged from this voting exercise (see Figure 15, p.97) was that instead of being centrally governed, members preferred a decentralised governance model that would give them autonomy and decision rights.

5.6 Coopetition Dynamics

Since a participatory design approach was used, involving representatives from all the members of the collective in developing the platform, there was inevitable competition of choices on design options despite the overall cooperation goal. Such competition and cooperation existed on multiple fronts. There was competition of choices between highly resourced private companies, particularly on the technical design choices of the platform. These organisations fielded highly technical experts to participate at design workshops, and to represent the interests of their parent organisations. For instance, competing standards on geo-location data where debated, Tourism Holdings Limited (THL) (a large private sector tourism company that provides holiday vehicles for rent and sale) fiercely competed with InterCity, (a passenger transport and tourism company) over the preferences to use Esri Geoportal Server to manage and publish metadata describing their geospatial resources so that others can discover and use those resources. THL supported a private solution to the server handling such data to protect any potential leak to private information about its clients. **[Design Workshop II Meetings Notes].**

Thus, experts from private sector corporates often had different opinions about the best options that could be adopted for the platform. The project manager had to be constantly involved to address conflict and deadlocks arising from competition, in effect trying to balance both the need for competitiveness (which was seen as beneficial in getting *'best of the breed'* design solutions), and the cooperation needed to move the development of the platform forward.

> *This workshop is lively with productive debates. These differences of opinion have led to a breakdown of technical solutions that were elusive to many. We thank the experts here who have rolled their sleeves and decided to put thought to these issues as they matter to all of us here. Designing 'best of the breed' solutions come out of these deliberations. It is my hope that we keep this momentum to the end.* **[Chief Executive Officer, MTA].**

Table 14: *Cooperation, competition, and agendas*

Sector	Cooperation & competition	Pursuit	General stance
Accommodation	Partial cooperation Competitive insights on rival performances and cooperative engagement on innovation	Both public and private options	Generally open with exclusive options

Sector	Cooperation & competition	Pursuit	General stance
Airports	Partial cooperation Competitive innovation to improve internal products and services	Both public and private options	Both open and exclusive options
Associations	Full cooperation Representative bargaining to derive cooperative value	Both public and private options (Industrial consortium)	Openness
MTA (central actor)	Full cooperation Representative bargaining and increasing incentives for membership	Both public and private options (Industrial consortium with a government contribution)	Both open and exclusive options
Government	Full cooperation Compliance driven to meet government policy and agenda open data and innovation	Public good	Openness
Local authorities	Full cooperation Compliance driven to meet government policy and agenda open data and innovation	Public good	Openness
Local tourism organisations	Full cooperation Compliance driven to meet government policy and agenda open data and innovation	Public good	Openness
Museums	Partial cooperation Driven to meet unique needs, particularly industry recognition	Public good	-
Private sector corporates	Voluntary participation Private cooperation (exclusive) arrangements Seeking competitive collaboration for innovation	Private good, exclusive industrial consortium	Generally exclusive option with exceptions
Restaurants	Full cooperation Representative bargaining to derive cooperative value and increase incentives for membership	Both public and private options	Openness
Visitor experience providers	Voluntary participation Private cooperation (exclusive) arrangements Seeking competitive collaboration for innovation	Private good	Generally exclusive option with exceptions
Transportation (airlines, cruise, and land)	Voluntary participation Seeking both private cooperation (exclusive) arrangements and public options	Private good	Both open and exclusive options
Universities	Research and cooperative community development agenda	Public good	-

Competition also existed between government's pursuit of a public option through open data, and private sector corporates seeking a private and more exclusive option. This can be seen in the overall architecture models presented and supported by the two sectors. It was more difficult for MTA as the 'project manager' to deal with this dynamic because on one hand, the balance of power was skewed towards the government as the main funding partner with huge data resources that were attracting many other actors towards the future platform. On the other hand, the pool of large private corporate that was fully willing to cooperate but in opposition to the public good option was significant enough to derail the project, or at least leave it as a government platform rather than a sector wide IOP.

Cooperation was prevalent in associations representing smaller businesses such as restaurants, and BnBs. For the small businesses represented (often family-operated), the only way in which their voices could heard was through cooperative association which enabled them to have a better bargaining power. Additionally, they had lesser technical capability resources to contribute during the design stages, despite a promise for providing a unique dataset on visitor experiences and spending which was difficult to obtain by other actors. It seemed therefore that members with lesser technical capabilities tended to cooperate with other actors.

Great cooperation also existed between government agencies. They were all pursuing the main agenda of developing an open government data ecosystem via the platform. They were all following government policy on open data and freedom of information which promotes openness to public data resources, which was seen as important in driving inter-agency cooperation, good governance, transparency, and accountability.

5.7 Platform Development Journey

Case data enabled us to trace IOP development journey by the collective group, showing how the project evolved over time. This shed light into the processes and practices of collective designing. We focused on two main aspects (i) how the design process occurred (structural changes and undercurrent dynamics), and (ii), how strategic management and leadership was practised and its influence on the collective design process. From our observations, the design activities can be organised into five key phases as shown in Table 15 (p.89) (for a more detailed look at the activities and events see Table 21, p.122). Although these phases were sequential, they were not mutually exclusive, but represent the shifts in the strategic intents of the group over time. A change in strategic intent was often demarcated by the calling of new workshops, meetings of the leadership panel, and launch and circulation of new strategic documents, all of which highlighted a shift in the agenda of the collective group.

Table 15: *Key phases of IOP development from case data*

Phase & Strategic Intent	**Highlights (Agendas, events & activities)**	**Sponsor's strategic management roles**
Phase 1: Initial discovery & sensemaking	*Discovery Report 1&2* *Industry consultations* - Benefits discovery - Value expectations - Key Question: How will the platform technology benefit my firm?	Attracting Initial interest
Phase 2: Development of strategic goals & priorities	*MBIE's Tourism Data Domain Plan* *MTA's Insight framework* - Vision, mission, and priorities - Collective agenda *vs.* individual priorities and interests - Key Question: What is the goal of the platform? How does it align with the internal goals of my organisation?	Aligning heterogenous goals and interests Setting priorities
Phase 3: Architecture & Data Design	*Design (Architecture) Workshop I* *Design (Architecture) Workshop II* - *MBIE's Tourism Data Hui* - Deciding on design options - Platform core and modules - Openness, control, standards - Key Question: What is the architecture of the platform and what will be the format of its data input and output? Can my organisation's capacity and capabilities fit with the proposed architecture?	Negotiating Architecture Design Aligning heterogenous interests
Phase 4: Deciding on multiple Governance options	*Design (Governance) Workshop III* *MBIE's Tourism Data Domain Plan* - Deliberating on multiple governance options - Formation of business networks - Key Question: Which governance option best represents the interests of my organisation?	Sustaining Commitment
Phase 5: Development of platform artefacts	*Insight Leadership Panel* *Development Lightning (Innovation) Lab* - Implementation strategy - Prototyping and experimenting - Key Question: Is the desired platform feasible? Can my firm afford to contribute to its development? What will be my role?	Sustaining Commitment to Implementation Aligning heterogenous resources

5.7.1 Phase 1: Initial Discovery

Key Question: How will the platform technology benefit my firm? At project commencement, participants were trying to make sense of the project, its benefits and how it matched the internal needs of their respective organisations. The participating organisations were a heterogenous collective,

involving government agencies, private firms, small, and large institutions. They all provided a diverse range of tourism products and services such as airlines, airports, motorhomes, restaurants, private sector consultancies, local tourism experiences, and trade associations for SMEs such as holiday homes and bed & breakfast services (see Table 19, p.101). As such, their needs, opportunity interests, and offers towards the intended platform were diverse, and incentives for participation were also different (for examples, see Figures 10, 11 & 12, p.90-92). Each and every member had different views about the opportunity, value, and the future use(s) of the IOP.

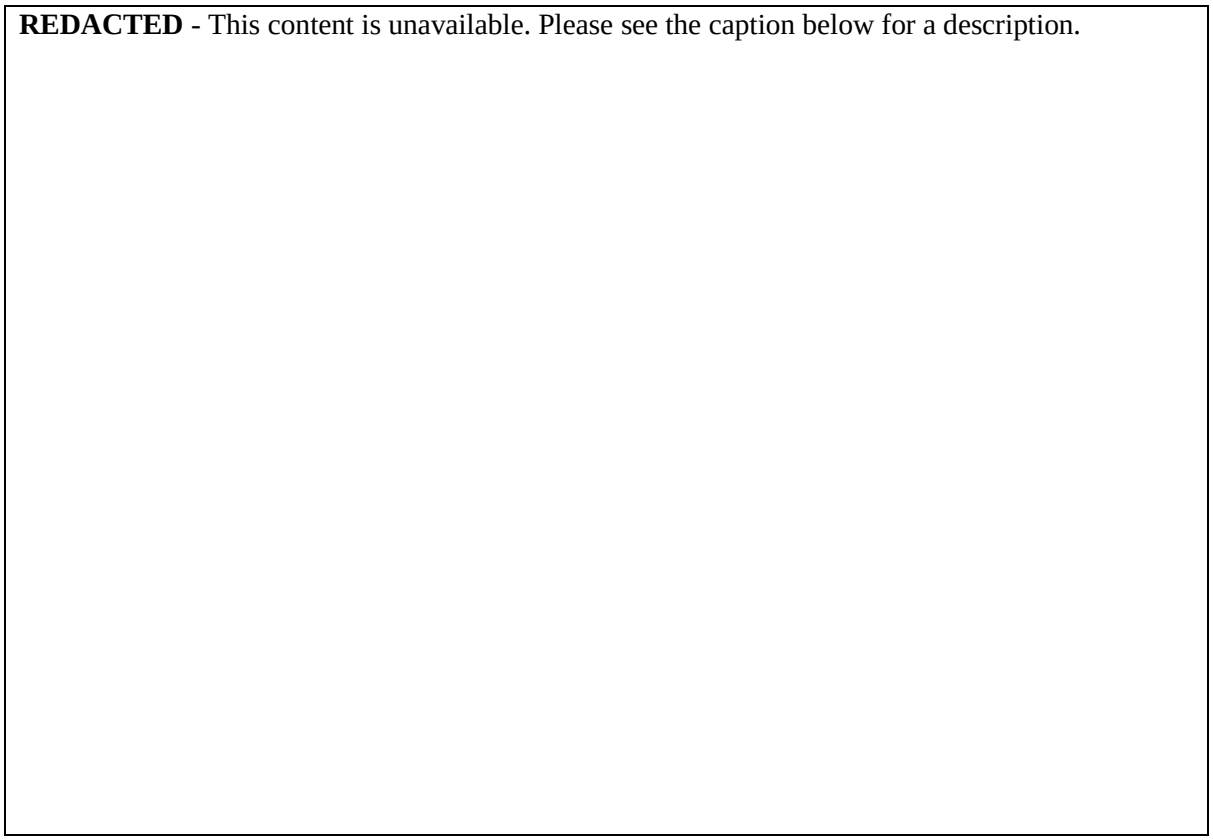

Figure 10: *Different benefits and opportunity expectations stated by participants*
Source: *Case data from workshop deliberations – permissions by MTA*

Specifically, they wanted to find out how the intended IOP would provide value to their organisations. For instance, they wanted to find out the extent of coverage of the IOP on data systems for which they had internal options. This would help them decide if future switching and adoption costs were necessary and needed to be planned for. According to one transport and tour services provider, *"It's an interesting opportunity. At the same time as a company, we have to be sure what we are heading into. What are the opportunities for our data team, and how potentially, are we going to need to align ourselves?"* **[Founder & Director, HH Tours]**.

Because of such heterogeneity, extensive work was conducted to understand the current state of tourism data systems, what the industry wanted from a future IOP ecosystem. This resulted in a compilation of need cards, a snapshot of which is shown in Figure 11 below. Faced with these needs, MTA faced a collective organising conundrum of aligning the multiple lenses about the platform's value expectations, and to convince the diverse group of participants that they had a convincing value proposal that would match the goals of these multiple target firms. MTA also needed to show that these needs could be achieved and thereby promote incentives for participation. Aligning conflicting the goals would also reduce uncertainty risk and speculation about what the platform would offer to each individual's firm. To address this, MTA invited organisations to a panel at which goals and priorities would be collectively set and discussed, thus leading to a next phase in the development process.

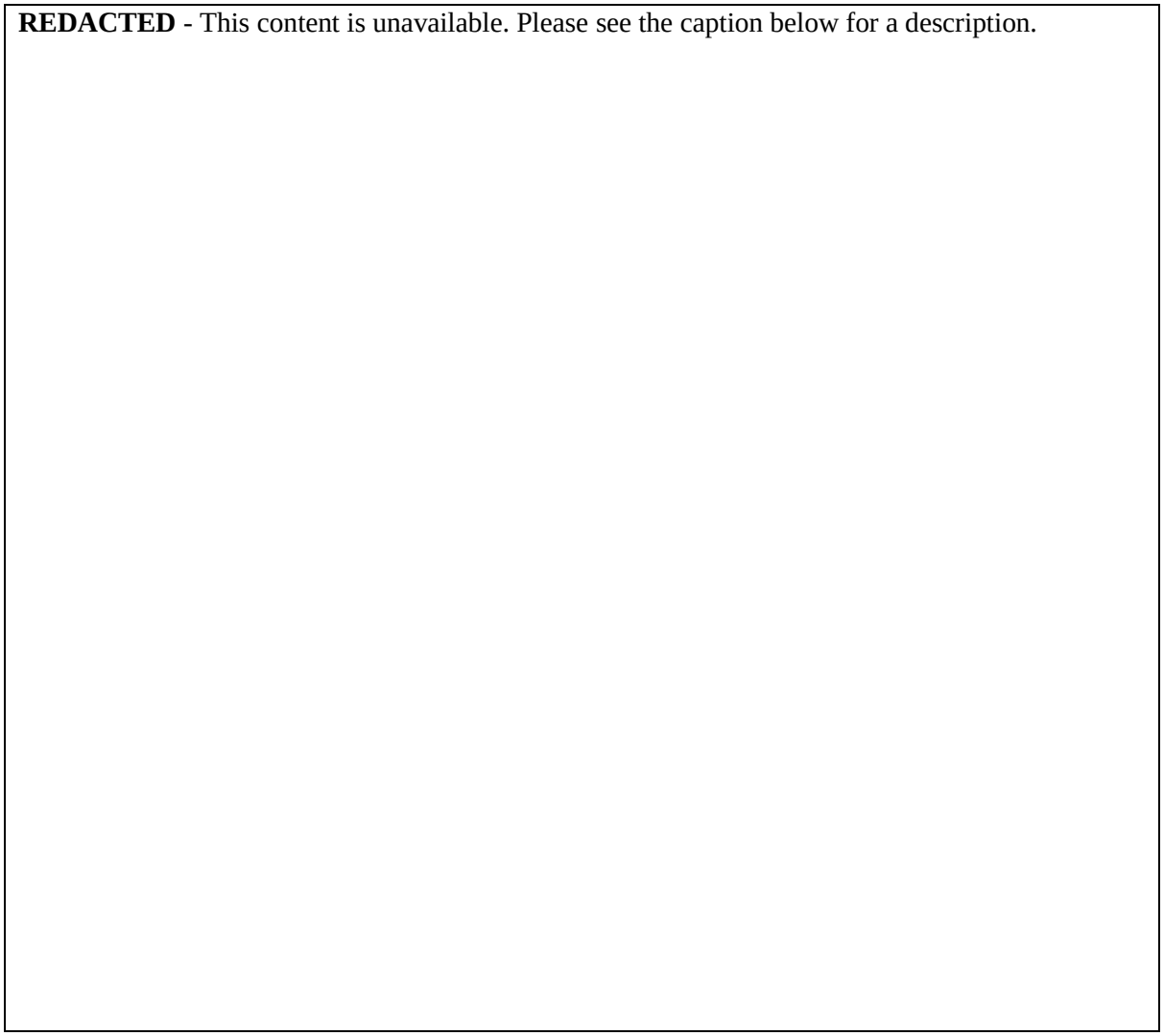

Figure 11: *Data 'need cards' from participating forms*

Source: *Case data from workshop deliberations – permissions by MTA*

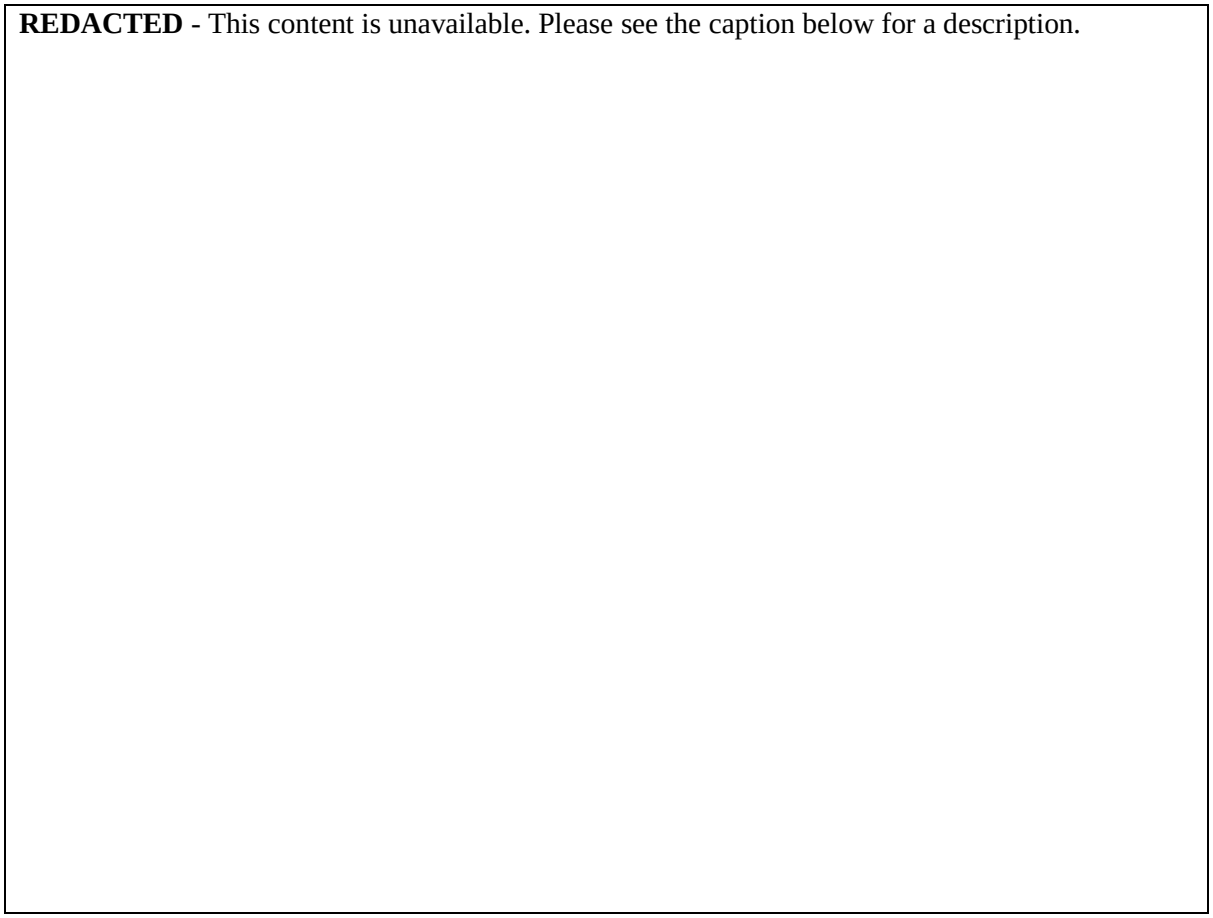

Figure 12: *Data 'offer cards' from participating forms*
Source: *Case data from workshop deliberations – permissions by MTA*

5.7.2 Phase 2: Development of Strategic Goals & Priorities

Key Question: What is the strategic goal of the platform? As there were too many benefits and value expectations, MTA conducted further industry consultations, visiting each of the 46 represented organisations. In these consultations, chief executives, senior management, and data experts were asked about their data priorities in the future platform. At this time, a parallel activity was also occurring in the industry with the MBIE holding Tourism Data Domain Plan workshops across the country at which data priorities were also discussed. These two streams of work resulted in a compilation of various data priorities for the platform.

Having consulted firms individually during the development of the priorities, MTA decided to hold a panel meeting that would bring together representatives of the firms into one room to deliberate on and compile a general list of priorities for the IOP. Deliberations at the panel meeting culminated into a voting exercise, which resulted in a general list of data priorities for the platform (see Table 16, p.93). These priorities were to be used as a guide in future deliberations about platform design and governance.

Table 16: *Priorities set and ranked by the participants.*

Source: *Data extracted from MTA's Project Report – Permissions by MTA*

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Consequently, the panel meeting led by MTA developed what they called an *Insight Framework,* which articulated the current state of the industry regarding data, the collective group's desired future state, and the benefits that the aspired platform would generate to the participating organisations (see Table 17, p.94). The Insight Framework was used as a collective agenda that provided a foundation of the collective strategic goals, which firms could refer to and compare their expected value versus what the platform was expected to offer. As noted by the MTA's project manager:

> *To move the project forward, a clear and unifying industry voice is needed to determine priorities for the platform from all the various goals that were put forward by members, and for establishing mechanisms for undertaking these priorities. [MTA], with the support of industry, has led development of this tourism data Insight Framework. It aims to drive changes so that tourism businesses and stakeholders have the quality knowledge needed to make better informed decisions and achieve better outcomes. In this project, extensive work has been completed to understand the current state of tourism data systems, what the industry wants from a future insight system and the actions needed to bridge that gap. Insight includes all types of data, analysis and strategic research that generates knowledge to support tourism decision-making. It also includes the release and dissemination of insight to users.* **[Insight Specialist, MTA].**

Table 17: *Insight Framework*

Source: *Extracted from the MTA's Project Framework – Permissions by MTA*

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The collective development of the project framework of strategic goals and priorities not only laid the foundation of the development process and exhibited its potentials, but it also advanced the project by shifting the strategic intents of participants from sensemaking and goal setting, to thinking about how to design the actual platform technology. Participants who had shown willingness to participate and enthusiastic about the values set in the framework, the priorities targeted, and the promise it had for their organisations soon began to ask about the key features that the intended IOP would deliver. Head of a restaurant chain succinctly captured these sentiments:

> *At this stage, the Insight Framework although promising, it's quite abstract. We want to know what this technology will offer to the chain of restaurants that we represent. What will be the key features and how will these promote services to a casual diner downtown or the premium restaurant in central city? We have yet to be shown some diagram that shows us this technology and where we might fit in. And that's worrying.* **[Chief Executive Officer, Restaurants Association].**

5.7.3 Phase 3: Deciding on Multiple Design Options

Key Questions: What is the architecture of the platform and what will be the format of its data input and output? Can my organisation's capacity and capabilities fit with the proposed architecture?

The call for illustrations of the platform features were a signal for the need for coring the platform by specifying its components and how they were expected to interact, i.e., designing its architecture, leading to the holding of workshops that focused on Architecture and Data Design. It seemed that design coring was needed to concretise business opportunities and value expectations, and to form a feasible basis on which to sustain commitment, as well as drive the collective design process because *"... the benefits of participation become visible rather than speculative."* **[Insight Specialist, MTA].** Without a clear deliberation about the description of the platform being developed, there existed information and knowledge deficits regarding design features of the aspired platform between the platform sponsor (i.e., MTA) and platform users (i.e., participating firms) that acted as a barrier to the progression of the project. Thus, participants deliberated on various design options for different aspects of the platform (architecture elements are fully discussed earlier).

At the design workshops, drawing visual illustrations (see Figure 13, p.96) was a design practice that helped to identify and visualise the cognitive models of each organisation's vision of the desired IOP (i.e., its core, components, and structure). By doing so, collective engagement was possible because organisations were able to compare and contrast different design options and choices. MTA was also able to determine the cognitive gaps between the organisations, in what the collective group envisioned as the best design options for the IOP. Rotations at group roundtables within the workshops enabled the participants to collectively think about ways to start reducing the cognitive gaps, and to notice actors they aligned with whose vision for the platform matched theirs or at least showed the possibility of some complementarities.

In the deliberations that took place in the second design workshop, it was clear from the previous session that participants had varying design choices and expectations about two main aspects: the architecture (components), and content (data domains) that the platform would focus on. Those firms working in the accommodation sector sought to emphasise accommodation data, and so did the firms in transportation, tour providers, airlines, and small businesses – they all wanted their areas of focus to be the key content of data that the platform would focus on (Figure 14, p.96, captures some of these data areas). Thus, collective designing underscored how priorities set before were not agreeable to all organisations, and that priorities needed to be closely matched with and set during the designing rather than as separate abstract statements. Reversals regarding the initial rankings were clear because some lowly ranked priorities were prominent in the models promoted by participants.

Faced with this conundrum, and after rounds of deliberations at the workshop, participants & the MTA resolved to organise firms into groups, to focus on designing the structure and content of datasets peculiar to their firms. Thus, design groups emerged. Airlines and airports focused on international visitor data, hotel chains and holiday homes focused on accommodation data, local tourism organisations focused on regional tourism estimates for volumes in visitors and spending, and so on. This naturally led to modular design thinking as each dataset area could be considered as a module or component at this design stage.

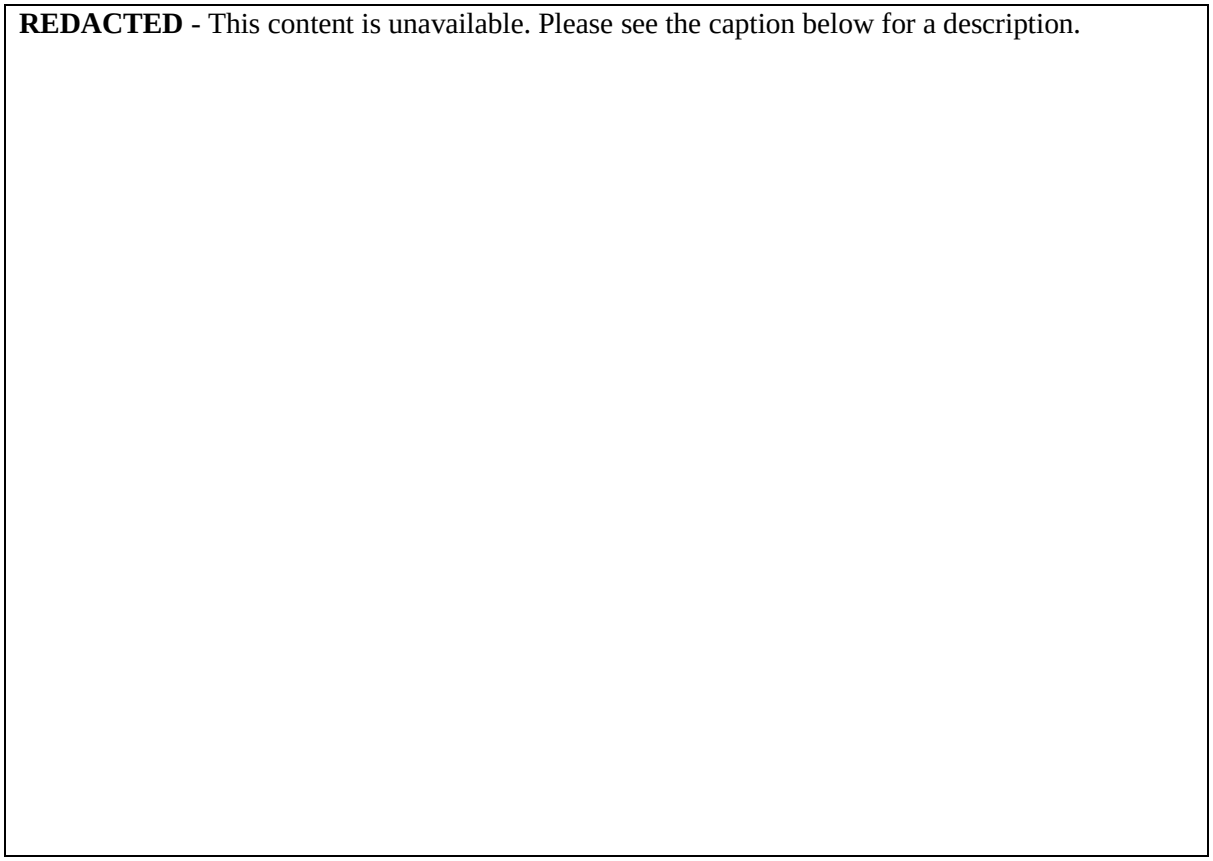

Figure 13: *Members' illustrative visualisations of the envisioned IOP*

Source: *Case data from workshop deliberations – permissions by MTA*

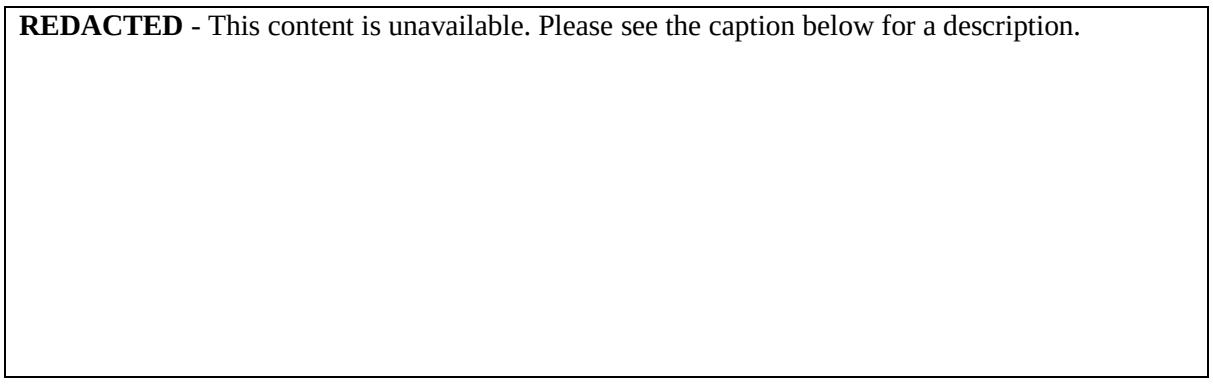

Figure 14: *Participants deliberating on data choices to be included in the platform*

Source: *Case data from workshop deliberations – permissions by MTA*

Key to some abbreviations in the figure

CAM	Commercial Accommodation Monitoring	**CAS**	Cash Analysis System
MRTEs	Monthly Regional Tourism Estimates	**CDS**	Customised Data Services
IVS	International Visitor Survey	**RTOs**	Regional Tourism Organisations

5.7.4 Phase 4: Deciding on Multiple Governance Options

Key Question: Which governance option best represents the interests of my organisation? With regards to governance, participants wanted to know who would lead the overall project, what their roles would be, how decision rights would be practised several other governance issues, which had not been addressed yet. Thus, the third design workshop focused on governance issues. Members engaged in voting exercises choose amongst the different governance options discussed earlier. This included aspects such as who would deliver specific technology components, the standards to be followed and related choices (see Figures 15 below for an example of voting; and Figure 5, p.60, for the components for which these decisions were considered).

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Figure 15: *A voting poll on different preferences of governance options*
Source: *Case data from workshop deliberations – permissions by MTA*

5.7.5 Phase 5: Development of Platform Artefacts

Key Questions: Is the desired platform feasible for development and implementation? Can my firm afford to contribute to its development and implementation? What will be my roles and responsibilities and who can I partner with to complete my part successfully? The final phase for which we observed and collected data on in the IOP development process, was the early-stage development of artefacts. At this phase, design groups had coalesced at design and governance phases, structuring the collective group into several sub-groups that were loosely connected by the endeavour to create and overall IOP ecosystem. The sub-groups made initial steps in developing the components of the platform for which they were assigned roles and responsibilities (see Table 18, p.99).

This phase faced another commitment challenge, this time it was about sustaining participation in the development and implementation of various artefacts of the platform. Realities of the resources

that were required and needed to be expended were becoming more pronounced, particularly when experts were called to participate in a 1-12-month long innovation incubation hub dubbed "tourism lightning lab." At the innovation hub, significant staff time from participants in each sub-group was required in order to ensure that prototypes and experiments with data systems and models being developed were fruitful. Thus, organisations at this stage were now required to commit significant resources such as their staff time and skills to develop some aspects of the platform's core technologies. A key challenge here was that roles and responsibilities were not equally distributed, and some organisations, particularly the smaller operators, were clearly underrepresented. Thus, whilst some firms were interested in working on specific parts of the platform that were aligned to their businesses whilst others had limited resources to contribute. The MTA needed to organise them in a way that would enable each one to contribute.

Another observed dynamic here is that as prototype development started, new entrants, third party developers, innovation consultants, and technology vendors began to join the sub-groups, either by invitation from MTA, or from the participants in the sub-groups. Organisations were using their own internal networks to invite key experts to participate (see Table 18, p.99). This was an interesting development in that it showed how the structuring of collective designing into smaller focused groups led to specialisation and also attracted third parties. This set the future platform in good position to generate both direct and indirect network effects.

5.8 Summary

This chapter provided descriptive findings on the range of options (i.e., in designing architecture, governance, value systems, openness & control, etc.) faced by members of the collective during IOP development **(RQs1-4)**. This includes descriptive discussions and illustrations of the outcomes (e.g., the architecture that was developed, the governance option that the group gravitated towards, and why). Additionally, the chapter discusses contextual issues such as heterogeneity of resources and interests, and coopetitive dynamics that came up in design activities **(RQ5)**. We have followed the advice by Pettigrew (1985), to start off by to using descriptive contexts to reveal nuances and subtleties that support process analysis, which follows in the next chapter. At the end, we provided an overview of the platform development journey that sets the scene for Chapter 6, which goes into detail in uncovering processes and practices in IOP development.

Table 18: *Case data on sub-groups for data design & technology development*

Development Area	Objective	Gap covered	Development groups: Members (in bold) and Partners
Tourism Administrative Data Tool	To understand the quality and usability of emerging and existing methods of administrative data as a quality input for the tourism insight system.	There are fragmented examples of where the tourism industry has utilised this data (e.g., the now defunct Voyager product by Qrious). There are also examples of government agencies using this data for their insight projects (e.g., commuter flows project by Ministry of Transport)	- Adara (Global) - DataMine (2 degrees) - MarketView - Qrious - RoadTrippers (GeoZone) - **Statistics New Zealand** - Venture Southland
Business benchmarking	To create measures on the sector level profile of businesses to gain an understanding of metrics such as profitability, staff capacity and visitor volumes. To have a consistent standard for data sharing of government and private sector that can be integrated to meet insight gaps in business level intelligence.	Some sectors such as Hotels are relatively well serviced in this area. For example, those that provide data for the monthly TIA Hotels survey, receive regional comparatives on variables such as Occupancy Rate (OR), Average Daily Rate (ADR), and Revenue Per Available Room (RevPAR). There is a massive gap in this area for other sectors (e.g., other forms of accommodation, activities, and transport operators).	- **Hospitality NZ** - MTA - Regional Tourism NZ - Waikato University
Domestic tourism (Development of the DGiT Tool)	The International Visitor Survey (IVS) captures a range of information on the travel behaviours and characteristics of international travellers although this is lacking for domestic visitors, even though this is a larger group.	There has been a massive gap in understanding domestic visitor market since the decommissioning of the MBIE run Domestic Travel Survey in 2012. While comprehensive proprietary information exists through the Automobile Association (AA) Traveller, the industry only has access to the DGiT tool which provides segmentation level information.	- Automobile Association (AA Traveller) - **MTA**
Global Trends (Development of Tourism Economics & Global Market Share)	To understand New Zealand's competitiveness in terms of number of visitors and value of visitor's market share. This would be broken down by geographical and other market characteristics (e.g., FITs *vs.* tour groups) Understanding global trends such as technology development, threats, and opportunities, to ensure New Zealand tourism products are leading edge in terms of innovation.	Derived from a range of global sources in a fragmented manner (e.g., through UNWTO media releases or reports). There is fragmented global insight currently available, particularly through partners such as PATA. There is no consistent and usable methodology to the wealth of global data and insight available	- Global agencies such as: - Pacific Asia Travel Association (PATA) (*this sub-group had an MoU with PATA to access to the strategic insight suite of products*) - **Tourism Export Council** - United Nations World Tourism Organisation (UNWTO)
Labour Supply (Visa trends and tourism workforce data, including collection of working holiday visa data).	Measures to understand tourism labour force trends and issues. Immigration patterns and modelling Short to long term forecasting of the labour and skills supply mapped to tourism sector organisation and business needs	There are reports/data available on regional employment in tourism, but this is very fragmented. For example, some is captured through MBIE economic reports and private sector economists such as from BERL and Informetrics gather this information which is used for proprietary purposes or policy making by government. There is a lack of integrated data can be used as one source of truth for regions, businesses, and government policymakers to better prepare for the workforce requirements at a macro and micro level.	- **Immigration New Zealand** - Ministry of Transport - Ministry of Business, Innovation & Employment (MBIE) - Private sector economic research houses
Industry & Market-level Data (e.g., International Visitors Arrivals, Demographics, Length of Stay, VFR, etc.)	For decision-makers in business or a local government level to gain a better understanding of market data and use this to plan and cater for these markets. Make better use of the data available and package into a useful tool for the industry to access.	The approach is fragmented but the information produced across government is useful, for example the International Visitor Arrivals reports produced by TNZ and the TNZ market reports	- Auckland International Airport - Christchurch Airport - Statistics New Zealand - **Tourism New Zealand (TNZ)**
Productivity of Tourism	To comprehensively show how the productivity of a tourist looks like in New Zealand.	There is a fragmented approach to this at present with research available both nationally and globally, however there	- Christchurch NZ - Tourism Info Ltd

Development Area	Objective	Gap covered	Development groups: Members (in bold) and Partners
	To show near real-time value of tourism to businesses in specific regions To illustrate how tourism expenditure reduces the subsidies required to maintain essential public services e.g., transport, arts, and culture services	is no common approach to solving the productivity research problem. This is a relatively new area that needs further exploration to better understand these angles of the tourism productivity argument. Tools needed here should focus on data aggregation, analytics, algorithms & models, and machine learning.	- **Ministry of Business, Innovation & Employment (MBIE)** - Statistics New Zealand - University of Otago - Victoria University of Wellington
Regional Accommodation breakdown	An accurate measure covering non-commercial as well as commercial accommodation to assist regional planning	A chronic lack of accommodation sector information, particularly in the non-commercial/ emerging accommodation types. Some regions reporting that the core commercial accommodation market is only 10% to 20% of their market.	- Bed and Breakfast Association of NZ - **Hospitality NZ** - MTA - Statistics New Zealand (Commercial Accommodation Monitor) - West Coast Air BnB Association
Regional tourism economic activity including GDP and employment	To provide insight on how tourism really works with regional economies, ideally to express tourism impacts in comparison to other aspects of regional economies.	Persistent lack of understanding on how tourism works in regional economies. Gross expenditure numbers are a crude proxy, whereas GDP value-added and employment data a significantly more useful, especially if produced by a standardised methodology.	- **Tourism Info Ltd** - Standards New Zealand (SNZ) - Tourism Bay of Plenty
Short-term visitor demand forecasts	To use real data, such as airline and accommodation booking data, to provide solid insight to industry on demand levels to assist business planning and destination management.	MBIE forecasts serve to provide for a medium to long term outlook, but systematic assessment over the short term is absent, even though various data sources exist and could be used. Short term predictive models are needed.	- **Air New Zealand** (they have their own set of forecasts which need to be tested further for applicability for use by the industry via the platform). - Amadeus IT Group - Immigration New Zealand (already releases Visa data from China on a regular basis). - MTA
Sustainability	To provide measures across all 4 Tourism Sustainability Commitments (TSCs) strands of work to better inform policy and business decision-making.	Apart from global and some national level research (e.g., mood of the nation), there is very little data available on sustainability. This is particularly true at a regional or sub regional level. For a start, a tool for TSC data measurement is needed.	- **Department of Conservation** - Dunedin City Council - Ministry of Transport - NZ Cycle Trails - Real Journeys - Regional Tourism Organisations
The economics of operating sustainably	To build a body of evidence that participating in the Tourism Sustainability Commitment contributes positively to the success and sustainability of tourism businesses	A relatively new area in New Zealand however there may be global studies that could be drawn on.	- **Tourism Export Council** - Pacific Asia Travel Association (PATA)
Tourism flows	To understand visitor movements around New Zealand to assist business planning, and destination management and marketing.	Chronic lack of insight of visitors within New Zealand – where, when, activities, mode of travel etc. No systematic approach	- Adara (Global) - DataMine (2 degrees) - **Lincoln University** (previously assigned to examine tourism flows post the Kaikoura earthquake) - MarketView - Qrious - RoadTrippers (GeoZone) - Venture Southland (South Island Visitor Flows Project)
Tourism role in creating value	To provide insight into how tourism creates value for the New Zealand economy.	While we have a good understanding of tourism expenditure, contribution to GDP and employment, the dynamic of how it creates value or wealth is less well known and yet is vital to managing the tourism system	- Not assigned yet (at the time of data collection)
Visitor Satisfaction	To provide a deeper understanding of international and domestic visitor satisfaction levels, including areas of dissatisfaction and expectations met.	Well reported at a high level but lack of understanding of satisfaction levels between regions and visitor profiles.	- AA Traveller (domestic) - AB & Associates (Visitor Insight Programme) - **Tourism New Zealand** (Visitor Experience Monitor)

Table 19: *Challenges, goals & value expectations by participating organisations.*

Sector	Organisation	Challenges	Business Goals	Expect to share	Expect to gain
Accommodation Sector	**1.** Bed and Breakfast Association NZ	Lack of capacity and capabilities to generate needed data and insights	To access consistent, timely and regular data as well as analytics capabilities for forecasting	Accommodation Insights	Broader Accomo. Data from other Actors
	2. Hospitality NZ	Disparate data sources with unreliable and inconsistent statistics	To understand the market trends, make forecasts, and provide latest insights to members	Resources to help tourism services business operate efficiently and in line with NZ law and regulations. This includes data on employment contracts, position descriptions, disciplinary schedules, licensing of products and services, remuneration surveys etc.	-
	3. Youth Hostel Association of New Zealand	Lack of a central place to access comprehensive localised accommodation, visitor trends, and spending data	To understand the market trends, make forecasts, and provide latest insights to members	Accommodation Insights	Accommodation data from other actors
Airports	4. Auckland Airport	Limited data sharing between airports.	To increase airport capacity and customers coming to and through Auckland airport. To market development and customer insights	Can share a large dataset about travellers coming to and through the airport as well as ancillary services at the airport	Visitor flows linked to but outside the airport
	5. Christchurch Airport	Limited data sharing between airports. To contribute data about regional visitor, spend and volumes	To airport capacity and customers coming to and passing through Christchurch airport	Can share a large dataset about travellers coming to and through the airport as well as ancillary services at the airport	-
	6. Wellington International Airport	Limited data sharing between airports.	To increase airport capacity and customers coming to and through Wellington Airport. Market development and customer insights	Owns a large dataset about travellers coming to and through the airport as well as ancillary services at the airport	-
Associations	7. Tourism Industry Association	Various data gaps that impact on the performance of its members	Leadership of the project. Expertise to manage the design and development stages. To identify new clients, offer new business value (e.g., data-based insights) and sustain member participation	Can share existing close ties and networks of its members with other organisations	-
	8. Tourism Export Council	Disparate data sources with unreliable and inconsistent statistics	To market NZ tourism services and products globally. To promote local tourism services globally	Can share existing close ties and networks of its members with other organisations	-
Government	9. Department of Conservation	Limited data about tourism services offered by numerous small to medium enterprises	To promote sustainable tourism and safeguard social license (support host community participation and benefit)	Can provide technical, legal and policy knowledge regarding conservation and sustainable tourism.	Tourism services data offered by numerous small to medium enterprises. Visitor flows (international & domestic).
	10. Immigration NZ	-	To promote government immigration policy. To provide a clear picture of New Zealand's migration trends through graphical illustrations of migration stocks, flows and pathways.	Immigration datasets on international visitor trends and market trends, labour, and economic analyses.	Detailed data on visitor experiences and labour market trends
	11. Ministry of Business Innovation & Employment	Lack of a unified national ecosystem of tourism data	To promote government policy and initiatives on tourism, directed at developing the tourism economy	Financial and technical capacity to support the development of a tourism data ecosystem (platform design team)	-
	12. Ministry of Transport	Limited access to third party transportation data from private sector transport private providers	To access to big data on transport services for economic modelling, forecasting, and planning	Transport analytics & intelligence	Transport analytics & intelligence
	13. Statistics New Zealand	-	To distribute national and regional statistics to targeted clients identified through the platform.	Various government generated statistics. Statistical capabilities through staff and technological tools.	-

Sector	Organisation	Challenges	Business Goals	Expect to share	Expect to gain
	14. Tourism New Zealand	Overall data challenges presented by firms in the tourism sector in NZ	To market New Zealand tourism services and products internationally. To promote NZ as the best tourism destination	Financial and technical capacity to support the development of a tourism data ecosystem (platform design team)	Industry level data and insights
	15. Hospitality New Zealand	Lack of comprehensive domestic tourism data	Assisting more than 2400 hospitality operators across the country with business needs and capabilities	Various data from hospitality operators	Accurate / Consistent / Synchronised data
Local authorities	16. Queenstown Lakes District Council	Access to more accurate predictive analytics about visitor flows	To promote sustainable tourism and safeguard social license (Support host community participation)	Data about infrastructure use (roads, water, electricity)	-
	17. Wellington Regional and Economic Development Agency	Lack of comprehensive data about small businesses and their data related concerns	To promote tourism economic activities, particularly in small businesses in and around the Wellington region	-	-
Local tourism organisations	18. Christchurch NZ	Lack of reliable and consistent data about visitor volumes and spending in the region	To grow the tourism businesses in and around the Christchurch region	Economic Models for Analysis	Visitor Flows and Domestic Tourism Data
	19. Destination Kaikoura	Disparate data sources with unreliable and inconsistent statistics	To promote Kaikoura as a destination of choice to both domestic and international visitors	-	-
	20. Hamilton and Waikato Tourism	Disparate data sources with unreliable and inconsistent statistics	To promote Hamilton and Waikato as a destination of choice to both domestic and international visitors	-	-
	21. Regional Tourism Organisations NZ	Disparate data sources with unreliable and inconsistent statistics	To promote networking and engagement between various RTOs. To generate insights from the platform for RTOs	Regional Tourism Trends (visitor/spend)	Accurate and consistent regional reporting
	22. Rotorua New Zealand	Disparate data sources with unreliable and inconsistent statistics	To promote Rotorua as a destination of choice to both domestic and international visitors	-	-
	23. Tourism Bay of Plenty	Disparate data sources with unreliable and inconsistent statistics	To promote Bay of Plenty as a destination of choice to both domestic and international visitors	Visitor Flows Spend and Experiences	Regional and National Benchmarks
	24. Nelson Tasman Tourism	Disparate data sources with unreliable and inconsistent statistics	To promote Nelson and Tasman as a destination of choice to both domestic and international visitors	Visitor Flows and Experiences	Regional and National Benchmarks
	25. Venture Southland / Great South	Lack of accurate and consistent data about tourism spending in the region	To promote Southland as a visitor/tourist destination of choice to both domestic and international visitors	-	-
Museums	26. Museums Aotearoa	-	To understand audience experiences and develop new or improve current services	Visitor Experience and Cultural Data	Audience Experiences to map contribution
	27. Te Papa Museum	-	To understand audience experiences and develop new or improve current services	Audience Insights & Experiences	Audience Experiences
Private sector corporates	28. AB & Associates	Opportunity to target data services needing data analysis, insights, and data reporting	To promote corporate brand and sell analytics and insight services. To identify new clients	Analytics Intelligence	Big Data
	29. Tourism Info Ltd	-	To promote corporate brand and sell data analytics services. To access big data. To identify new clients	-	-
	30. Horwath HTL Ltd	Lack of access to big data on tourism from private and corporate entities	To promote corporate brand and sell data analytics services. Also, to access big data. To identify new clients	Tourism big data	Analytics Intelligence & Other Big Data

Sector	Organisation	Challenges	Business Goals	Expect to share	Expect to gain
	31. Tourism Holdings Limited (THL)	-	To promote corporate brand and sell data analytics services. Also, to sell big data. To identify new clients	-	-
	32. WETA Workshop	-	To promote products services and understand audiences	-	-
Restaurants	33. Restaurants Association of NZ	-	To offer improved business value to clients and sustain member participation and collaboration	Customer spending data, customer preferences, trends, and experiences	Accurate data on accommodation bookings & visitor flows and spending in specific regions
Visitor experience providers	34. Canyon Swing	To understand trends in the targeted market segment,	To understand trends in the targeted market segment, attract more clients and compete with rival providers	Forecasting and client experiences	Regional flows on spend and time
	35. HH Tours	Limited access to visitor/tourist experiences from competing services	To understand visitor/tourist experiences and provide new/improve existing services. To provide tailor made tourist services.	-	-
	36. NZ Cruise Association	-	To identify new clients, offer new business value (e.g., data-based insights) and sustain member participation.	-	-
	37. NZ Cycle Trails (NZCT)	-	To promote sustainable tourism, social license, and conservation. To support host community participation and inclusive benefits.	Mapping out tourism journeys	Conservation, accommodation, and domestic data
	38. Real Journeys NZ	-	To understand trends in the targeted market segment, attract more clients and compete with rival providers	Capacity, Growth and Experiences	Regional flows on spend and time
	39. Skyline	-	To understand trends in the targeted market segment, attract more clients and compete with rival providers	Customer Experience Data	Regional flows on spend and time
	40. Aotearoa Ziptrek	Limited access to rival competitor data about tourism spend (e.g., time) and experiences	To understand trends in the targeted market segment, attract more clients and compete with rival providers	Customer Experience Data	Regional flows on spend and time
Transportation	41. Air New Zealand	-	To access rich data about market trends, customer experiences and possible new routes	Aggregated customer insights from both domestic and international travel	Accurate domestic travel data
	42. InterCity Group NZ Ltd	Limited spending data from adjacent services which limits their view on customer spend	Promote road transportation to various customer segments. To understand passenger experiences, improve service delivery / create new services e.g., new routes.	Domestic Travel Insights (aggregated)	Air Travel Data & Tourist Definition
	43. KiwiRail	Do not have precise data about the value generated by their services through tourism spending (provided by numerous actors)	To promote rail transport to customers accessing tourism services offered by other participants in the project	-	-
Universities	44. University of Otago	-	To access big data for research. To provide technical advice to the project team.	Modelling and Analysis Intelligence	Tourism Big Data
	45. Victoria University of Wellington	-	To access big data for research. To create university-industry link and to provide technical advice	Technical expertise and support	Research data and access to industry networks (organisational connections)
	46. Weltec	-	To access big data for research. To create college-industry link	Technical support and support	Research data and access to industry networks (organisational connections)

Chapter 6: Findings & Insights on Collective Action

Uncovering Processes & Practices in IOP Development

Organising is a process; an organisation is the result of that process.
— Elinor Ôström, Governing the Commons

This chapter examines how IOP development processes that occur through collective action unfolds. It addresses two research questions: **RQ6:** ***(a)*** *How does an IOP development process involving multiple organisations working together through collective action unfold?* ***(b)*** *How is management practised in the process of IOP development that happens through collective action?* Case data made it possible to trace and reconstruct key events, activities, and actions in the project (see Table 21, p122). To make sense of all the activities, actions, and events in the project, main processes were identified, described and examples given. A descriptive table with a timeline of key events was also produced (see Table 21). Six key process models were developed that depict key domains in IOP development in the case. These are: (i) setting strategic goals and priorities; (ii) designing a value system; (iii) setting up a leadership panel; (iv) selecting and designing technical standards; (v) designing a governance model; and (vi) architecture design. Each process model illustrates and highlights structural changes and progress toward resolving issues pertaining to each domain. It shows how strategic management & leadership were practised to facilitate the coordinated actions and activities amongst distributed and disparate actors pursuing self-interests. Key insights were derived from examining these processes, such as how collective designing is practised, as well as the critical thresholds needed to drive development processes (a critical mass phenomenon which is fully explored in ***Chapter 7***).

6.1 Process Concepts of Activities in IOP Design

In order to (re)construct and explore the progressive structure of processes in the collective design of the IOP, **17** process concepts of activities carried out by members and the MTA were identified (see Table 21, p.122). Theoretically, identification of these process concepts was interesting not only because it developed new 'process grammar' (Lee, Wyner, & Pentland, 2008; Pentland & Rueter, 1994) in collective action, but also because this process perspective is seldom investigated in collective action at all. The process concepts describe activities of *collective organising* practised in IOP development. By organising the process activities into goal-oriented and domain specific process models (e.g., setting strategic goals or and designing technical standards see ***Sections 6.2.1-6.2.6***), this research illustrates the set of practices that underpin collective action. For instance, it shows when management practices such as coordination of members was necessary, and when self-organisation was more effective (e.g., compare Figures 16 & 17).

Process activities and models also show the thresholds needed to reach decisions and propel collective design processes.

The following sections unpack the process analysis, starting by providing a description of the **17** process concepts. All definitions, descriptions and examples were derived from case data. This is followed by illustrations and explanations of the process models and insights gained.

6.1.1 Aligning

Aligning was the action of giving support by coaching and resourcing members, to ensure that they can meet targeted goals. The MTA, as the leading organisation in the project, often needed to make sure that roles, duties, and responsibilities were linked to members with matching resources, capabilities, and interests. To achieve this, the team from MTA provided guidance, coached members, and assigned responsibilities. For example, members were organised into sub-groups to work on different aspects IOP architecture design – organisations such as large corporates, airlines, and airports worked on more challenging aspects such as designing how infrastructure and core processing systems would be configured, whilst smaller tour operators focused on 'lighter' roles such as app design for data formats and API management systems (fully discussed in ***Section 5.2***).

6.1.2 Coalescing (of actors)

Coalescing was the action of group aggregation that occurred after activities of divergence such as nesting (nesting is described below). It helped to maintain cohesion amongst the distributed members. Case data shows that coalescence was at the centre of collective organising. After going through activities of divergence, such as nesting into sub-groups, members needed to coalesce again by banding together as one group, to discuss and compare notes on goals, progress, and courses of action, and to iron out contentious issues. Coalescence thus maintained group identity even after multiple divergence exercises.

6.1.3 Committing

Committing was the action of taking responsibilities, obligations, and partaking in activities that showed support and attachment to the collective action endeavour (see Figure 28, p.135). This was observed when members took duties and responsibilities that expended their resources to support specific activities in the project. Commitment was also observed when members continued to support the project despite seeing other members exiting (see Table 21 p.122). Such commitment was observed after key decisions were made during the project often requiring members to show support. For instance, this was observed

when strategic goals and priorities were set, when funding commitments were made, or when secondment was needed to support ratification of resolutions and agreements on governance (see Table 21, p.122).

6.1.4 Coordinating

Coordinating involved building commonalities between disparate member goals and resources, ensuring that the collective group could take advantage of complementarities and matching between purposes, actors, and resources available for each decision. MTA achieved this by facilitating the holding of meetings, workshops, and other forums that enabled members to carry out deliberations and design activities. Assigning responsibilities to members ensured that commitments were carried out and thus propelling the design process forward. MTA also facilitated workshops for designing platform architecture and fielded a design team that actively took part in assigning responsibilities. This ensured that sub-groups intermingled with each other. At times, deliberate coordination by the MTA was not present, yet case data shows that members continued to coordinate and self-organise themselves (see Figure 18, p.115). This appears to support previous observations that highlight the importance of *absence* in coordinating activities (c.f. Jarzabkowski, Lê & Feldman, 2012) and demonstrates how experiencing absence can lead groups to self-organise. It also points towards activities that require more deliberate coordination through strategic management (e.g., setting strategic goals or developing a leadership panel, see ***Sections 6.2.1 & 6.2.3***), and those that may benefit from non-deliberate coordination that emerges out of self-organisation (this was observed in the process of designing a value system for the IOP, see ***Section 6.2.2***)

6.1.5 Deciding

Deciding was the action of choosing courses of action. In order to select courses of action at various stages in design processes, members needed to make choices by deciding. This was preceded by sensemaking activities or deliberations (see Figures 17-21, p.114-119) that enabled members to make informed decisions when faced with a range of options such a multiple governance models (e.g., see ***Section 5.3.1***), different design solutions, or multiple standards. It culminated into a choice-making exercise such as ranking, prioritising (see Table 16, p.93), or voting (for example see Figure 15, p.97). For members, these choice-making activities were a key point at which they could exit if they did not agree with key decisions or show commitment by providing continued support.

6.1.6 Deliberating

Deliberating was the action of undertaking long careful discussions and considerations in which members compared and debated alternate solutions or courses of action *on a specific issue*, often preceding

decision making or design activities. Examples of specific issues that were deliberated on include: (i) data format standards to choose amongst a host of options, (ii) whether to opt for a peer-to-peer infrastructure architecture or one that is supported by a centralised host, or (iii) debating the benefits and drawbacks of different governance models before deciding on which one to vote for (e.g., see ***Section 5.3.1***; Figure 15, p.97). Deliberation activities were thus different from sensemaking activities in that whilst sensemaking involved several issues – deliberations were centred on a specific issue.

6.1.7 Designing

Designing was the action of creating plans, concepts, and models that translate imagined ideas into representations that can be used as a basis for developing the platform. Designing activities were carried out at various workshops. Designing was used for such purposes as to create concept maps, visual illustrations, and models of the IOP, such as designs for its infrastructure, architecture, value system, and governance. Both free-hand drawings and formal rule-based illustrations were created by members, translating their cognitive visions into explicit models that could be evaluated by others. For example, members modelled architecture designs by drawing visual illustrations (Figure 13, p.96) and made concept maps of value systems (Figure 9, p.77). This activity of making visual illustrations was a design practice that helped to identify 'cognitive distances' between members regarding their expectations of various design components. For instance, there were very different mental representations of envisioned platform such that when each of the representatives of the participating firms were asked to draw illustrations of what they envisioned as the overall architecture of the platform, they came up with very different diagrams that represented their mental pictures (see Figure 13, p.96). Thus, designing also helped to understand the different technology frames that members had about the overall platform configuration, technical restrictions on access, structure, and content of data output as well as the technical standards that would be followed (the concept of *technology frames* is fully explored in ***Chapter 8***).

6.1.8 Exiting

Exiting refers to the formal termination of participation by one or more members of the collective. Members leaving the collective group often preferred to become 'non-members' but remain affiliated with MTA in other projects. Exiting often occurred after key decisions were made, for instance, after the adoption of priorities and strategic goals, or the ratification of a new governance model (see Table 21, p.122). Exiting was important in determining which members remained committed and those that would otherwise free ride had they not had a chance to leave.

6.1.9 Formalising

Formalising refers to the action of officialising decisions made into recognised resolutions and agreements that are endorsed by members of the collective. The goal of formalisation was to preserve agreed decisions and references to those agreements as precedence for future decision making. In such a highly variable and heterogenous project, formalisation promoted both 'concretisation' of choices made, and standardisation of behaviour. Formalisation was also used to define tacit concepts so that they were formally adopted by the group, to concretise arrangements, and to create definitive structures in the collective group so that roles and responsibilities were less ambiguous. For instance, without formal definitions of key terms in such a highly heterogenous group of organisations, there was a risk that members would have widely different interpretations of technology elements (e.g., different interpretation of data, value, or the platform itself). Similarly, without formal ranking and ratification of priorities members were likely to have unresolved assumptions about priorities that the project should focus on.

6.1.10 Identifying

Identifying was the action of locating where and establishing what information is available, and who has access to or ownership of it. Often the initial activity in all the processes, identifying actions occurred when members sought to gain information such as: who was interested in a specific component, what where the lists of goals for all participating members (for example, the *List of Goals & Expectations* presented in Table 19, p.101), or inventorying data systems used by members. At basic level, identifying activities were about finding and gathering necessary information for sensemaking and at times deliberating (see "Sensemaking" on p.109 for disambiguation of the two activities).

6.1.11 Integrating

Activities of integration occurred when members connected different components of technology to show how they could work together seamlessly. Design activities were carried out at component level, and integration was important to ensure that all the different components could be connected. Integrating also included the synthesis of design models, electing those that were 'best of the breed' into the overall design for the IOP.

6.1.12 Joining

Joining involved the formal entrance of an organisation to become a member and part of the collective. Members joining the collective group often needed to formally register to indicate their

membership, which was confirmed with a letter of acceptance from the MTA. Whilst **15** members joined at the beginning of the project, other members joined in later stages (see Table 21, p.122). The joining of larger corporates and government departments was crucial in generating a critical mass needed to sustain the project over time (critical mass is fully discussed in ***Chapter 7***).

6.1.13 Motivating

Motivating was the action of promoting specific courses of action or attracting members to support specific objectives. MTA was involved in encouraging members to participate, showing them the benefits of participation, and providing coaching services to ensure that each member can contribute. Close analysis of processes observed from case data shows that motivation was needed, not only when commitments had to be made to concretise decision reached earlier, but also to encourage members to participate in deliberations, and formalise all agreements made (see Figures 17, 19 & 21).

6.1.14 Nesting

Another observed collective action activity was nesting. 'Nesting' in this sense refers to the partial decomposition of the larger collective into smaller, specialised, and semi-autonomous sub-groups. It went beyond simple division of the larger collective into smaller sub-groups. All nests inherited the same main challenge albeit working semi-autonomously on unique and more specific data and technology design challenges (see Figure 16, p.110). For instance, one sub-group worked on developing a tool understanding domestic visitor market[11], whilst another worked on global trends to create a consistent tool for accessing data derived from a range of global sources (e.g., through UNWTO media releases or reports). See a full description of all nested groups and the areas they worked on in Table 18 (p.99). These two sub-groups worked as different teams within the broader nest of the collective's endeavour to build a field level IOP for tourism data in New Zealand. Thus, although specific aspects of the platform were designed by multiple sub-groups, they were all inheriting the same challenge – trying to collectively develop an IOP for tourism data services and resources, and they all in the end coalesced into this one main platform. This system of nesting facilitated loose connections that supported specialised interest groups, attracted innovators to those groups (see Table 18, p.99), and balanced participatory process by aligning complementing institutions together. This illustrates Öström's observations about collective organisation – that collective groups evolve into poly-centric institutions organised in multiple nested layers (Öström, 2010, p.653; Figure 16 p.110).

[11] There was an information gap since the decommissioning of the MBIE run Domestic Travel Survey in 2012

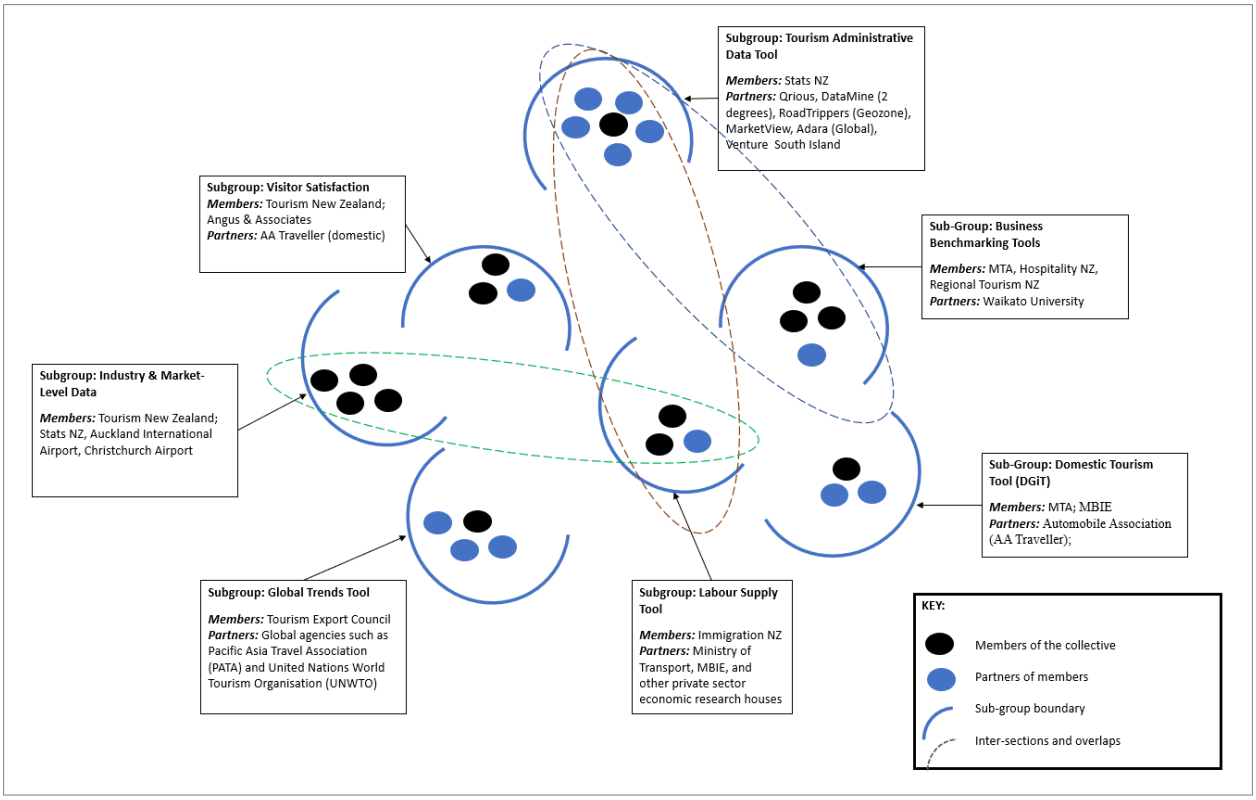


Figure 16: *Sub-group organisation & nesting in collective action*

Source: *Created by author based on case data*

6.1.15 Networking

Networking was used to widen the circle of the collective group and its partners such as third-party developers and vendors. Members used networking to discover ambient opportunities (e.g., key experts in the tourism data space), increase industry awareness about the IOP development project, and to keep abreast with data related trends in the tourism space. For example, members regularly attended the TRENZ – the most significant business-to-business tourism event in New Zealand, which attracts over 1500 delegates including tech innovators, vendors, sellers, buyers, media, tourism industry leaders, and top government representatives[12].At the conference, members had ample opportunities to connect, network and secure contracts with tech developers & innovators. Thus, networking helped to build the relationships needed to work on technical aspects of the platform, catalysing development efforts for the IOP.

[12] https://trenz.co.nz/about/

6.1.16 Prototyping

Prototyping was the action of creating and testing early versions of technology artefacts. Members engaged in experimental processes where sub-groups on data design and technology development (see Table 18, p.99) translated concepts and models into artefacts. A twelve-month incubation programme that housed various sub-groups was used for the groups to experiment, build, and test prototypes of varying degrees of fidelity, capturing the design concepts that had been debated and deliberated on earlier. Incubation enabled agility by setting short goals and an intensive and competitive environment. Some sub-groups worked outside of the incubation programme, setting development teams that cut across organisations and developing prototypes by partnering with third-party developers and technology vendors. For instance, Air New Zealand working with Immigration New Zealand and partnering with Amadeus IT Group (see Table 18, p.99), developed a tool for predicting short-term visitor demand. The tool was expected to use real-time data, such as airline and accommodation booking data, to provide solid insight to industry on-demand, and to assist business planning, and destination management. What was observed here is that, unlike previous suggestions that collective groups may find it difficult to be agile and to organise very large IT projects, it was possible to create conditions for agility by coordinating members into (i) nested groups, (ii) using incubation programmes and (iii) enabling semi-autonomous and more specialised teams to engage and attract third party innovators.

6.1.17 Sensemaking

Sensemaking was the action of actively and collectively constructing meanings by members. Sensemaking activities occurred at the start of all processes – as a means to understand heterogeneous elements (interests, goals, expectations, resources etc.) and to collectively construct meanings of what the existing challenge was and how it may be dealt with. Therefore, sensemaking went beyond just interpreting what the challenges were, but also, actively, and collectively constructing meanings by members. This involved consulting, assessing, reading, discovering, and constructing agendas based on available information. For example, members spent time reading and making sense of Discovery Reports I & II to understand the various goals, interests and offers brought by other members to the collective endeavour for developing the IOP. Sensemaking also helped members to develop common understanding and language in defining terms especially in such a technically dense subject of IOP design involving many technical terms used very differently between professionals in disparate organisations.

Table 20: *Summary of process concepts and examples from the case*

Process concept	**Description of activities & actions**	**Examples from the case**
1. Aligning	finding commonalities, complementing, matching	When members where organised into sub-groups according to their capabilities, interests, and complementarities.
2. Coalescing (of actors)	bringing together, forming	The banding together of organisations after activities in sub-groups
3. Committing	taking responsibilities, agreeing, seconding	Agreeing by seconding decisions such as when members committed to the leadership of the ILP
4. Coordinating	facilitating, assigning responsibilities	When MTA facilitated workshops for designing platform architecture and fielded a design team that actively took part in assigning responsibilities and making sure that sub-groups intermingled with each other.
5. Deciding	voting, choosing, ranking, ratifying	Determining or choosing a solution, for instance, by ranking priorities (Table 16, p.93) or voting on multiple options leadership options (Figure 15, p.97)
6. Deliberating	discussing, comparing, debating	Members debating the advantages and disadvantages of different governance models before deciding on which one to vote for (e.g., Workshop II)
7. Designing	drawing concept diagrams, visual illustrations, modelling	When members modelled architecture designs by drawing visual illustrations, or when they made concept maps of value systems (see Figures 9, p.77 & Figure 13, p.96)
8. Exiting	exiting	Members leaving the collective group
9. Formalising	defining, concretising, registering	When organisations registered as formal members of the collective or when they approved the list of priorities as official goals of the IOP.
10. Identifying	identifying, listing, inventorying	For example, the *List of Goals & Expectations* presented in Table 19 (p.101)
11. Integrating	converging, merging, synthesising (applies to artefacts)	Bringing together various subgroups design models for a data repository into one stable model that fits with the platform architecture
12. Joining	joining	Members joining the collective group
13. Motivating	promoting, attracting	Encouraging members to participate, showing them the benefits of participation, and coaching services to ensure that each member can contribute
14. Nesting	splitting, creating sub-groups	Members splitting into smaller groups to work on specific objectives. For instance, when they split to work on different components of platform architecture.
15. Networking (of actors)	socialising, connecting	When members networked and secured contracts with tech innovators and third-party developers at TRENZ, a premier tourism event in New Zealand.
16. Prototyping	building, experimenting, testing	When design teams developed experimental products in innovation incubation programmes
17. Sensemaking	consulting, assessing, reading, discovering	Members reading Discovery Reports I & II to understand the various goals, interests and offers brought by other members to the collective endeavour.

6.2 Process Models

This section introduces six key process models that were developed from case data. The models illustrate how IOP development processes evolved in key areas such as (i) setting goals and priorities; (ii) designing a value system; (iii) setting up a leadership panel; (iv) selecting and designing technical standards; (v) designing a governance model; and (vi) architecture design. The process models highlight key activities carried out at each stage of development and how they were interconnected. They also show how strategic management & leadership were practised to facilitate the coordinated actions and activities of distributed and disparate members. Key insights derived from examining these processes are discussed in ***Section 6.3.***

6.2.1 Setting Strategic Goals and Priorities

The intent for collective action was to develop a data and resource sharing IOP in the tourism sector. While many platforms have been initiated by technology providers who retain their identity as software companies rather than members of the industries they are working in, MTA and its collective group opted a consortium type of arrangement that was industry-led through an elected leadership panel. Technology vendors and third-party developers were welcome as partners rather than members of the collective. It was thus an incumbent driven, rather than an entrant or third-party driven platform initiative.

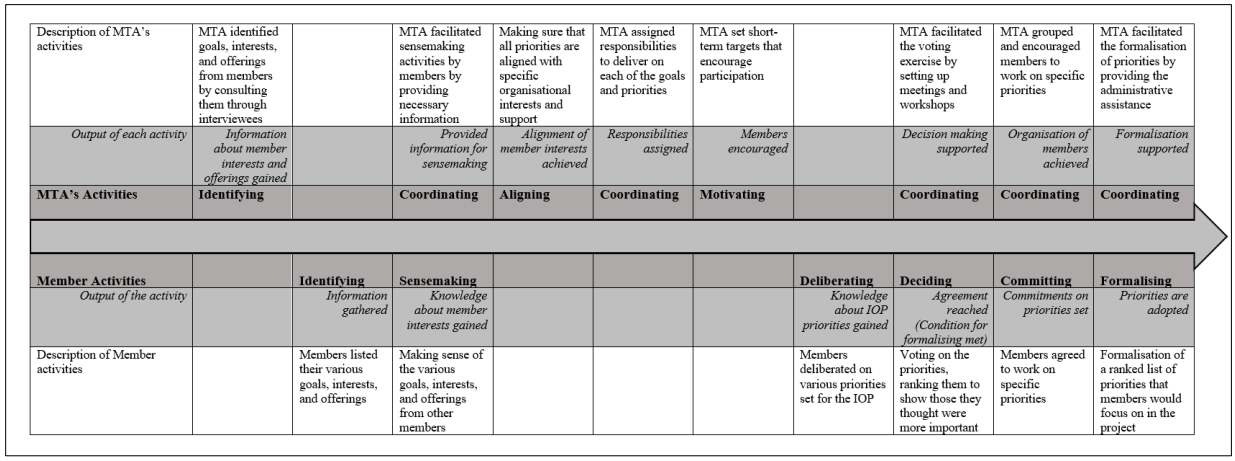
There were noticeable credibility advantages to this provider-led consortium approach. For instance, it meant that the key players also had a common understanding of the challenges and opportunities in the industry. This was important in setting up goals and priorities for the IOP. Despite credibility advantages, provider-led platform consortia typically follow a slower pace of platform development given the complexity of consensus building and the hurdles in coordinating the resources from disparate organisations (de Reuver et al., 2015; Markus & Bui, 2012; Steinfield et al., 2005). In this case, the collective group moved at a relatively faster pace considering that they moved from setting goals and priorities to developing prototypes within a the two-and-half year period in which we observed the IOP development processes (see Table 21, p.122; Figure 24, p.121).

As there were too many different value expectations (Table 19, p.101), MTA conducted further industry consultations, visiting each of the 46 represented organisations. In these consultations, chief executives, senior management, and data experts were asked about their data priorities in the future platform. At this time, a parallel activity was also occurring in the industry, with the Ministry of Business (MBIE) holding Tourism Data Domain Plan (TDDP) workshops across the country at which data priorities were also discussed. These two streams of work resulted in a compilation of various data priorities for the platform. Having consulted firms individually during the development of the priorities, MTA decided to hold a panel meeting that would bring together representatives of the firms into one room to deliberate on

and compile a general list of priorities for the IOP. Deliberations at the panel meeting culminated into a voting exercise, which resulted in a general list of data priorities for the platform (see Table 16, p.93). These priorities were to be used as a guide in future deliberations about platform design and governance.

In order to set goals and strategy collaboratively, the MTA needed to not only consider members consider the interests and barriers at industry or 'collective' level, but also the internal motivations of individual members (e.g., influential stakeholders). To achieve these, coordination and alignment activities involving coaching of members and assignment of responsibilities were carried out by dedicated team from MTA. They worked as 'boundary spanners' of the inter -organisational relationships within the collective. To achieve this, they facilitated workshops and meetings at which multiple forms of interaction were promoted to ensure that the views of all members were aired and discussed.

Goal and priority setting therefore required (i) an understanding of the inter-organisational dynamics within the collective, and (ii) a holistic view of member interests from the internal perspective of their respective organisations, and (ii) strategic management of emergent interactions between members and the collective group.



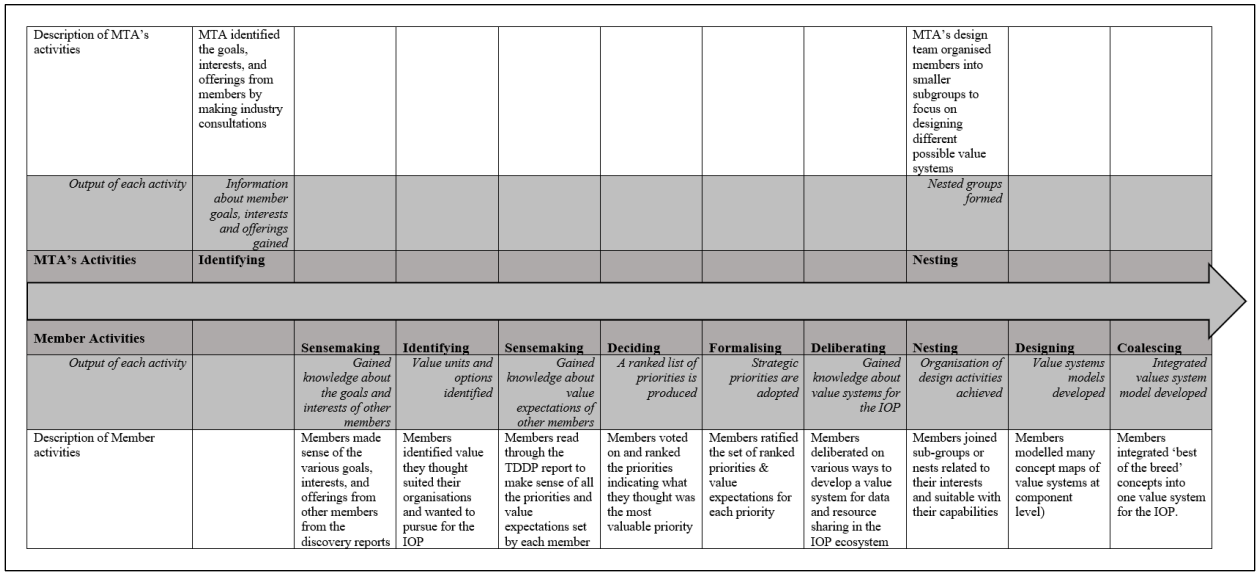
Description of MTA's activities	MTA identified goals, interests, and offerings from members by consulting them through interviewees		MTA facilitated sensemaking activities by members by providing necessary information	Making sure that all priorities are aligned with specific organisational interests and support	MTA assigned responsibilities to deliver on each of the goals and priorities	MTA set short-term targets that encourage participation		MTA facilitated the voting exercise by setting up meetings and workshops	MTA grouped and encouraged members to work on specific priorities	MTA facilitated the formalisation of priorities by providing the administrative assistance
Output of each activity	*Information about member interests and offerings gained*		*Provided information for sensemaking*	*Alignment of member interests achieved*	*Responsibilities assigned*	*Members encouraged*		*Decision making supported*	*Organisation of members achieved*	*Formalisation supported*
MTA's Activities	**Identifying**		**Coordinating**	**Aligning**	**Coordinating**	**Motivating**		**Coordinating**	**Coordinating**	**Coordinating**
Member Activities		**Identifying**	**Sensemaking**				**Deliberating**	**Deciding**	**Committing**	**Formalising**
Output of the activity		*Information gathered*	*Knowledge about member interests gained*				*Knowledge about IOP priorities gained*	*Agreement reached (Condition for formalising met)*	*Commitments on priorities set*	*Priorities are adopted*
Description of Member activities		Members listed their various goals, interests, and offerings	Making sense of the various goals, interests, and offerings from other members				Members deliberated on various priorities set for the IOP	Voting on the priorities, ranking them to show those they thought were more important	Members agreed to work on specific priorities	Formalisation of a ranked list of priorities that members would focus on in the project

Figure 17: *A process model for setting strategic goals and priorities*
Source: *Created by author*

6.2.2 Designing a Value System

The process shows that MTA had a limited role in designing a value system for the IOP. The MTA kick-started the process by collecting information about the goals, interests, and offerings of each member, and sharing this information with all members. MTA left members to make sense of it, to deliberate, decide, and to formalise decisions on value models that the platform would eventually offer. It would seem that such an 'influence-free' condition was required for the members to 'self-organise' and come up with decisions that satisfy collective interests.

This provides insights into how collective value design processes are managed in IOP development. In value designing for an IOP intended for sharing data services and resources amongst organisational members, there existed unique challenges in trying to address network effects: (i) unlike in traditional consumer platforms, members played dual roles as both suppliers and users of the intended data services and resources, and (ii) there was a limited number of firms (i.e., members of the collective where 46), and potential partners (vendors and third-party developers). This meant that the onus lay on these members (instead of the platform sponsor or provider as is often the case in one-to-many consumer-facing platforms) to determine a value system that worked.



Description of MTA's activities	MTA identified the goals, interests, and offerings from members by making industry consultations							MTA's design team organised members into smaller subgroups to focus on designing different possible value systems		
Output of each activity	*Information about member goals, interests and offerings gained*							*Nested groups formed*		
MTA's Activities	**Identifying**							**Nesting**		
Member Activities		**Sensemaking**	**Identifying**	**Sensemaking**	**Deciding**	**Formalising**	**Deliberating**	**Nesting**	**Designing**	**Coalescing**
Output of each activity		*Gained knowledge about the goals and interests of other members*	*Value units and options identified*	*Gained knowledge about value expectations of other members*	*A ranked list of priorities is produced*	*Strategic priorities are adopted*	*Gained knowledge about value systems for the IOP*	*Organisation of design activities achieved*	*Value systems models developed*	*Integrated values system model developed*
Description of Member activities		Members made sense of the various goals, interests, and offerings from other members from the discovery reports	Members identified value they thought suited their organisations and wanted to pursue for the IOP	Members read through the TDDP report to make sense of all the priorities and value expectations set by each member	Members voted on and ranked the priorities indicating what they thought was the most valuable priority	Members ratified the set of ranked priorities & value expectations for each priority	Members deliberated on various ways to develop a value system for data and resource sharing in the IOP ecosystem	Members joined sub-groups or nests related to their interests and suitable with their capabilities	Members modelled many concept maps of value systems at component level)	Members integrated 'best of the breed' concepts into one value system for the IOP.

Figure 18: *A process model for designing a value system*
Source: *Created by author*

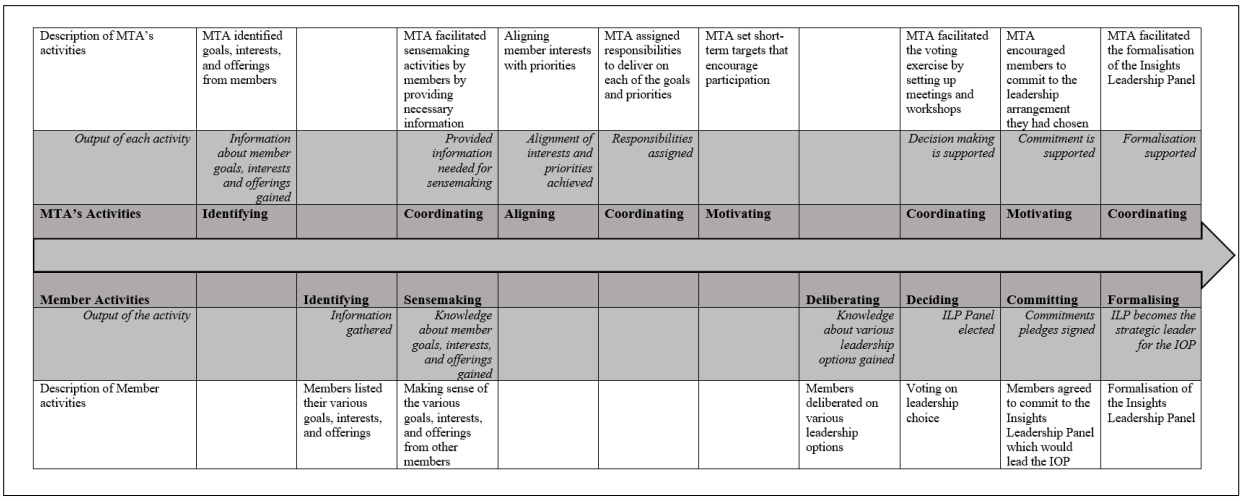
The IOP offered two types of network effects. There were direct network effects between the tourism businesses. The more members that joined, the more value would be gained from benchmarks and trend analysis tools. In the case where direct network effects were minimal, small tour operators stood to gain from using the platform's analytics capabilities for analysing their own trade volumes (e.g., sales). There were also indirect network effects possible from the data consumers (members that primarily used but produced minimal data to share) to the data suppliers (members that primarily produced more data to other members than they consumed e.g., Statistics New Zealand). For suppliers, the value of market-level insights depended on how many 'data consumer' members joined. Without a sufficiently large number of small firms on the platform, the value for suppliers would be low. Hence, the IOP would only provide superior value compared to existing offerings if there was a sufficiently large part of the small tour operators on the platform, allowing for representative market-level insights.

Since the user group of small tour operator firms generated strong indirect network effects to suppliers, the value system model would – by self-organisation – organically subsidise small tour operator firms. Such subsidisation will likely be required since small restaurants, canyon swings, ziptreks, etc., would otherwise not afford premium-priced data analytics solutions. Thus, collective value system design was a self-organisation process in which firms decided which role they played and how much contribution they needed to make for the value system to become functional. This may provide insights into the elusive 'chicken-n-egg' challenge inherent in value design at platform launch – showing how self-organisation can help to deal with it without necessarily expending coordination and leadership influences.

6.2.3 Setting up a Leadership Panel

Whilst IS research often treats platform leadership as a "a less tangible issue" (de Reuver, Nederstigt & Janssen, 2018, p.10), this research shows that resolving the leadership issue was an important process in collective designing. As members of the collective engaged in discovery and sensemaking activities to determine the best leadership for the IOP, the potential sponsor (MTA) of the future platform was heavily engaged in coordinating and motivating members, to convince them that the platform will ultimately win the data-space market in the tourism industry. Those touch points for coordination and motivation in the process of setting up a leadership panel highlighted the importance of building and communicating a coherent vision of the platform, its technology, ecosystem, and market. A key learning observed here is that the future provider of an IOP needs to convince and build a 'coalition of support' around the intended platform. This also explains why the MTA in this case as the leading organisation, needed to set priorities and strategic goals before the leadership panel was formed. Without a clear vision to tell, members of the collective would likely be reluctant to join. Another benefit of stating a clear vision in setting the leadership was that it created a clear-cut path that enabled supporters to stand out whilst those who clearly did not exited (see Figure 18, p.115; Table 21, p.122).

However, having a coherent strategy and vision might be at odds with the uncertain situation of the start-up conditions of collective organising in IOP development. As is discussed in other sections of this chapter (also see ***Chapter 2 Section 2.4***), what constitutes the core of a platform at architecture, governance, and value system level, may shift over time and warrant a different strategic vision than was previously possible with foresight. For instance, industry events may render certain technologies redundant, value leveraging systems may also be of temporary nature. Thus, whilst the process of leadership-setting is, at its core, communicating a compelling vision and strategy towards potential user groups, it needs to be sustained by continuously updating and adapting to the changing circumstances that are characteristic of early stages in IOP development.



Description of MTA's activities	MTA identified goals, interests, and offerings from members		MTA facilitated sensemaking activities by members by providing necessary information	Aligning member interests with priorities	MTA assigned responsibilities to deliver on each of the goals and priorities	MTA set short-term targets that encourage participation		MTA facilitated the voting exercise by setting up meetings and workshops	MTA encouraged members to commit to the leadership arrangement they had chosen	MTA facilitated the formalisation of the Insights Leadership Panel
Output of each activity	*Information about member goals, interests and offerings gained*		*Provided information needed for sensemaking*	*Alignment of interests and priorities achieved*	*Responsibilities assigned*			*Decision making is supported*	*Commitment is supported*	*Formalisation supported*
MTA's Activities	**Identifying**		**Coordinating**	**Aligning**	**Coordinating**	**Motivating**		**Coordinating**	**Motivating**	**Coordinating**
Member Activities		**Identifying**	**Sensemaking**				**Deliberating**	**Deciding**	**Committing**	**Formalising**
Output of the activity		*Information gathered*	*Knowledge about member goals, interests, and offerings gained*				*Knowledge about various leadership options gained*	*ILP Panel elected*	*Commitments pledges signed*	*ILP becomes the strategic leader for the IOP*
Description of Member activities		Members listed their various goals, interests, and offerings	Making sense of the various goals, interests, and offerings from other members				Members deliberated on various leadership options	Voting on leadership choice	Members agreed to commit to the Insights Leadership Panel which would lead the IOP	Formalisation of the Insights Leadership Panel

Figure 19: *A process model for setting up a leadership panel*
Source: *Created by author*

6.2.4 Selecting & Designing Technical Standards

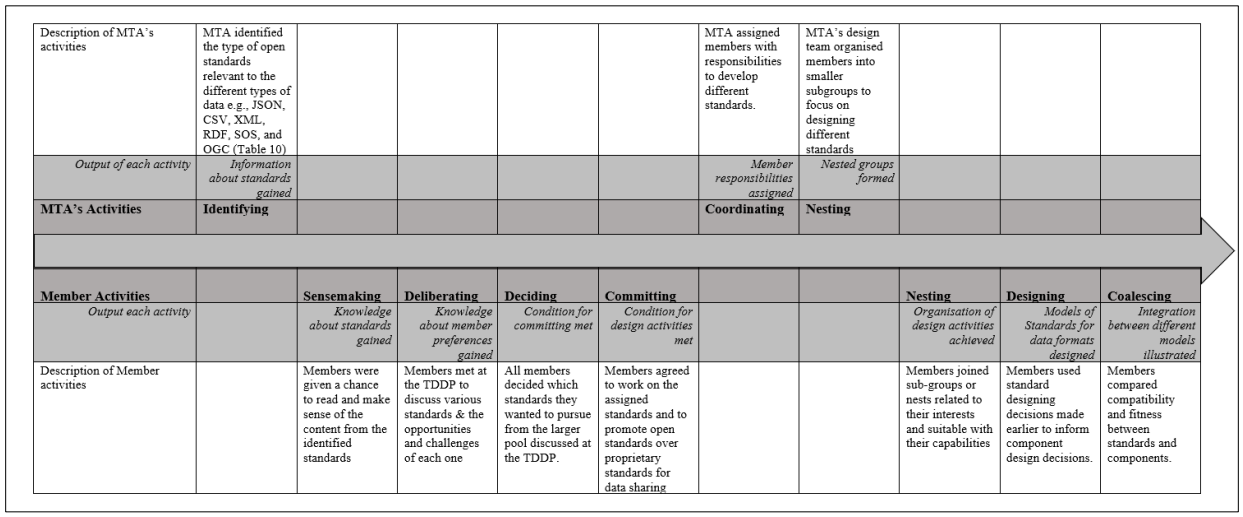
Due to the complexity introduced by the involvement of organisational members with diverse characteristics and interests, the IOP architecture for sharing data resources and services in the tourism sector also tended to be complex and nested. Both MTA and the members of the collective were confronted with a high number and variety of standards for building the platform's core components (see Figure 5, p.60). For instance, for data alone, they needed to decide on over twenty different standards for data storage, data transmission, interfaces between multiple apps, and data formats (e.g., see Table 10, p.62).

An interesting observation here is the role of group-organisation. Decision making on standards was relatively quick covering a period less than three months (see Figure 24, p.121). Previous studies show that decision making on standards in collective action tends to be 'slow and contentious' extending over two or more years (Markus & Bui, 2012). It would seem that the MTA countered this challenge by ceding the deliberation and decision-making processes to the members, to make self-choices on standards, thereby making process responsive to member preferences. The effect of the choices, i.e., the number and variety of standards chosen, is not yet known as this research ended before full launch. All the same, there was enough data to draw a conjecture that leaving members to deliberate on and make decisions regarding standards enabled key issues around standards to be addressed amicably and quickly.

The above observation does not dismiss MTA's role as the leading organisation in coordinating activities during deliberations and decisions on standards. Rather, case data shows that MTA's coordinating role was structural (for instance organising the groups into nests, ensuring that coalescing activities take place after nesting, and facilitating meetings), but they had limited involvement in the actual substance or

content matter, thus leaving members to make choices of their own without being steered into one direction or another.

Additionally, the MTA played a critical role in facilitating and encouraging external networking, which enabled touch points with the wider tourism business environment (e.g., at the TRENZ conferences). This ramped up support for newly proposed open standards, creating a path for them to gain legitimacy in in an industry.



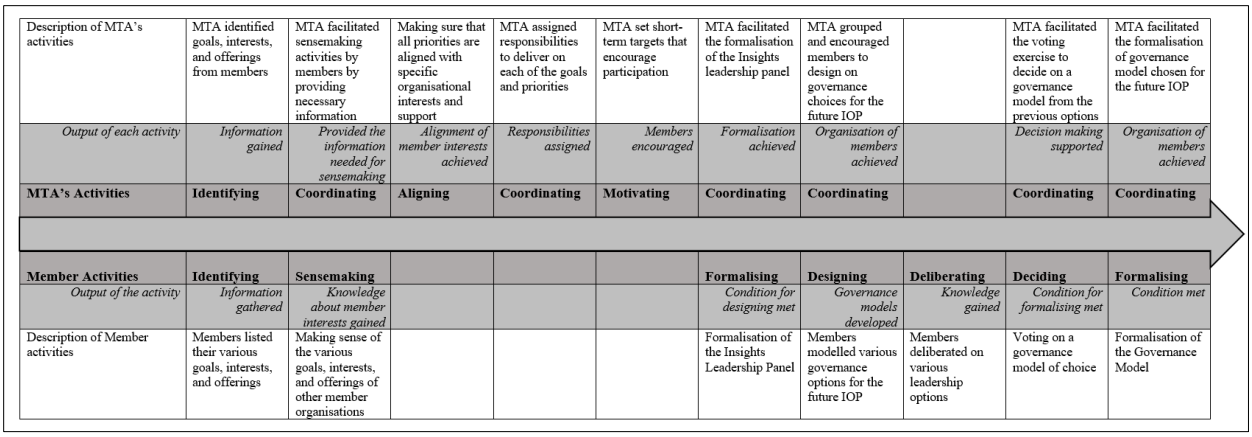
Description of MTA's activities	MTA identified the type of open standards relevant to the different types of data e.g., JSON, CSV, XML, RDF, SOS, and OGC (Table 10)					MTA assigned members with responsibilities to develop different standards.	MTA's design team organised members into smaller subgroups to focus on designing different standards			
Output of each activity	*Information about standards gained*					*Member responsibilities assigned*	*Nested groups formed*			
MTA's Activities	**Identifying**					**Coordinating**	**Nesting**			
Member Activities		**Sensemaking**	**Deliberating**	**Deciding**	**Committing**			**Nesting**	**Designing**	**Coalescing**
Output each activity		*Knowledge about standards gained*	*Knowledge about member preferences gained*	*Condition for committing met*	*Condition for design activities met*			*Organisation of design activities achieved*	*Models of Standards for data formats designed*	*Integration between different models illustrated*
Description of Member activities		Members were given a chance to read and make sense of the content from the identified standards	Members met at the TDDP to discuss various standards & the opportunities and challenges of each one	All members decided which standards they wanted to pursue from the larger pool discussed at the TDDP.	Members agreed to work on the assigned standards and to promote open standards over proprietary standards for data sharing			Members joined sub-groups or nests related to their interests and suitable with their capabilities	Members used standard designing decisions made earlier to inform component design decisions.	Members compared compatibility and fitness between standards and components.

Figure 20: *A process model for selecting & designing technical standards*
Source: *Created by author*

6.2.5 Designing a Governance Model

For members of a collective group, developing and accepting to participate in a new IOP for data & resource sharing required significant changes in internal organisation, and the relationships that each member had with many other organisations within and outside the collective. For instance, it required a re-think of data standards, data sharing methods, control of privacy, security arrangements, and so forth. All these areas needed to align, not only with the new platform technology, but also with how other members in the collective managed their own data services and resources. The new IOP for data and resource sharing would thus create a new way of conducting business and new types of interactions among members. For such new changes to be accepted by collective involving members with widely different interests, many possible models of governing the platform need to be reconciled.

The governance models considered in this case can be summarised into five options: (i) lead organisation as coordinator (MTA); (ii) participant collective governance i.e., collectively governed by individual participants; (iii) separate organisation set up as a 'parent provider'; (iv) subgroup arrangement; and (v) government as central leader. These are fully discussed in ***Section 5.2***.



Description of MTA's activities	MTA identified goals, interests, and offerings from members	MTA facilitated sensemaking activities by members by providing necessary information	Making sure that all priorities are aligned with specific organisational interests and support	MTA assigned responsibilities to deliver on each of the goals and priorities	MTA set short-term targets that encourage participation	MTA facilitated the formalisation of the Insights leadership panel	MTA grouped and encouraged members to design on governance choices for the future IOP		MTA facilitated the voting exercise to decide on a governance model from the previous options	MTA facilitated the formalisation of governance model chosen for the future IOP
Output of each activity	*Information gained*	*Provided the information needed for sensemaking*	*Alignment of member interests achieved*	*Responsibilities assigned*	*Members encouraged*	*Formalisation achieved*	*Organisation of members achieved*		*Decision making supported*	*Organisation of members achieved*
MTA's Activities	**Identifying**	**Coordinating**	**Aligning**	**Coordinating**	**Motivating**	**Coordinating**	**Coordinating**		**Coordinating**	**Coordinating**
Member Activities	**Identifying**	**Sensemaking**				**Formalising**	**Designing**	**Deliberating**	**Deciding**	**Formalising**
Output of the activity	*Information gathered*	*Knowledge about member interests gained*				*Condition for designing met*	*Governance models developed*	*Knowledge gained*	*Condition for formalising met*	*Condition met*
Description of Member activities	Members listed their various goals, interests, and offerings	Making sense of the various goals, interests, and offerings of other member organisations				Formalisation of the Insights Leadership Panel	Members modelled various governance options for the future IOP	Members deliberated on various leadership options	Voting on a governance model of choice	Formalisation of the Governance Model

Figure 21: *A process model for designing a governance model*
Source: *Created by author*

6.2.6 Designing Architecture

Designing architecture was complex because of the multi-layered nature of the platform. The collective group needed to make decisions and to design components covering infrastructure, core processing systems, data warehousing, data formats, data processing, data transmission, and so forth (see Figure 5, p.60). For instance, for infrastructure alone, they needed to decide between centralised *vs.* decentralised configuration, P2P *vs.* client-server solution, inhouse *vs.* outsourcing, and variations within those options. Adding to this, members started off the design process with widely different expectations, interests, and choices on how to design interconnected components withing those layers (Figure 10, p.90). They all had envisioned very different architectures for the same IOP (see Figure 22, p.120).

To address these complexities, the first activity was centred on identifying and making sense of all the different opportunity expectations (Figure 10), needs (Figure 11), and offerings (Figure 12) all the participating members. By engaging in these activities, members discovered what they and others had in common as well as the key differences that needed to be harmonised in order to support the collective endeavour. For instance, there were very different mental representations of the envisioned platform such that when representatives of the member organisations drew illustrations of what they envisioned, they came up with very different diagrams that represented their mental pictures, as seen in Figure 22. Thus, sensemaking enabled members to collectively think about ways to start reducing this 'cognitive distance'.

Additionally, MTA and the members countered the complexity of technical design by organising themselves into semi-autonomous sub-groups or 'nests' that focused on designing specific components of the platform. Forming specialised sub-groups enhanced alignment of members between those with complementary resources, capabilities, and interests. It also attracted third party developers and innovators who were attracted to those specialisations (e.g., see Table 18, p.99; Figure 16, p.110).

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Figure 22: *Members' illustrative visualisations of the envisioned IOP*
Source: *Case data from workshop deliberations – permissions by MTA*

Description of MTA's activities	MTA identified the goals, interests, and offerings from members by making industry consultations				MTA design team coordinated and coached members to work on different design aspects		MTA's design team organised members into smaller subgroups to focus on designing different components		MTA facilitated the reconvening of meetings after group activities	
Output of each activity	*Information about member goals, interests and offerings gained*				*Members organised and coached*		*Nested groups were formed*		*Coalescing of members after nesting*	
MTA's Activities	**Identifying**				**Coordinating**		**Coordinating**		**Coordinating**	
Member Activities		**Sensemaking**	**Deliberating**	**Deciding**		**Committing**	**Nesting**	**Designing**	**Coalescing**	**Integrating**
Output of each activity		*Gained knowledge about the goals and interests of other members*	*Knowledge about the pros and cons of various components*	*Component of the architecture are approved*		*Roles are assigned*	*Group - organisation of design activities achieved*	*Components of the architecture are modelled*	*Members reconvene as a single group*	*Synthesis and integration of components into one platform architecture model*
Description of Member activities		Members made sense of the various goals, interests, and offerings from members by reading through the discovery reports 1 & 2)	Members met at to discuss the various components possible to address data and resource sharing.	Members decided which components they wanted to pursue from the larger pool discussed at the TDDP.		Members agreed to work on the assigned roles for component design which fit with their capabilities, capacities, and interests	Members joined sub-groups or nests related to their interests and suitable with their capabilities	Members designed various components as sub-groups, focusing on different aspects of the platform.	Members reconvened as a single group assessed their progress on the various components.	Members integrated the various components into a composite and stable platform model

Figure 23: *A process model for architecture design*
Source: *Created by author*

	Formation		Designing		Implementation	
	Phase 1: Initial Discovery	**Phase 2: Goal setting**	**Phase 3: Deciding on Design Options**	**Phase 4: Deciding on Governance Options**	**Phase 5: Developing**	**Phase 6: Testing**
	End of August 2017	*End of February 2018*	*End of August 2018*	*End of February 2019*	*End of August 2019*	*End of February 2020*
Setting priorities *(strategic goals and priorities for the IOP)*						
Designing value system *(value elements, value interactions, value leveraging)*						
Setting a leadership panel *(leadership of the future IOP)*						
Designing standards *(standards for data formats, messaging, transmission, etc.)*						
Designing a governance model *(Roles and responsibilities, membership type & decision rights, data governance, etc.)*						
Architecture design *(Designing IOP components such as core processing systems, data repository, API management system)*						

Figure 24: *Timeline of IOP design processes and main phases of development*

Source: *Created by author*

Table 21: *Project activities, events, actions, and processes*

Dates	Internal & External Project Events	Member Activities (Core actors)	No.	Actions	Decisions & conclusions	Collective action (theoretical events)	Abstraction
04 Aug 2017	**First industry consultations** (informal) - Getting a sense of the data challenges in the industry.	- Organisations make first interactions with MTA regarding the possibility to develop an IOP for sharing data resources and services	**-**	**Sensemaking:** Consulting potential members		- MTA's **initial sensemaking of the commons dilemma** (i.e., the collective action challenge that needs to be resolved)	- Sensemaking
17 Aug 2017	**Second industry consultations** (both formal and informal) - Identification potential participants - Discussions about data challenges faced by each organisation consulted - Listing of potential participants - (unconfirmed initial list on spreadsheet via MTA website)	- Initial expression of interest by consulted firms (15 firms from airlines, airports, hotel chains, and private sector corporates) - Informal 'joining' by agreeing to be listed on the list of potential participants via MTA website	**15**	**Coalescing:** Bringing together actors via an informal listing **Sensemaking:** Assessing heterogeneity of organisations and their data challenges **Motivating:** Motivating actors to join by promoting collective action.	-	- **Coalescence** of an early informal group - **Early sensemaking of heterogeneity** (of the organisations and their data challenges) by MTA - **Motivating actors to join** by making available to targeted actors an informal listing of participants via MTA's website (i.e., **promotion**)	- Coalescence - Heterogeneity - Promotion
24 Aug 2017	**Discovery Report 1** - The report complied consultations made to all the 20 organisations. Organisations described their business goals for the IOP, i.e., the specific data challenges they were faced with and the expected role of the IOP in addressing those challenges	- 5 government departments joined the unconfirmed list (MBIE, Statistics New Zealand, INZ, TNZ & HNZ) - Listing of business goals for the IOP by the 20 organisations via the unconfirmed listing	**20**	**Sensemaking:** Assessing heterogeneous goals **Formalising:** Defining the IOP's value proposal **Deciding:** Deciding the value proposition to pursue **Joining**: 5 actors join	- A value proposition for the IOP is defined	- **Coalescence of a critical mass** - **Assessment of heterogenous** goals and interests - **Value definition** - **Motivating actors** to join by listing business goals and linking them to data needs & availing the information to members	- Motivation - Critical Mass - Heterogeneity - Value definition
12 Sept 2017	**Discovery Report 2** - Organisations listed the current data systems they were using and explained the challenges posed by each one as well as why a data and resource sharing would help to resolve those challenges	- Detailing current data systems by actors - 6 private sector actors join the unconfirmed list	**26**	**Sensemaking:** Assessing both individual and collective resources **Formalising:** Defining the commons challenge **Joining**: 6 actors join	-	- **Assessment of individual and collective resources** - **Defining the collective action challenge** and source of value (i.e., why individuals on their own cannot solve the challenge)	- Value definition - Heterogeneity - Formalisation
20 Sept 2017	**Invitations to key organisations** - Both formal and information invitations made by MTA to targeted organisations not on the current unconfirmed list -	- Formal expressions of interest to join by 6 more private actors	**32**	**Identifying:**	-	- MTA faced with **first governance decisions** on member selection (i.e., who can join) - **Commencement of formalisation** of the collective group	- Governance - Formalisation
18 Oct 2017	**Compilations of data offer cards** - Organisations completed offer cards in which they detailed the data resources (and services) they would offer via the platform. Organisations could see what others were offering via a shared spreadsheet. Least and most contributors, as well as complementarities were apparent by comparing the heterogenous offers	- Detailing of expected individual contributions - Comparisons of offers between actors - Joining of 17 more actors (mainly RTOs and local authorities across the country) -	**49**	**Sensemaking:** Assessing heterogenous resources **Identifying:** complementarities between actors **Joining**: 17 actors join	-	- **Assessment of heterogenous resources** from the collective group - **Identification of complementarities** between actors - Early identification of **potential risks of free riding** and other moral hazards prompting discussions about formalisation and rules	- Heterogeneity - Complementarities - Free riding
14 Nov 2017	**First Insight Leadership Panel (ILP) meeting** - Formation of the Insight Leadership Panel (ILP) and General Members of the project - Organisations **formalised** themselves as members of the collective group by being registered with MTA. In a further step, **members practised decision rights** by electing leadership panel members. By doing so they transferred decision rights to the leadership panel although they retained some rights such as being consulted on any new initiatives.	- 18 members were voted-in to become ILP members led by the MTA - 23 members remain as General Members - 6 local authorities and 2 private organisations chose to remain as informal, non-contributing members	**41**	**Formalising:** membership formalised by registering **Coordinating:** assignment of responsibilities **Deciding:** voting to choose a formal governance model **Exiting**: 8 members exit	**Membership is defined** **Governance model for the platform is chosen** (Governance issues)	- **Formalisation of the collective group** (41 organisations) - **Formation of a formal governance system** for the collective group's IOP development project through the ILP led my MTA - **Creation of two classes of participants** (ILP members had decision rights whilst general members were consulted e.g., on priorities and initiatives) - **Assignment of ILP responsibilities** (e.g., calling for meetings, workshops, and other events)	- Formalisation - Governance options (leadership and membership types)

Dates	Internal & External Project Events	Member Activities (Core actors)	No.	Actions	Decisions & conclusions	Collective action (theoretical events)	Abstraction
17 Nov 2017	**Development of the Insight Framework** - After multiple rounds of meetings, members jointly developed a strategic vision of the IOP referred to as the Insight Framework. Although the Framework was expected to represent all members, some felt less represented. Minutes of the meeting show that those in support of the Insight Framework affirmed their commitment by seconding it.	- Collective contributions to the strategic vision (all 41 organisations were consulted, and contributed) - Members affirmed the decision to continue participation	**41**	**Sensemaking:** Assessing heterogenous interests **Aligning:** Finding commonalities amongst heterogenous interests **Deciding:** Seconding and supporting the newly developed collective vision for the IOP **Committing:** Expressing commitment to participation	**Collective strategic vision is defined** (Collective Organising & Governance Issue)	- **Aligning heterogenous interests** by consulting and adding contributions of all members in developing the strategic vision of the collective endeavour (i.e., the IOP) - **Sustaining a critical mass** by creating a collective vision	- Heterogeneity - Critical mass - Commitment - Collective Governance
12 Dec 2017	**Development of a List of Priorities** - Members jointly developed a list of priorities for the IOP. These were **priorities** on data resources and services that needed to be addressed first before others. As such whilst the majority of members were happy because their data areas were prioritised those whose concerns were the least priority felt disadvantaged	- 39 members voted on a list of priorities for the IOP resulting in a ranked list - 2 members chose to remain as informal, non-contributing members (they expressed that their specific data challenges were not prioritised)	**39**	**Sensemaking:** assessing different priorities **Identifying** a list of priorities **Deciding:** Voting on priorities and ranking the list **Exiting**: 2 members exit	**Priorities are set** **2 members exit** (Collective organising issue)	- **Aligning heterogenous interests** for participation - **Concretising commitment** by setting explicit priorities - Individual *vs.* collective prioritisation	- Heterogeneity - Commitment - Individual *vs.* collective prioritisation
Mar 2018	**MTA's presentation of a Budget Proposal and Funding model based on:** - The budget was internally developed by MTA and then circulated to members for expression of support. Although the majority of members contacted expressed support, they also indicated that they would have wanted to be consulted on the funding model used before the budget was developed. Four members did not back it.	- Actors given an opportunity to express decision to continue/ discontinue participation based on budget support - 4 private providers choose to become informal members (non-contributing)	**35**	**Committing:** Members expressed commitment to the budget presented by MTA **Exiting**: 4 members exit	**Funding commitment is made** **Four members exit** (Governance and collective organising issues)	- **Testing and concretising commitment** - **Resourcing and securing**	- Commitment - Resourcing and securing
Mar 2018	**MBIE's Tourism Data Domain Plan (TDDP) Workshop I:** - Members deliberated on how to **define the value** of the IOP in the broad context of tourism as a business. Members defined value according to five key areas	- Individuals listed what they thought were the key values of the intended data ecosystem - Ensuring that individual interests are reflected in the collective priorities developed from the workshop	**35**	**Sensemaking:** members were consulted to express individual interests and expected benefits **Deliberating:** Members discussed the key values of the intended platform **Designing:** Designing a value system of the IOP	-	- **Value ideation and definition** - Further identification and scrutinisation of **individual and collective value** - First discussions on **collective designing** (on data formats and standards)	- Value ideation & definition - Collective designing
May 2018	**TDDP Recommendations Report** - Development and documentation of a final set of recommendations from the Tourism Data Domain Plan (TDDP)	- Members got a chance to read and ratify the 'value system' concept presented by MBIE through the TDDP report	**35**	**Sensemaking:** Reading of the TDDP recommendations report by members **Deciding:** ratification of the TDDP recommendations by members	**Value proposal is ratified** (Value creation issue)	- Ratification of collective value by members	- Value ideation?
7-10 May 2018	**TRENZ Conference 2018** - Feedback to the industry on project progress - Recruitment of new members - Appealing for funding sources - Attraction of potential third-party contributors	- 11 actors join (mainly visitor experience providers such as Canyon Swing, Aotearoa Ziptrek and Real Journeys) - Many third-party players, vendors and potential investors indicate interest in the project and pledge future engagement	**46**	**Networking**: members network with third party players at the premier tourism conference **Joining**: 11 actors join	-	- **Engaging wider ecosystem environment** (securing future actors to generate network effects) - **Motivating new members to join** & participate - Adding new members to develop and **sustain a critical mass** - Strengthening of **ecosystem-wide business network**	- Congruence with wider ecosystem environment - Motivation - Critical mass

Dates	Internal & External Project Events	Member Activities (Core actors)	No.	Actions	Decisions & conclusions	Collective action (theoretical events)	Abstraction
June 2018	**Design Workshop I** - Members deliberated on the architecture of the platform. At this stage they decided to come up with multiple component and feature options for which they would choose the most appropriate options for the IOP. Overall structure and envisioned runtime configurations were illustrated and presented by different organisations. Members agreed to protect the base level infrastructure, but to maintain a principle of openness on the top layer components such the API Management system. Open standards were listed and approved although options for propriety were not discouraged if the contribution would be unique.	- Listing of desired features and components by member representatives at the workshop - Hand-drawing illustrations of the desired overall architecture by each of the 46 organisations represented - Sub-group deliberations and comparisons of different design options and choices of features, standards, formats and levels of openness and control	**46**	**Deliberating:** members deliberated on how to design the architecture Identifying: members listed various components and features they thought were required for the IOP **Designing:** Members developed concept maps of components and features of the platform **Integrating:** Members illustrated how different components and features they had suggested could be **integrated** into and architecture for the IOP using hand -drawn visual illustrations	**The collective group opted for:** **(i) a modular architecture** **(ii) a closed base-level infrastructure** **(iii) an open API Management System** **(iv) a list of specific open standards** (Architecture issues)	- **Designing the collective good** - **Assessment of cognitive distance** between members regarding their vision of the aspired collective good - **Assessing individual *vs.* collective interests** (change of priorities from the initial set) - **Aligning heterogeneous choices** on design features and components (e.g., between proprietary and open components) - **Identification of complementarities** (organisations with complementary choices) - **Identification of nested groups** (organisations working well as a smaller sub-group)	- Collective designing - Cognitive distance - Heterogeneity - Complementarities - Nested groups
July 2018	**Design Workshop II** - At this stage members debated on the benefits and drawbacks of the architectures developed from the previous workshops. When deliberations were complete, a suite of the components required for the IOP were compiled and two architectures emerged, one that was more public and the other more private. A decision was made to pursue a hybrid architecture that blended both private and public options.	- Detailed consideration of various architectures, each member presenting their own points on benefits and drawbacks - Members expressed commitment to some design components (e.g., MBIE & Statistics New Zealand were committed to developing the analytics module) -	**46**	**Deliberating:** Members debated on the benefits and drawbacks of the components and features developed from the previous workshop **Integrating (Synthesising):** A 'best of the breed' suite of the components required for the IOP were compiled **Deciding**: Two architectures emerged, one that was more public and the other more private. A decision was made to pursue a blended hybrid with both private and public options. **Committing:** Members expressed commitment to support the development of specific components	**Decided to pursue a hybrid architecture that blended public and private good options** (Architecture issue)	- **Coring the design of the collective good** - **Concretising commitments** to contribution - **Public *vs.* private good** discussions were salient here particularly on deliberations of openness, control, and standards	- Collective designing - Commitments - Public *vs.* private goods
Aug 2018	**Design Workshop III** - Deliberations were made here about the governance option that would be appropriate for the platform once operational. After deliberations, five governance options were presented. Members chose to maintain MTA's leadership, but to also have **decision rights** through a separate governance institution made of member representatives.	- Organisations discussed how the future platform would be governed - They identified and listed governance options on poster-cards - Aspects of governance discussed include leadership, membership & decision rights. - From these they developed five governance model options and conducted a voting exercise to decide which option to adopt for the IOP	**46**	**Identifying:** Members listed numerous governance options **Deliberating:** Members discussed the possible ways to govern the IOP once operational **Designing:** Members developed five different governance models for the future IOP **Deciding:** Members voted to use a hybrid model that had aspects of both public and private options	**Future IOP Governance model defined** (Governance issue)	- **Deliberating on governance options** (leadership, membership type, decision rights, roles, responsibilities, etc.) - **Public *vs.* private good** discussions were also salient here because some governance options treated the intended IOP as a public good whilst others as a private good.	- Governance options - Public *vs.* private goods
05 Nov 2018	**Departure cards removed** - Data on outbound travel was temporarily unavailable - Catalysed the need for urgent targeted solutions	- 7 members (4 government agencies and 3 private actors were involved in the development of the solution (i.e., e-system replacing the old departure cards) -	**7/46**	Responding to external environment	-	- **Ecosystem wide events** impact on collective action structuring - **Nested groups** became salient when sub-groups were developed to focus on specific components	- Congruence with wider ecosystem environment - Nested groups
	MBIE's Tourism Data Domain Plan (TDDP) II: - Design options for specific components of the platform were discussed here. At the workshop, members organised themselves into groups according to the specific components they would engage themselves in the design process.	- MBIE met with different groups of tourism businesses (accommodation, transportation, restaurants, cruises, etc.) and discussed specific data design options suited to these groups.	**46**	**Aligning:** Aligning heterogeneous interests and capabilities **Nesting:** Forming nested groups	**Formation of nested groups** (Collective organisation issue)	- **Concretising nested groups** - **Complementarity** - **Alignment of heterogeneous interests and capabilities**	- Nested groups

Dates	Internal & External Project Events	Member Activities (Core actors)	No.	Actions	Decisions & conclusions	Collective action (theoretical events)	Abstraction
4 Feb 2019	**Insight Leadership Panel** - Deliberations on the collective development of an implementation strategy for the IOP. Sub-groups were asked to commit to the design components they had been involved in from the start. This concretised commitment to the development of those components. Sub-groups were also seen as an opportunity to promote specialisation and attract third party developers and vendors specialising in those areas.	-	**46**	Coalescing Concretising Committing	**Concretisation of nested groups** (Collective organising issue)	- **Sustaining commitment to implementation**	- Commitment
	Air New Zealand sub-group team meeting	- A sub-group team of 7 organisations met to deliberate on developing a technical solution for international visitor data	**7/46**	Nesting Prototyping & testing:	A nested group consults third party players to contribute to module development	- Exercise of nested autonomy - Partitioning of execution methods?	- Nested groups
	Christchurch NZ team meeting	- A sub-group of 9 members mainly composed of RTOs were involved in the development of a model for accurately estimating domestic visitor flows & spending	**9/46**	Nesting Prototyping & testing:	-	- Exercise of nested autonomy - Exercise of decision rights by nested groups	- Nested groups
	Westcoast Lighthouse Group Meeting	- A sub-group team of 11 members mainly composed of RDAs and visitor experience providers involved in the South Island Visitor Flows Project – they worked with Qrious, DataMine (2 degrees), & GeoZone	**11/46**	Nesting Prototyping & testing:	-	- Exercise of nested autonomy - Exercise of decision rights by nested groups	- Nested groups
26 Feb 2019	**Lightning Lab Tourism –** - Launch of a Tourism Platform Development Accelerator - 12-month innovation incubation lab that supports the development of various IT solutions	- 17 members of the collective group (46) were involved in this innovation incubation programme	**17/46**	Nesting Prototyping & testing:	**Decided to pursue an agile development methodology (Governance issue)**	- Agile prototyping and experimentation -	- Governance - Agility
19 Apr 2019	**CECA & RTOs NZ Group Meeting & Workshop** - Discussions on how to develop MRTEs for integration with other datasets	- A sub-group team of 9 members mainly composed of RTOs were involved in the re-design of the MRTEs dataset - This sub-group also was also designing data integration standards	**13/46**	Nesting Experimenting and testing:	-	- Exercise of sub-group autonomy - Exercise of decision rights by sub-groups -	- Nested groups
13-19 May 2019	**TRENZ Conference 2019** - "Over the four-day event, tech developers and innovators will have a total of 30,000 15-minute meetings. It is 'speed dating' that will catalyse our development efforts for this digital ecosystem" – MTA Insight Specialist. - Raise potential interest from third parties and attract potential new partners	- All (46) members participated in the premier event	**46**	**Networking**: Socialising and connecting with third party players	Identification of third-party payers (Collective organising issue?)	- Engaging wider ecosystem environment - Setting the IOP for network effects by attracting third-party developers, investors, vendors etc. - Formation of new business networks and strengthening of existing ones	- Congruence with wider ecosystem environment - Commitment
June 2019	**Cessation of Accommodation Occupancy Survey** - preparation of a new tool from the accommodation sub-group (external environment influence on collective organisation)	- The cessation of the CAM dataset created another opportunity for a sub-group to be involved in the development of an immediate solution	**-**	**Responding** to external environment		- Ecosystem wide events	- Congruence with wider ecosystem environment
17 Oct 2019	**MBIE's Tourism Data Hui** - Architecture design was revisited again, this time as a convergence exercise in which the collective group sough to establish how the different components that were at various stages of development would fit together and match with the envisioned IOP as described earlier	- All (46) members participated in the workshop - The workshop was organised into sub-groups (i.e., the nested groups identified earlier). - Members presented their current development projects - Deliberations centred on how various designs could be integrated into a main IOP and its expected modules.	**46**	Integrating:	**Concept map of IOP architecture** (Architecture issue)	- **Coalescence of components** into a stable core and its modules for the IOP (i.e., the collective good) - Refining design elements of the collective good - **Integration of group components** into an overall collective good	- Convergence - Coalescence and integration
Feb 2020	Air New Zealand prototype testing	-	**7/46**	**Prototyping & testing:**	-	-	- Agility

6.3 Integration & Synthesis of Insights from Process Analysis

Examination of the six processes provides a rich and complex view of IOP development processes that occur in collective action. It highlights key activities, exceptions, interruptions, and extensive deliberations that have not been fully explored in previous research. This includes the following:

- The role of identifying and sensemaking activities in the collective construction of meanings that harmonises goals and priorities at the start of each design process
- The role of deliberating in scrutinising specific courses of actions, solutions, and choices before decision making
- Decisions as key thresholds at which processes can be propelled or paralysed
- The ways in which sub-group organisation of members into specialised 'nests' enables the collective group to tackle the complexity of data design and technology development activities in IOP development
- How agility may be achieved in solution development through incubation
- The inter-play between members actions and decisions, and the leader's strategic management practice

The process models also detail the sequential pattern and structure of activities and interventions that drive IOP development processes through collective action. The key contribution of this process analysis is that it abstracts and lays out key 'process propositions' on how collective action for IOP in any similar conditions may be structured and practised by both members and through management practices by the leading organisation.

A cross section of the six process models shows that the first activities in collective action for IOP development in any of the design domains such as governance, architecture, and value systems were that of identifying and sensemaking of the heterogenous conditions of the collective group (e.g., their profiles, goals, interests, resources, etc.). The function of these activities was for members of the collective (themselves and others) to discover and clarify the common goal, to explicate their interests, and to specify differences between individual and collective priorities. Identifying activities were for gathering information from all participating members and other external but relevant sources (e.g., from the government) to inform sensemaking activities. Sensemaking activities involved meaning-making activities that helped to address 'cognitive distances' between members and to align their align goals and interests towards the collective agenda of the developing an IOP. It also helped to define terms and jargon in such a technically complex project.

An additional point to note here is that although sensemaking activities were concentrated at the start of processes, they were not a once-off event in the project. Processes did not cleanly start one after the other in a sequential order. They were interwoven along and across time (as shown in Figure 24, p.121 and Table 21, p.122). Therefore, both members and leaders of similar projects should expect recurring sensemaking activities when new processes are started even as other processes may have progressed.

Whilst members were engaged in sensemaking, the MTA's role was to facilitate this through coordinating, coaching, and directing members to information resources. As the initiator, MTA had a greater understanding of the project than the members. Thus, rather than trying to gather and understand information, they were providing knowledge and insights to members who were trying to grasp many aspects of it. Additionally, MTA was in a unique position in that they already were an association representing members ranging from small owner operated tourism businesses to large corporates – collectively around 85% of total active businesses in the tourism industry in New Zealand[13]. As a leading organisation, they had strong business connections and relations with sector-wide industrial players. This put MTA in a unique position to facilitate the sensemaking process.

Process Proposition 1:

When a collective group of heterogeneous organisations intends to collectively develop an IOP, given that they have widely different goals and interests, ***identifying and sensemaking activities can be used to harmonise strategic goals and priorities.***

[When X…]	[Given that…]	[Process activity]	[The outcome is…]
Intention Collective group of heterogenous organisations **starts collective action for IOP development**	**Condition** Given that they have: - Widely different goals and interests - Wide-ranging options - Members support different choices	**Observed Intervention** Start by engaging in: - Identifying and sensemaking activities that help them to collectively construct meanings, interpretations and goals of the collective endeavor	**Observed outcome** The are likely to: - Harmonise strategic goals and priorities - Align member (individual) interests to collective interests

Box 1: *Detailed composition of Process Proposition 1*

Source: *Created by author*

[13] This is as per the MTA Report of 2019

Process Proposition 2:

When a collective group of heterogenous organisations starts a technical design process for IOP development, given that each of the participating members have different interpretations, meanings, and frames of the technical terms used, ***sensemaking can reduce cognitive distances that exist between members, (and between members and the leading organisation) and enable congruity to technology frames of references between members.***

[When X…]	[Given that…]	[Process activity]	[The outcome is…]
Intention Collective group of heterogenous organisations **starts a technical design process (e.g., designing IOP architecture)**	**Condition** Given that they are heterogenous, and have differences in: - Technical capabilities - Technology frames (e.g., meanings of technical terms, functions and uses)	**Observed Intervention** Start the process by engaging in identifying and sensemaking activities, i.e., constructing collective meanings of: - Interpretations - Terms - Technology frames	**Observed outcome** The are likely to: - Reduce of cognitive distances as the design process evolves - Enhance congruity in technology frames of references between members of the collective

Box 2: *Detailed composition of Process Proposition 2*

Source: *Created by author*

Deliberating activities supported decision making that may have been difficult to arrive at when considering a host of options in highly technical domains of IOP development faced by members, such as standards or architecture design. Deliberations focused members on a specific issue or question (Figure 25, p.129). For instance, should APIs for data sharing be open to third parties? Which formats are favourable and durable for specific types of data? Should the infrastructure be centralised or distributed? By focusing on such questions, members debated and compared alternatives before a specific solution, choice, or course of action was taken (see Figure 24 p.121). Deliberations were meant to fully engage members who had doubts or individual choices that were contrary to collective choices to ensure their buy-in unless those members demonstrably could not be shifted from choices that were obviously detrimental to the collective action endeavour (for instance when a single or two small operators rejected a popular standard). The outcome of deliberating was to have generate good evidence to justify following a specific course of action, choice or solution. This was particularly important the collective group as it needed to sustain the support and commitment of all members. It made decision making less contentious and reduced the risk that members would exit when decisions were made that they found less justifiable. Thus, the processes analysed above show that key decisions should be arrived at after careful deliberations by members.

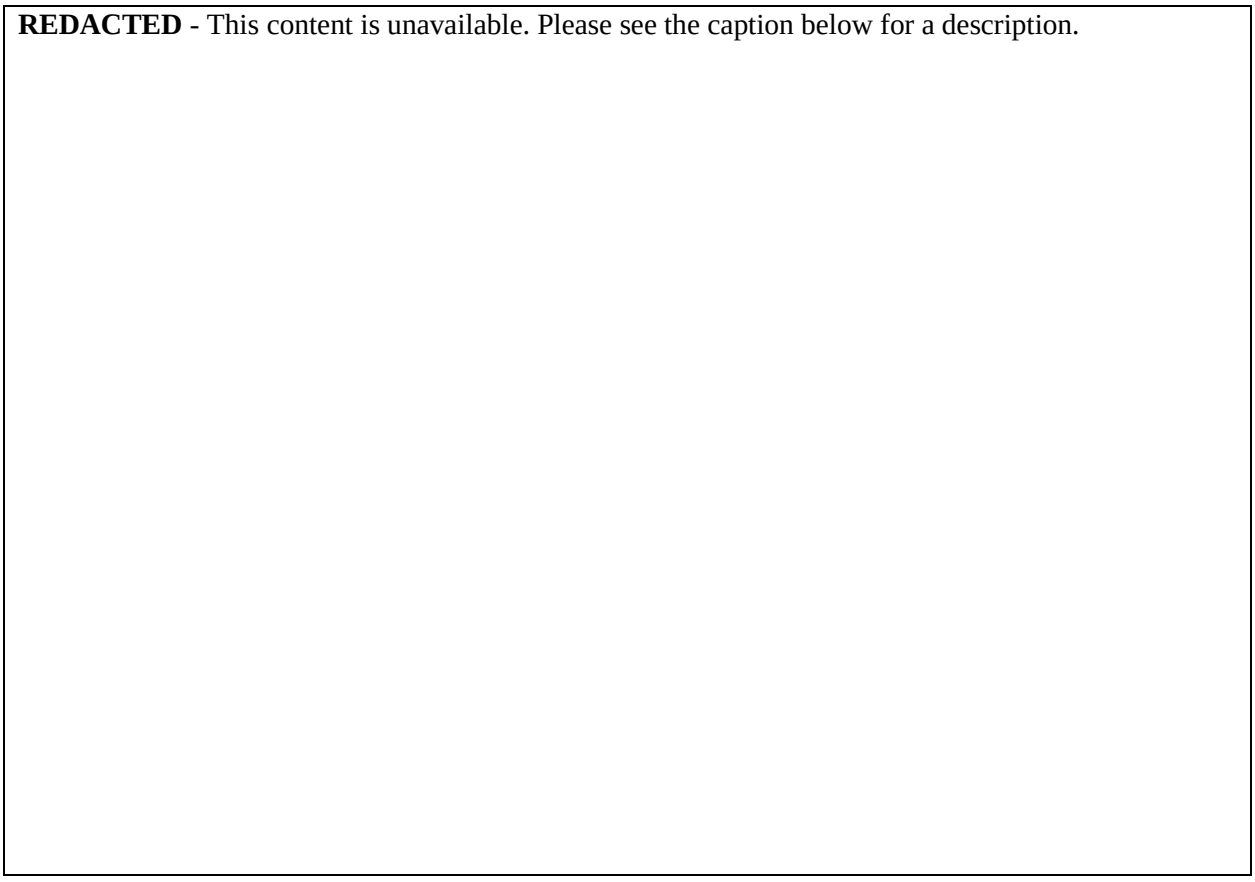

Figure 25: *Members deliberating on "next steps" for a course of action in architecture design*
Source: *Case data from workshop deliberations – permissions by MTA*

All the process models also revealed that decisions were key thresholds at which members could make choices and bindings agreements. Decisions were important because they charted path-dependent courses in specific domains of the IOP such as how value systems would work, how governance would be practised, and architecture that supported the platform. Decision making be done should considering the unique positions of different members at each stage of development. When members felt that decisions made did not serve their interests or that their interests were not fully considered before key decisions were made, they were likely to exit collective action. This was potentially detrimental to a group such as the one we studied that needed all members to participate, especially when they all had unique contributions to the desired IOP (see Table 13, p.84). This was observed when six local authorities and two private organisations exited soon after the decisions on setting the leadership panel were ratified. Future implications of their exit may be that the IOP would not cover data resources and services from local authorities. However, it should be noted here that because of widely different interests, it was likely that some members would exit.

Whilst four process models showed that highly complicated choices – which were usually technical in nature – required careful deliberations before specific decisions were made (e.g., see Figures 21 & 23, p.119-120), two process models showed that when faced with uncertain choices such as choosing the most appropriate leadership panel or governance model (e.g., see Figures 20 & 22), not only were deliberations required, but also democratic processes, for instance through nominations, ranking of priorities (see Table 16, p.93), and voting (see Figures 25 & 26). It would seem that when members had to decide on complicated aspects of the IOP – for which an optimal choice could be determined (e.g., determining the most efficient data format for data sharing), deliberations that carefully considered alternatives were useful in resolving differences in choices by producing evidence and justifications for the most appropriate choice. It was also important in such deliberations that members consider other members' unique positions. For instance, if adopting a new data format may mean than some organisations have to make significant changes to their data for it to be accepted on the platform, those members would need to be consulted to ensure their buy-in and consider supporting them in the necessary changes that would be required.

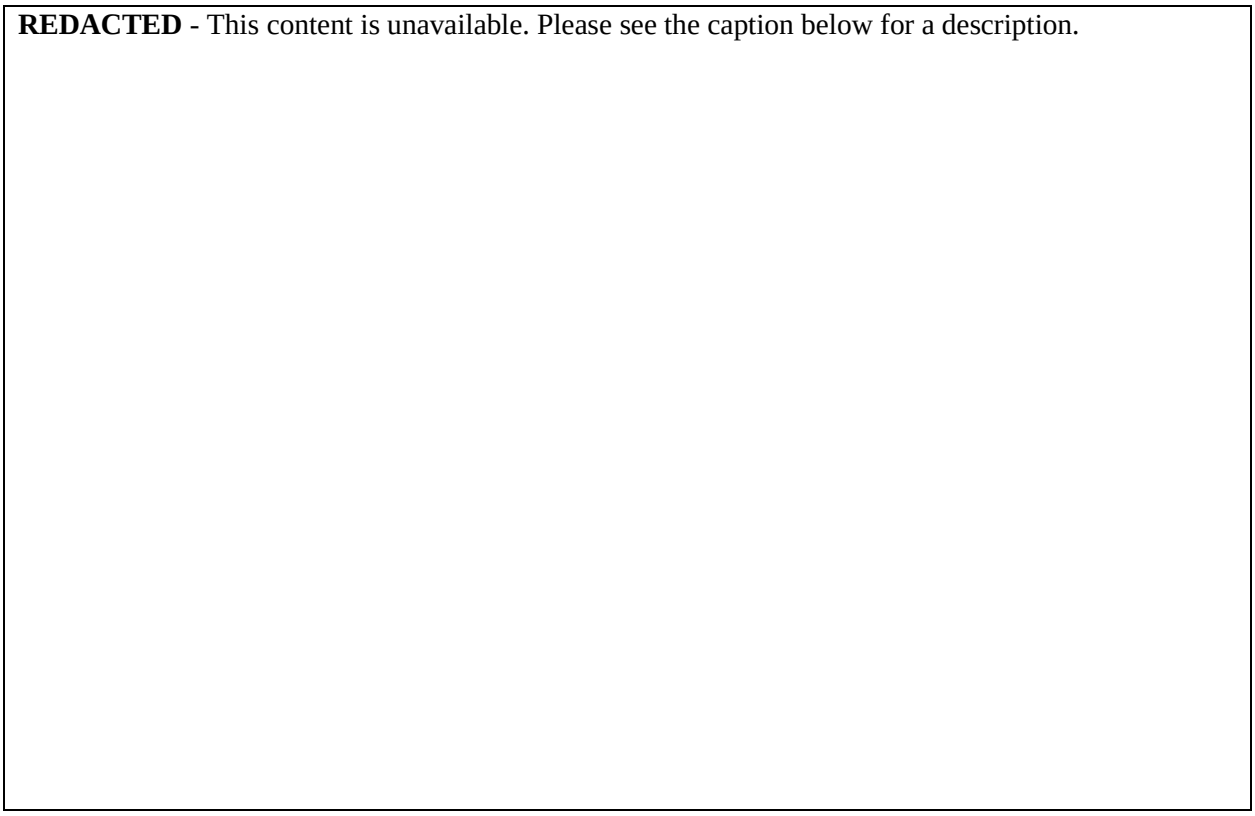

Figure 26: *A member voting on a governance issue*

Source: *Case data from workshop deliberations – permissions by MTA*

However, it was also observed that when members needed to decide on aspects such as the best possible leadership and governance choice from multiple options, for which an optimal choice was unclear or uncertain to determine through deliberation, democratic processes such as ranking, and voting were used to resolve potential hindrances in decision making. Another explanation here could be that the requirement for consensus in these decisions warranted popular or democratic processes to be followed. In both the cases, nominations, ranking, and voting exercises (for an example see Figure 27 below) were conducted and the outcomes of those voting activities were the basis for the choices made. However, we observed that voting left some 'losing' members with unresolved grievances. This happened with the eight members mentioned earlier that left after a vote on governance was made. We thus suggest that whilst voting can be used to get past such choices, the grievances of members who 'lose' the vote should still be considered after the vote. This is especially important if there is a risk of 'flock-exiting' where members who have lost leave *en-masse* by following each other in exiting from the group.

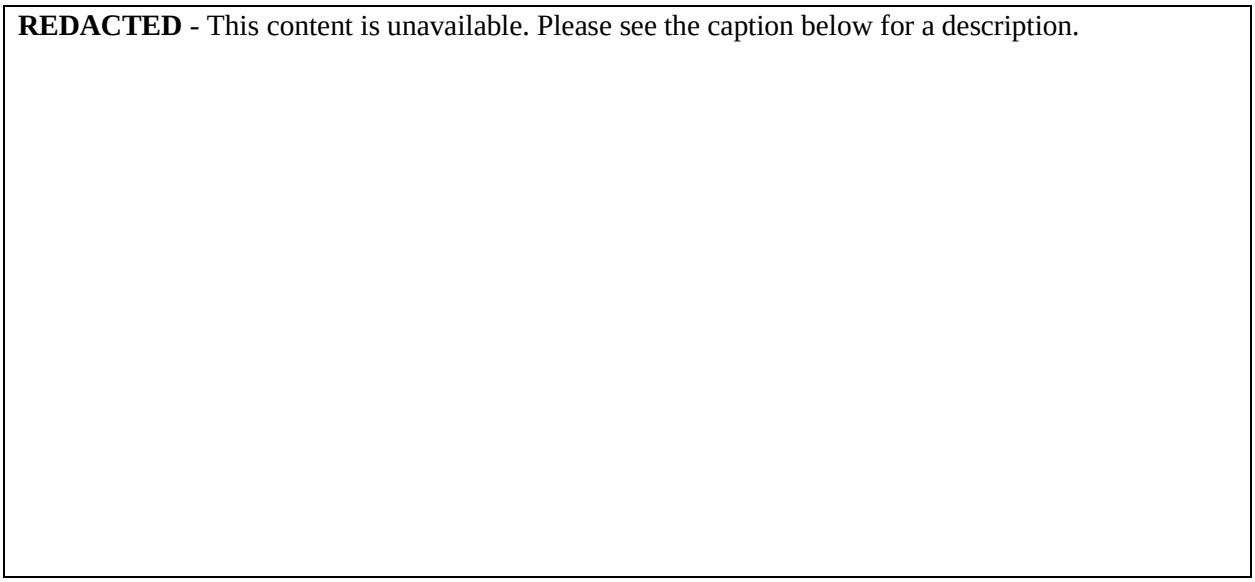

Figure 27: *An example of members voting on various governance and leadership options*
Source: *Case data from workshop deliberations – permissions by MTA*

Process Proposition 3

When a heterogeneous group of organisations must decide on aspects of a future IOP for which an optimal choice exists or can be determined through deliberation, given that they have wide-ranging options and that members support different choices, ***deliberations that carefully consider alternatives can resolve differences in choices by generating evidence and justifications for decisions made.***

Process Proposition 4

When a heterogeneous group of organisations must decide on aspects of a future IOP for which an optimal choice may not exist or is difficult to determine through deliberation, given that they have wide-ranging options and that members support different choices, ***democratic processes such as ranking, and voting can resolve potential hindrances in decision making, but can also create grievances that can persist for the losing parties.***

Process Proposition 5

When a heterogeneous group of organisations must decide on aspects of a future IOP, given that they have wide-ranging options and that members support different choices, ***deliberations that fully engage members, considers their positions, and ensures their buy-in can resolve potential tensions that can persist and may result in members exiting.***

[When X…]	[Given that…]	[Intervention…]	[The outcome is...]
Collective group of heterogenous organisations **intends to make decisions on aspects of the future IOP**	They must make a decision for which an optimal choice exists or can be determined through deliberation (***Complicated but optimal choices can be determined***)	Deliberate - Carefully consider alternatives (e.g., pros, cons, opportunities, threats) to generate evidence that justify choices to be made on a specific issue - Considers member positions and buy-in	Intended consequences - Make evidence-based decisions on technical design choices - Justify decisions made - Resolve differences in choices Unintended consequences - Delay decisions and reduce project agility
	They must make a decision for which an optimal choice may not exist or is difficult to determine through deliberation (***Uncertain and complex, optimal choices are unknown***)	Deliberate + Vote - Deliberate on possible choices, issues and concerns, **and,** - Follow democratic processes to win the majority through ranking of priorities, voting on a range of options, nominations, etc.	Intended consequences - Resolve political decisions - Make popular decisions - Speed up decision making process Unintended consequences - Persistent grievances from losing parties - Flock-exiting by losing parties

Box 3: *Detailed composition of Process Propositions 3,4 & 5*

Source: *Created by author*

Regarding decision making, it was also observed that setting strategic goals early helped members to know the direction of the project (this was important in cultivating commitment). However, having strategic goals alone may not be sustainable in the long run. We noticed that organisations typically agreed

on strategic goals and priorities (e.g., to develop the common platform, to produce regional visitor satisfaction estimates, and to develop tourism productivity measures, see Table 16, p.93 & Table 17, p.94) but seldom clarified specific details about how each of the prioritised goals would be reached. Although high-level strategic goals and priorities were important, these needed to be followed by more detailed articulation of more specific objectives, and specific responsibilities assigned to members. As the project evolved, shorter term goals and objectives were needed to guide organisations on specific components especially towards implementation phases considering the many technology artefacts and data tools developed by sub-groups at this stage (see Table 19, p.101).

From MTA's position, the ability to influence member decisions was important. As the leading organisation, and aspiring to become the platform provider, MTA utilised its leverage on business relations with the participating members. MTA achieved this by using its existing connections with tourism organisations, particularly the larger and well-reputed organisations such as Air New Zealand, Tourism Holdings Limited, Auckland International Airport, and government agencies such as MBIE and Statistics New Zealand. This earned MTA the trust of other parties enabling them to at garner favourable decisions as the project evolved.

Three of the process models (Figures 19, 21 & 23) show that design activities were organised into nested groups that specialised on specific components and aspects of the platform, and later coalesced as a single group to compare, synthesise, and integrate their outputs. Such group organisation worked well because it made it easy to align interests of members, and to match organisations with complementing capabilities and resources (see Table 18, p.99; Figure 17 p.114). This system of nesting facilitated loose connections that supported specialised interest groups, attracted innovators to those groups (see Table 18), and balanced participatory process by aligning complementing institutions together. This illustrates Öström's observations that, in order to deal with complex design challenges, collective groups evolve into poly-centric institutions organised in multiple nested layers (Öström, 2010 p.653).

Another observation was that in the period towards development of prototypes, members engaged in experimental processes where sub-groups went into incubation programmes. Incubation also attracted innovators and developers to join various sub-groups to develop prototypes, and to experiment with early-stage technical solutions using the design specifications from members. Such incubation also enabled agility by having highly technical experts focus on specific components and targeting short-term goals within an intensive and competitive environment. Whilst previous research explains that partnering with third party players improves agility in IT platform development projects such as this (c.f. Richardson, Kettinger, Banks & Quintana, 2014), this research specifies how such partnerships can be built to generate agility. We observed that it was possible by coordinating members into (i) nested groups, (ii) using

incubation programmes and (iii) enabling semi-autonomous and more specialised teams to engage and attract third party innovators.

Process Proposition 6

When a collective group of heterogenous organisations engages in design activities for IOP development, given that the design activity is complex and modular, and members have different capabilities, resources, and interests, ***if they nest into semi-autonomous sub-groups that specialise on specific components, they are likely to align the interests of members, to match organisations with complementing capabilities and resources, to attract third party innovators, and to be agile.***

[When X…]	[Given that…]	[Process activity]	[The outcome is…]
Intention Collective group of heterogenous organisations engages in design activities for IOP development	**Condition** Given that: - the design activity is complex and modular - members have different capabilities, resources, and interests	**Observed Intervention** Nest into sub-groups: - That are semi-autonomous - That specialise on specific components - That use incubation programmes	**Observed outcome** They are likely to: - Align interests of members - To match organisations with complementing capabilities and resources - To attract third party innovators to specialised groups - To be agile

Box 4: *Detailed composition of Process Proposition 6*

Source: *Created by author*

It was also observed that members participated in events that enabled networking with external parties. This attracted government agencies, third party developers, vendors, and innovators to the project. Networking and partnering with such players were important. Third party developers, innovators, and vendors were crucial in the solution development stage as they provided the needed technical know-how to transform designs and models developed by the members into working artefacts. The government played an important role in sponsoring various aspects of the project. Through the MBIE, the government also developed a sector wide plan and guidelines for data services and resources that encouraged government-industry collaboration. In addition, by attracting such influential partners, networking encouraged other organisations to join the project and set the future platform in a good position for generating both direct and in-direct network effects.

The process models also show the importance of commitments by members in order to ensure that decisions agreed on are carried out. Commitments were observed when members took duties and responsibilities that expended their resources to support specific activities in the project. Besides this *normative commitment*, members also showed continued to support the project despite seeing other members exiting (see Table 21, p.122). Such *continued commitment* was observed after key decisions were made during the project often requiring members to show support. For instance, this was observed when goals and priorities were set, when funding commitments were made, or when secondment was needed to support ratification of resolutions and agreements on governance (see Table 21). Thus, continued commitment was important in ensuring sustained backing by members, and worked as a check mechanism in collective action, to ensure that enough support was available to follow specific courses of action.

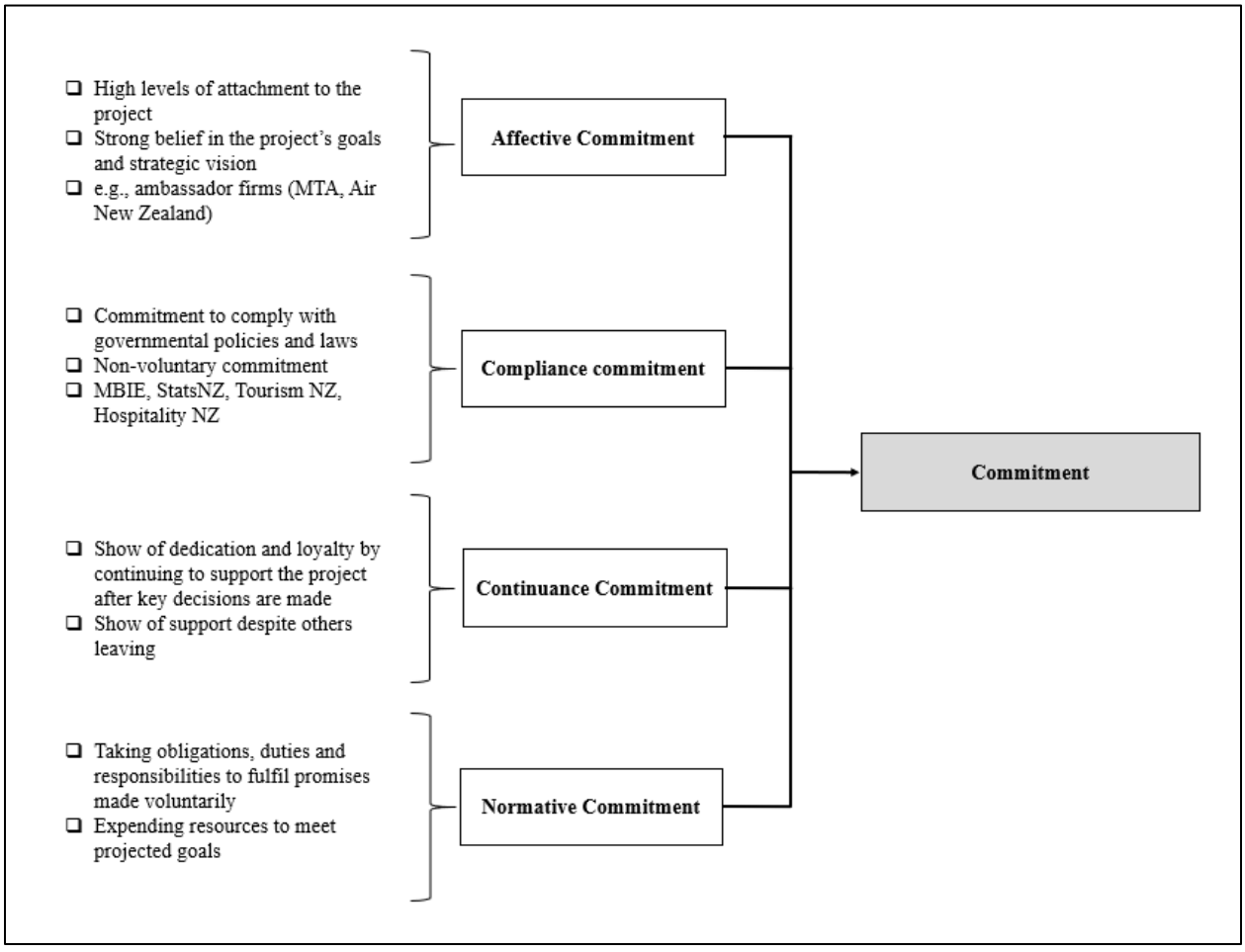

Figure 28: *Types of commitments observed*

Source: *Created by author*

For government institutions that were members of the collective, commitment was often part of *compliance* to governmental policies, particularly on data governance and open data, that directed such entities to work with industry partners in developing data solutions in the tourism sector. For instance, Statistics New Zealand and MBIE were expected to adhere to New Zealand government's Open Data Policies[14] and the Tourism Data Domain Plan[15] that promoted industry-linkages such as those expected out of the development of the IOP. Similarly, Hospitality NZ, Export Council of NZ (ECNZ), and Regional Tourism Organisations (RTOs) of NZ were all required to comply with data sharing requirements that were being supported by the development of the IOP. Thus, by complying or following these policies and guidelines, these institutions committed themselves to the collective action endeavour to develop an IOP.

Additionally, some members showed *affective commitment* by acting as ambassadors, going beyond their obligations, and volunteering and advocating for support from their networks. For instance, Air New Zealand took up major responsibilities to develop a reference architecture for the infrastructure of the IOP and also created a dedicated team to focus on designing a solution on short-term visitor demand forecasts (see Table 18, p.99). The Insights Manager at Air New Zealand described their actions as, *"... we are dedicated because we believe in the goals and intentions of the project."* As such, this show of allegiance or *affective commitment* to the project occurred in members that believed in the project's goals and strategic vision.

6.4 Integrative Summary

In this section conclusions are drawn from the findings and key insights presented above. To fully address initial research questions, the research framework presented in the theoretical foundation chapter (***Chapter 3***) is brought back here to review the findings and insights gained alongside the research questions asked from the start (see Table 22, p.141). A discussion is provided that explains how gaps and questions from previous research are addressed, and new avenues of research that are yet to be explored. In the end, the boundary conditions within which the findings and insights from this study should be understood are presented – also drawing contrasts and comparisons with different contexts in previous studies that have investigated IOP development processes through collective action lenses.

[14] https://www.data.govt.nz/manage-data/policies/open-data-policy/

[15] https://www.mbie.govt.nz/assets/157deaf9d8/tourism-data-domain-plan-2018.pdf

6.4.1 Review of Previous Research Gaps and Study Insights

There is limited knowledge from previous research on platforms that explains early-stage design, composition, and infrastructure elements of IOP architecture developed by collective groups. Here we provided insights into the architecture that emerges out of collective action (Figure 5, p.60), and how it is formed from conception. Findings from the research show that the platform architecture that emerges out of collective action gravitated towards modularity to reflect the group characteristics. This included (i) member interests, (ii) resource complementarities, (iii) pre-existing business connections, and (iv) sub-divisions by type of business (e.g., airlines, airports, government, hotel chains, and so forth). Whilst previous research identifies modularity as a key property of platform architecture (Baldwin & Woodard, 2009; Hukal, 2017; Tiwana, 2014), there are seldom clear explanations about how IOPs get to become modular as we have found in this study. Additionally, prior studies shows that high modularity can increase the autonomy of contributors over the platform and create a risk of inversion of control (c.f. Parker, Van Alstyne & Jiang, 2017) – in this study, such autonomy appeared to be an important factor in sub-group organisation that enabled specialisation and attracted third parties to the IOP development process. Also, in our case, contributors to the platform were primarily the members of the collective and therefore had a minimum risk of inversion of control as would if they were external and competing third party players.

One avenue of research which is opened by this is that such sub-group organisation may raise the complexity of governing the different platform 'nests' of sub-groups and increase the possibility of drifting the platform from the intended strategic direction, or even disintegrating. The risk of drifting existed because sub-groups were semi-autonomous, they specialised on specific data areas (see Figure 16, p.110), and they were closely supported by technical experts from outside the collective (see Table 18, p.99). The risk of breaking up existed because members could end up pursuing the interests in their own 'nest' or from third-party players rather than that of the collective. Additionally, they could end up seeing more value in the one aspect they specialised on rather than the whole platform, leading to fracture from the collective IOP. We observed that the leading organisation mitigated this by regularly convening coalescing activities that were aimed at synthesising and integrating the outcomes from nesting activities. Future research can investigate how such sub-groups are governed beyond the development stage of an IOP.

Regarding openness and control, there remains an open research question in IS research about what should be the appropriate options and balance for openness and control in platforms (Huber, Kude & Dibbern, 2017; Karhu, Gustafsson, & Lyytinen, 2018; Parker, van Alstyne, & Jiang, 2017) and insights are less common in IOPs let alone on decisions made during the development process for an IOP (Fürstenau, Auschra, Klein & Gersch, 2019). This research showed that although openness was seen as important for top layers of the platform such as API management systems, data transmission, data formats, and apps, there was an interest towards more closed lower layers, particularly regarding the infrastructure and core

processing systems that lay the foundation of the platform. In terms of process, it was observed that there was emphasis of openness at first and considerations for some parts to close over time.

Prior research also asks questions regarding the types of governance options that emerge out of IOPs (Agarwal & Tiwana, 2015; Boudreau, 2017; Huber, Kude & Dibbern, 2017; Wareham et al., 2014). The governance models that emerged out of collective action to develop an IOP in this case can be summarised into five options: (i) having the lead organisation as coordinator (MTA); (ii) a participant collective governance i.e., collectively governed by individual participants; (iii) setting a separate organisation set up as a 'parent provider'; (iv) a subgroup arrangement; and (v) having the government as central provider. Each option had its own implications on member roles & responsibilities, leadership, membership type & decision rights, and data governance (see Table 11, p.75). Selection of the most appropriate choice amongst these options was complex because there was no clear optimal choice even after multiple deliberations. We observed that members resolved this by engaging in voting exercises that enabled them to make decisions and move on, although this created persistent grievances for losing parties – at times resulting in a significant number of organisations exiting the collective group. Here, we suggest that although democratic processes can be used to deal with decision making hurdles when faced with complex choices, leaders of IOP development projects should be carefully consider ways to address concerns of losing parties. This should be done to mitigate against exiting – especially when all participating members have unique contributions to the intended platform as any exits would reduce the potential value of the platform.

Another existing issue in platform research concerns the possible options for creating value in IOPs considering heterogenous nature of participating organisational members, and the difficulty in creating network effects (c.f. Cennamo & Santaló, 2019; de Reuver et al., 2018; Le Masson, Weil, and Hatchuel 2009). In this research we observed the possible options for generating value for members in a data IOP. These included the following:

Creating a single point of access (SPA) to data resources (e.g., comprehensive data on visitor spending) and services (e.g., analytics tools) that would otherwise be difficult to access or costly to develop by a single organisation.

Dataset Integration to enhance reliability of methods of data aggregation, and consistency in data collected from disparate sources, and to provide insights that a single or few members alone could not otherwise produce. Such datasets include commercial accommodation monitoring, sector level cash, and spend analyses, real-time tourism estimates nationally and regionally, domestic, and international visitor analyses (see Figure 14, p.96).

Leveraging complementarities that would otherwise be missed between organisations participating in the IOP. For instance, this means that organisations can reduce redundancies

in creating datasets that another organisation produces more effectively and shares via the platform.

Knowledge transfer – by participating in an IOP project, members benefited from exchange of ideas and ambient learning from experts and leaders during various touchpoints such as design workshops and leadership panel meetings.

A potential high potential for resource re-use – particularly the potential of benefiting from economies of scale in infrastructure reuse as members would share the same data infrastructure and core processing systems.

Co-creation of resources & innovation between (i) members and other members, (ii) members and partners (i.e., parties such as developers, vendors, government), and (ii) members and the leading organisation (see Figure 16, p.110, and Table 18, p.99)

Previous research also points out that value creation is likely to be more difficult to achieve in IOPs because of different governance mechanisms per institution (Jacobides, Knudsen, and Augier 2006; Bosch-Sijtsema and Bosch 2015) and achieving commonalities in value is also challenging because of different business models and goals per organisation (de Reuver, Verschuur, Nikayin, Cerpa & Bouwman, 2015; Nikayin, de Reuver & Itälä, 2013). In this research we observed that to address this challenge, collective value system design was a self-organisation process in which firms decided which role they played and how much contribution they needed to make for the value system to become functional. It would seem that such an 'influence-free' condition was required for the members to 'self-organise' and come up with decisions that satisfy collective interests. This may provide insights into the elusive 'chicken-n-egg' challenge inherent in value design at platform launch – showing how self-organisation can help to deal with it without necessarily expending coordination and leadership influences.

Collective organising for IOP development is problematic because of the difficulty in coordinating actors with heterogenous interests, widely different technology frames, resources, and capabilities (de Reuver et al., 2015; Munkvold, 1999; Nikayin, de Reuver & Itälä, 2013; Öström, 2009; Steins & Edwards, 1999). Many 'collective' decisions need to be arrived at that need to harmonise these heterogeneous conditions. This study illustrated how these challenges can be dealt with by starting design processes with information discovery and sensemaking activities that help to reduce cognitive distances between players, to enable congruity of technology frames, and identification of resource complementarities. Further, it showed how decision making can be supported by deliberating activities that tease out available options and can resolve differences in choices by generating evidence and justifications for decisions made.

Prior research suggests that in order to promote cooperation amongst actors from diverse sectors, it is important to reconcile divergent interests of the different groups (Markus and Bui, 2012; Wigand et al.,

2005). However, it is often unclear how such reconciliations can be achieved without sacrificing one group over another. Differing interests, conflicts, and governance choices resulting from this can be so acute as to cause collective action discontinuance in IOP development (c.f. de Reuver, et al., 2015). Our study illustrated many ways in which resolutions and reconciliations can be realised (see Propositions 1-6).

There exist outstanding questions in IS literature about how leadership in inter-organisational platforms is practised at work level to achieve strategic goals within coopeting collective groups (Nikayin, Itälä & de Reuver, 2012; de Reuver et al., 2018). An empirical gap exists about how platform managers address coopetition and associated heterogeneous interests and resources in the inter-organisational mobilisation needed in IOP development (Markus & Bui 2012). In this research we found the different roles that leading organisation plays at different IOP development stages. At the start of new processes, the leader played a facilitatory role in supporting discovery and sensemaking activities by members. During deliberations, the leader coordinated members to ensure that they all fully engaged and contributed to discussions. When members engaged in design activities, the leader organised them according to their complementarities and interests and supported them with coaching and technical capabilities. The leader was responsible for ensuring that any divergent activities such as nesting should have proceeding integration activities that coalesce members again to ensure that all components designed autonomously coalesce into a stable platform design (this also mitigated against project drift).

Finally, insights from this study were also valuable of data access and real-time collection of data during the project. In terms of data access, the researcher and team of advisors had in-depth access to data from the conception of the project. The study participants were generous in providing the necessary permissions for the researcher to talk to representatives of the 46 organisations, to participate in multiple workshops, meetings, and other key events as the project evolved (see Table 21, p.122). This enabled the gathering of data from multiple sources such as observations of deliberations, minutes of meetings, reports, photographs, and so forth. Such levels of access to rich data enhanced our analyses and confidence in the insights drawn from the case. Further, recent studies note a scarcity of research in platform ecosystems that assesses platform development projects that involve multiple institutions taking part with a perspective that covers an entire organisational field (de Reuver, Sørensen & Basole, 2017). There are also calls longitudinal work on platforms that details *how* development processes such as architecture and governance designing occurs because the bulk of existing research often studies platforms retrospectively and "a snapshot in time" (de Reuver et al., 2017, p.128; Fürstenau, Auschra, Klein & Gersch, 2019, p.13). The majority of previous research has so far not revealed much direct design knowledge because the secrecy of most platform projects makes reliable first-hand data on design activities and decisions almost impossible to ascertain (c.f. de Reuver et al., 2017, p.129). We thus think this research is unique in this way and offers valuable insights that are still scarce in current IS research on platforms.

Table 22: *Research framework & summary of key findings*

Category	Constructs	Research Questions	Key Findings
Desired outcomes	Platform Architecture	**RQ1:** *What is the form & characteristics of architecture that emerges out of collective action to develop an IOP amongst a varied group of firms within the same industry?*	- Modular architecture that reflects group organisation in (i) member interests (ii) resource complementarities, (iii) pre-existing business connections, and (iv) organisation's type of businesses
	Governance	**RQ2:** *What governance options emerge out of collective action to develop an IOP amongst a varied group of firms within the same industry?*	- Option 1: Lead organisation as coordinator (MTA) - Option 2: Participant collective governance i.e., collectively governed by individual participants. - Option 3: Separate organisation set up as a 'parent provider'. - Option 4: Subgroup arrangement - Option 5: Government as central leader
Options	Openness & Control	**RQ3:** *What are considered options for openness & control in the design process for an IOP?*	- Emphasis of openness at first and considerations for parts to close over time - Top layer components – open with exceptions (data transfer, data formats, API management system, data apps) - Lower layer components – closed with exceptions (foundational infrastructure and core processing systems)
	Value Creation & Leveraging	**RQ4:** *What are the considered options for generating and leveraging value in the IOP?*	- Single point of access (SPA) - Data Integration - Complementarities - Cost-savings - Knowledge transfer - Resource re-use (Economies of scale) - Innovation
Context conditions (i.e., fixed parameters)	Heterogeneity & Coopetition	**RQ5:** *As context conditions, how does **(a)** heterogeneity of interests, **(b)** heterogeneity of resources, and **(c)** coopetition dynamics affect collective organising in IOP development?*	- Heterogeneity of interests – creates alignment issues that can be addressed by sensemaking, coordination, and deliberation before decision making. - Heterogeneity of resources – Is beneficial to collective action because it increases complementarities but requires alignment

Category	Constructs	Research Questions	Key Findings
			according to those complementarities. It contributes to nesting at design stages. - Coopetition dynamics – are consistent throughout the IOP development processes. Strategic management by the leading can be used to harmonise differences and reconcile decisions.
IOP development processes & practices	Activities & actions	**RQ6:** ***(a)*** *How does an IOP development process involving multiple organisations working together through collective action unfold?* ***(b)*** *How is management practised in the process of IOP development that happens through collective action?*	- Identified and defined seventeen fundamental process concepts and constructs in IOP development that occurs though collective action. - Developed process models that illustrate actions and activities of IOP development in platform domains such as designing architecture, governance, openness & control, and creating a value system. - The models also show the structural organising of the collective at various stages of IOP development (e.g., nesting & coalescing of members in design stages), and how key decisions were arrived at.
	Socio-cognitive process	**RQ7:** *How do different technology frames between organisations influence collective action design process and practices during the design process of an IOP?*	***These findings are fully presented in Chapter 7*:** - Developed a socio-cognitive process model of technology frames of references (TFRs) that provides a visual representation the co-influences between TFRs and design practices that can propel collective design process. - This illustrated how frame incongruences and cognitive distances may be resolved through joint actions at different design stages.
	Critical mass	**RQ8:** *How do critical mass issues arise, manifest, and are managed in phases of development that occur before platform launch?*	***These findings are fully presented in Chapter 8*:** - Problematised critical mass, by using our case data, and raised questions to confront original theoretical ideas about critical mass – the outcome variable in collective action (see Figure 34 p.185).

6.4.2 Boundary Conditions

When reading the findings and insights presented above, it may be useful to highlight how this study is unique, and the contextual issues observed from the case. These boundary conditions reveal nuances that further provide rich insights from our study that can be used to understand collective action in IOP development projects. Contrasts and comparisons are drawn between what we observed in this study and what researchers found in other collective action for IOP development projects.

First, in this research, the leading organisation (i.e., MTA), was in a unique position, in that they already were an independent association representing New Zealand's diverse tourism businesses ranging from SMEs to large publicly listed corporates, and government agencies (see Figure 6, p.67). Collectively MTA represented around 85% of total active businesses in the tourism industry in New Zealand[16]. The nature of collective organisation, coordination, deliberations, decisions, commitments, and outcomes (Figures 17-23, p.114-120) could drastically change with a different leading organisation. By being an already existing institution for which members seek advice, business support, coaching, networks, and credibility, MTA started off well to be in a position of trust and influence that naturally set them up as the leader of the collective. Previous research shows that this is not always the case. At times, an aspiring platform leader has to employ much more deliberate strategies to earn the trust of its members for them to lead an IOP development project like this (c.f. Gawer & Cusumano, 2002; Ibrahim & Ribbers, 2009; Nikayin, et al., 2012; 2013). The battle for platform leadership can be so intense as to lead to discontinuance and failures in such collective action projects for IOP development (Nikayin, et al., 2012; 2013; de Reuver et al., 2015; 2018). For instance, studying the development of an IOP for mobile payments between banks and telecoms operators, researchers found that one of the reasons for eventual discontinuance was the battle for leadership (de Reuver, Verschuur, Nikayin, Cerpa & Bouwman, 2015).

Second, although we observed competition, and commercial interests by members of the collective in this research (see ***Section 5.5.3***), these were not as acute and critical as seen in other more commercially driven IOP development projects. Representatives from large corporates such as Air New Zealand, Auckland International Airport, Tourism Holdings Limited (THL), and InterCity Ltd often made it clear that although long term commercial outcomes were welcome, their immediate contributions through technical, financial, and leadership support was meant to support smaller operators with access to data resources, data systems, and data analytics capabilities. In the long term, such an investment would then generally grow the whole tourism sector and have longer term benefits that the larger corporates would

[16] This is as per the MTA Report of 2019.

benefit from. This sets insights from this study apart from the more commercially driven IOP development projects studied and dominating much of IS literature (Blaschke, Haki, Aier & Winter, 2018; Jarvenpaa & Markus, 2018; NG, Muthukannan, Tan & Leong, 2017; de Reuver et al., 2015; 2018; Leong, Pan, Newell & Cui, 2016; Schirrmacher, Ondrus & Kude, 2017; Schreieck, Wiesche & Krcmar, 2017; Tan, Pan, Lu & Huang, 2015).

In prior research, commercial interests of members in IOP development projects were often presented as immediate and more acute than we observed. This could be the reason why such studies find that network effects often need to be generated immediately at platform launch (c.f. Schirrmacher, Ondrus & Kude, 2017). In the study compared before, in which collective action for developing a mobile payment IOP was discontinued (i.e., de Reuver et al. 2015), researchers pointed out that high commercial interest between members, and the high market value of the intended platform both created stiff competition between players. Banks which already controlled credit and debit card transactions were competing to defend their dominance in consumer transactions, whilst telecoms sought to carve a new market by easing consumer transactions. This would reduce consumer dependencies on banks, making collaboration between banks and telecoms fiercely competitive and subsequently the dissolution of collective action (p.342–3).

In our study, moderate commercial interests meant that processes for value design and value appropriation arrangement in the platform under construction were not stiffly competitive despite noted differences between member interests (see Table 19, p.101). In our process model on value system designing (see Figure 18, p.115), we observed that members of the collective were able to 'self-organise' themselves and to agree on a value system that would enable benefits to be derived by both data contributors and data consumers (see ***Section 6.2.2***). Additionally, members did not seek to swiftly create network effects. Rather, there appeared to be an emphasis on building a durable foundational infrastructure and architecture for sharing data services and resources. Members spent time deliberating on and designing an architecture that would, in the long-term, transform the 'data ecosystem' in the whole tourism sector. Thus, we learn that previous suggestions that network effects should dominate design thinking in platform development (c.f. Parker, Van Alstyne & Choudary, 2016) may not be practical to IOPs with moderate commercial interests, that emphasise cooperation rather than competition, and that have a long-term focus on transforming an entire organisational field (i.e., the tourism sector in New Zealand in our case). We also learn that the extent of commercial interests and commercial value of an intended IOP can influence how processes in collective organising, values system design, and strategic management of collective action for IOP development unfolds.

Third, from the start of the IOP development project, the whole sector of tourism showed a degree of inclusive and cohesiveness that may not be there in other sectors or in different country contexts. This was indicated by prior levels of business connectedness between members in the collective group and

partners outside the group. In previous research, industry-level platform development projects often encounter lack of cohesion and inclusiveness between members. For instance, some studies of IOPs in healthcare (Fürstenau, Auschra, Klein & Gersch, 2019; Klein & Schellhammer, 2011; Nikayin, et al., 2012; 2013; Vassilakopoulou, Grisot, Jensen, Sellberg, Eltes, Thorseng & Aanestad, 2017) found that existing complex relationships between members such as insurance companies, governments, health-tech providers, health care and service providers, medical practitioners, pharmacists, and patients made it difficult to manage, and to sustain participation over time. They attribute collective action failures, particularly in e-health platforms to pre-existing inconsistencies in the structure of the healthcare sector, lack of inclusiveness between parties with complementary resources (Vassilakopoulou et al., 2017), and high conflicts of interests between actors (Nikayin, et al., 2012; 2013)[17]. Here, we learn that collective action for IOP development is likely to be more successful in industrial or business sectors that have pre-existing cohesiveness and inclusiveness between members. In other words, prior to collective action, organisations seeking to develop an IOP may benefit from building inter-firm business connections.

Fourth, in this research, the government agencies played a pivotal role in the providing support through funding, participating, setting of promotive policies and guidelines, and fielding technical support at workshops. Government agencies such as MBIE, Statistics New Zealand, Tourism New Zealand, Hospitality New Zealand, and the Department of Conservation actively participated in the project, at times even lobbying for central government support. During the course of the project, government agencies strengthened open data policies[18] that bolstered both inter-governmental data sharing, and government-industry partnerships that would ease regulation constrains for data sharing via the intended platform. The Ministry of Business, Innovation & Employment (MBIE) developed the Tourism Data Domain Plan[19] whose strategic vision aligned with and supported the IOP development project. Such active contributions from government agencies are not always the same in other projects of collective action for developing inter-organisational ***data*** platforms. For instance, in data IOPs for independent living services, assistive homecare devices, and health services, previous research shows that involvement of government agencies

[17] It should be noted here that these studies were mainly carried out in Europe, in countries which follow universal health coverage models. However, the researchers observed that inconsistencies and lack of inclusiveness were significant irrespective of the specific characteristics of the health systems. They averred that the same challenges are prevalent in platforms within health systems that do not follow a model of universal health coverage (such as USA) (c.f. Vassilakopoulou et al., 2017 p.12; also, for a study in the US see Fürstenau, Auschra, Klein & Gersch, 2019).

[18] https://www.data.govt.nz/manage-data/policies/open-data-policy/

[19] https://www.mbie.govt.nz/assets/157deaf9d8/tourism-data-domain-plan-2018.pdf

introduced restrictions through regulation of security and privacy issues on citizen and patient ***data*** (Nikayin, et al., 2012; 2013). Thus, in different types of ***data*** IOPs the government can play a very different role that can be enabling (as we have observed in this study) or restrictive (as observed previous research). As an example, a tourism data platform that is likely to boost economic activities will likely get support whilst a health, social, or smart living services data platform is likely to get scrutiny and restrictions on data privacy and security issues.

Finally, we observed that the project was composed of a mix of senior and mid-level managers, data experts and technical experts – as represented by our sample (see Appendix 2). With a different sample – say only technical members – events and processes in the project could have evolved differently. For instance, in this study we observed that the project generally started off by harmonising goals through sensemaking and discovery activities, went to deliberations, designing solutions and then only later invited technical experts to translate the solutions into artefacts. With a highly technical group, it may be that the project would have started off and evolved differently. Whilst the importance of type of players in terms of expertise and capabilities has been noted in previous research (c.f. Saarikko, Westergren & Blomquist, 2016; Tan, Pan, Lu & Huang, 2015), the way in which this influences the organisation of processes during collective action for IOP development has not been illustrated as we have and promises to be an interesting future research path.

Chapter 7: In-depth Exploration of Technology Frames

Technology Frames in Inter-Organisational Platform Design

Cognition and micro-level processes are keys to understanding
the organisational impact of new technologies.
– KE Weick, 1990

Abstract

The literature on inter-organisational platforms suggests that their design is plagued by collective action challenges, such as the alignment of participating firms' expectations and preferences around platform architecture and governance. In this longitudinal revelatory case study, we examined the design process of an inter-organisational platform. We investigated how representatives of the organisations engaged in face-to-face joint design workshops, negotiating agreements regarding the design an inter-organisational platform for sharing data services and resources. We also mapped out how the design process facilitated by the platform sponsor supported the development of shared technology frames, by reframing participants' expectations and assumptions. The findings show structural changes in technology frames for different 'groups' of firms. From these findings we developed a socio-cognitive process model of collective designing, which provides a theorisation of how technology frames shape inter-organisational platform design. Based on the findings, theoretical implications, and possibilities to improve support for the development of shared technology frames are discussed.

Keywords: Technology frames, Inter-organisational platforms, Platform design, Social cognition, Process model

7.1 Introduction

The noticeable success of 'unicorn' firms that have (re)configured themselves as platform ecosystems has attracted significant attention to how such organisations are developed, perform, scale, and become sustainable as they evolve. Platforms can be understood as 'meta-organisations' (Gawer, 2014, p.1240) that, through socio-technical systems, link interdependent actors, firms, and resources to exchange and co-create value through interactions, transactions, complementarities, and innovation (Constantinides, Henfridsson & Parker, 2018; Tiwana, Konsynski & Bush. 2010). As traditional 'siloed firms' platformise (Bygstad & Hanseth, 2018) or join other organisations to develop *inter-organisational* platforms, they are faced with unique challenges when interacting with other firms. One such challenge has to do with the design of the platform technology itself – for both its architecture and governance (Tiwana, 2014).

Platform sponsors need to answer two important questions regarding platform design: (1) How do we build a platform that invites participation and creates significant value for its users? (2) Which tools and services will make it easy for participants (e.g., producers and consumers of resources and services) to interact in mutually rewarding ways (Parker, Van Alstyne & Choudary, 2016, p.35)? These questions are especially critical for inter-organisational platforms that rely on shared digital architecture and governance arrangements between multiple organisations (Markus & Bui, 2012). For such platforms, the design of the platform architecture and its governance need to facilitate interactions amongst heterogenous firms with motivations that vary widely and change frequently as economic, regulatory, and technology changes in their environment evolve.

In previous research, the subject of platform design tended to focus on design options and governance rules considered by a single platform sponsor or 'parent-provider' (c.f. Ghazawneh & Henfridsson, 2013; Parker, & Van Alstyne, 2018; Tiwana, 2018), and about the specifics of those options. For instance, specifics of openness *vs.* control (Boudreau, 2010; Parker, & Van Alstyne, 2018), modular interdependencies *vs.* integration (Um, Yoo & Wattal, 2015; Hukal, 2017), privacy and security *vs.* access (Jarvenpaa & Markus, 2018) were studied.

To extend these findings, we focused on the design process of an inter-organisational data platform in which the platform architecture and governance rules were negotiated between multiple firms, with a perspective that covered an entire organisational field (cf. Chiasson & Davidson, 2005; Steinfield, Markus, & Wigand, 2005). We intended to uncover the association and influences between participating firms and their representatives' *technology frames of reference* (TFR) (Orlikowski & Gash, 1994). We also looked at the collective design actions practiced during the development of the platform. This area has received little attention from IS research, yet it has promising potential to elicit nuances of collective design practices that propel inter-organisational IT projects that involve heterogenous actors with competing interests.

Technology frames refer to participants' assumptions about a technology, such as the expected use, features, and benefits of that technology (Orlikowski & Gash, 1994). Technology frames are a relevant factor during platform design because they capture the underlying perspectives of organisational actors, and hence represent an opportunity for designers to understand and design technological solutions that meet those interests. Apart from a few important exceptions (e.g., Davidson, 2002), past research about technology frames has tended to focus on the *implementation* and *use* of an IS/IT (e.g., Khalil, Winkler & Xiao, 2017; Menold, 2009; Mishra, & Agarwal, 2010; Puri, 2006; Young, Mathiassen & Davidson, 2016), with limited attention on the influence of technology frames on IS *design*, and even less so on the design of platforms.

To analyse the design process a of large and complex inter-organisational platform, we asked the following research questions:

RQ1: *What are the TFRs that are held by firms participating in the design process of an inter-organisational platform?*

RQ2: *What are the co-influences and association between TFRs, and the collective design actions practiced during the design process of an inter-organisational platform?*

Our findings are based on a longitudinal revelatory case study, in which 46 firms in the New Zealand tourism sector sought to design and develop a platform for sharing data resources and data services. We disentangled how technology frames had co-influences with collective design actions on various architecture design options and governance aspects of the platform under construction. This highlights nuances and issues about the platform designing process that may have remained inconspicuous otherwise. Focusing on technology frames offered an analytic perspective for explaining the design process and enabled us to develop a process model, which provides a theorisation of how technology frames associate and co-influence with design process. Distinct technological frames exist in the organisational groups participating in a collective design process. We found evidence for joint actions that help to generate frame congruence, so that participants' expectations, values, and preferences are made visible, trade-offs among design options are evaluated, and design decisions can be made in consensus. We thus uncovered design actions used to address the wicked problem of integrating divergent frames around the design of a complex socio-technical artefacts. The rest of the paper is structured as follows: (i) a theoretical background, (ii) a description of the research methods, (iii) presentation of findings, (iv) a discussion of the implications of the findings, and (v) a conclusion.

7.2 Theoretical Background

7.2.1 Inter-Organisational Platform Design

Platform architecture and governance rules set out how various artefacts (the platform core, extensions, APIs, SDKs, integration engines, etc.) that coalesce into a stable platform and its complementary modules will interact, vary, and metamorphose as the platform evolves (Baldwin & Woodard, 2009; Tiwana et al., 2010). Platform designing is about setting the architectural configurations (including infrastructure) and governance rules that sets the course of a platform's developmental trajectory. Design choices can determine which users will participate, how they will participate, and whether the platform will become scalable and evolvable as it grows (Agarwal & Tiwana, 2015). Decisions about architecture design and governance rules can *lock-in* platforms into a path-dependent trajectory that can be impossible to reverse as it scales. Thus, the design of platform architecture and the rules that govern the interaction of resources and people over its infrastructure and architecture are critical in determining its eventual developmental course.

To exhibit a 'platform' characteristic, technology designs need to exhibit characteristics of extensibility, variability, malleability, and scalability (Baldwin & Woodard, 2009; Tiwana et al., 2010). The platform core is often launched as an early version of an artefact in continuous reconfiguration, and therefore needs to be both stable and scalable enough to accommodate varied changes. Thus, at the design stage, the design team needs to focus on those parts that are evolvable, but still serving the interests of the users. In inter-organisational settings where different actors have varying ideas about the design of the platform, and with organisations competing to have their design choices represented, designing an evolvable architecture is challenging because of the need to balance ambiguous design options and trade-offs. This is even more pronounced when the design process and associated activities are negotiated and distributed between participating firms. In such circumstances, the team tasked to design the platform has to balance various expectations and interests for each represented firm.

Platform designers may face conflicts on design options, for example: between modular versus integrative options (Um, Yoo, Wattal, Kulathinal & Zhang, 2013; Tiwana, 2014); balancing between designing for current stability versus future support of variation and mutation (malleability) (Baldwin & Woodard, 2009; Hukal, 2017); choosing open and interoperable versus highly controlled proprietary design options and standards (Boudreau, 2010; Ondrus, Gannamaneni & Lyytinen, 2015; Wessel, Thies & Benlian, 2017; Parker & Van Alstyne, 2018, p.3018), and emphasising data security and privacy versus liberating data access (Jarvenpaa & Markus, 2018). These tensions on design choices present trade-offs, each with its own benefits and drawbacks, and each with a potential to set the platform on a different developmental course. Choosing one option over another may mean that some organisations may be well-served whilst others opt out. Thus, at design stage, it is critical to understand the design choices and to orchestrate platform development. This means that the design team needs to understand the views about the platform requirements from the perspectives of all the players involved.

Requirements determination during inter-organisational platform design is a complex endeavour that requires discovery and sensemaking of varying expectations and choices, as well as communicative processes about design features and options (Davidson, 2002). Consistent with this line of inquiry, this study draws on the concept of technology frames of reference coined by Orlikowski and Gash (1994), to explain the collective socio-cognitive process of how frames and shifts in frame-salience influences the design process during inter-organisational platform design.

7.2.2 Technology Frames of Reference (TFR)

To successfully design an inter-organisational system such as a platform for sharing data resources and services, the designers need to understand the different expectations from the participating firms, and to be able to coordinate them to achieve a common solution that will be implemented. During platform

design that involves representatives from various organisations, understanding how each organisational member makes sense of the intended platform is critical to influencing their decisions, actions, and planned outcomes (Davidson, 2006). This means that the design process is an interpretive process that requires peeking into the minds of the various stakeholders at the design table.

Since the seminal work by Orlikowski and Gash (1994), researchers have recognised that IS design involves individuals making choices based on how they make sense of the information technology being built *vis-à-vi*s the internal challenges and opportunities in their organisations (Lin & Silva, 2005; Menold, 2009; Mishra, & Agarwal 2010). These interpretations could be in the form of meanings, assumptions, expectations, and knowledge, which they use to understand and contribute to the design process of the technology (Davidson, 2002). Orlikowski and Gash (1994) referred to these as technology frames of reference.

Information systems (IS) design is an interpretive process that involves individuals making choices base on how they make sense of the information technology being built (Orlikowski and Gash, 1994) vis internal challenges and opportunities in their organisations. This could be their assumptions, expectations, and knowledge, which they use to understand and contribute to the design process of the technology. Literature in managerial and organisational cognition and sensemaking suggests that cognitive frameworks, also referred to as mental models, knowledge structures, scripts, and frames are closely tied to how individuals make sense of and act within their environment (Abelson, 1981; Davidson, 2002; 2006; Gioia, 1986). It follows then that an understanding of users' cognitive frames should be a key factor in orchestrating the design of information systems such as digital platforms (Lin & Silva, 2005). Understanding technology frames from different players is important. For instance, incongruent technology frames can lead to resistance during the application and use of a new IT in an organisation (Menold, 2009).

Central to TFR concept is the understanding that in a group setting such as a consortium of organisations, members have three main frames that they use to interpret a particular technological artefact (Orlikowski and Gash, 1994, p.183):

- ***Nature of technology:*** mental images about the technology and their understanding of its benefits.
- ***Technology strategy:*** perceptions about why their organisation is interested in the technology, such as the motivation for its adoption and its strategic value to the firm.
- ***Technology in use:*** how the technology will be used, and possible or actual consequences connected with technology use.

The concept of technology frames of reference provides a useful theoretical background to analyse design and development of digital platforms, particularly in a multiple stakeholder setting. Conflicts in technology frames of key stakeholders can adversely impact outcomes of technology development and

social change, thereby impeding and problematising technology implementations (Orlikowski & Gash, 1994). This theoretical framework, therefore, provides a powerful analytical lens to examine and understand issues around the introduction of new information systems in multi-stakeholder settings. Since the design and implementation entail a multiplicity of stakeholders from diverse backgrounds who owe allegiance to different organisations, we draw upon the technology frames' approach to analyse the design process on an inter-organisational platform.

7.3 Research Methodology

To investigate technology frames in the design of an in inter-organisational platform, this study used longitudinal research data from a revelatory case study (Pettigrew, 1990). The study is part on an on-going program of research covering a two-and-half-year period (August 2017 – February 2020), documenting unfolding events as 46 organisations in the tourism sector in New Zealand worked together to develop an inter-organisational platform for sharing data services and resources. This case was selected because it presented a unique perspective (Benbasat et al., 1987) to the development of platforms in inter-organisational settings, with an opportunity to track real-time events covering a large number of organisations (46). Researchers got access to the platform development project from inception, which enabled participatory observation during the three design workshops reported in this paper.

Table 23: *Summary of sources of evidence*

Primary Sources	**Explanation**	**Interviews**
Interviews with representatives of the 46 org. & the MTA's team	Interviews included CEOs, Heads of Departments, Data & Insights specialists, owners, and representatives of organisations participating in the project.	70+
Secondary Sources	**Explanation**	**Documents**
Steering Committee Notes	Meeting agendas and notes with action items, discussion, and decision actions	500+ pages
Meeting Notes	Meeting agendas, presentations and notes from other MTA led Platform Development meetings	
Web Page Content	Content from MTA's official website. Includes content from related government websites such as Ministry of Business Innovation and Employment (MBIE) and Statistics New Zealand	
Press Releases articles	Official press releases and news/journalistic content about the platform development project	
Workshops	**Explanation**	**Participants**
Design Workshop 1	Facilitated by the MTA, Auckland & Wellington	50+
Design Workshop 2	Facilitated by the MTA, Christchurch & West Coast	35
Design Workshop 3	Facilitated by the MTA, Auckland	50+

To understand the influence of technology frames in platform design, data collection was conducted in four stages: (i) at the initial discovery stage when all participating firms expressed their expectations of the project's offerings, (ii) at design workshop 1 when they deliberated on architecture design, (iii), at the second design stage when they deliberated on governance issues, and (iv) at the third design stage when they deliberated on implementation of the platform. Data from the initial discovery stage was collected through semi-structured interviews, whilst data from the workshops came from participatory observation and documentation of the deliberations that took place by the first author. Secondary data sources such as minutes of meetings, web-page content and press-release articles were also consulted (see Table 23 p.152).

Table 24: *An example of coding technology frames*

Design Domain	**Technology Frames**	**Definition & Explanation**	**Example of Evidence**
IOP Architecture	Structure of data output *(Raw Data Output)*	*Definition:* Raw data that is unaltered from source, for instance, in the form of database extracts and spreadsheets. *Explanation:* Larger firms wanted to access raw data because they found it more useful and had the capacity and capabilities to perform their own internal analyses.	*For us, we would like data in basically raw format. The other users of data are the ones who may have a specific project in mind, and the pre-set templates won't just work for them. And that's one of the challenges that a lot of people have, for instance with data from the MBIE site where MBIE have said, "well, we think that people want to see these graphs, and so that is what we'll give them". But actually, what we want is access to the granular level data, because we want to cut and dice it for a particular purpose. For instance, there's a segment of customers, or a mode of travel or whatever that we're interested in, and probably no one else is interested in it, but we're interested in, and we want access to that raw data that allows us to make our own internal analyses.*
	Structure of data output *(Statistics and Reports Output)*	*Definition:* Aggregated statistics that show trends and flows as well as distribution maps *Explanation:* Most small firms had little capacity to work with large raw datasets. They preferred analysed statistical data and reports as an output of the platform.	*I am operating a fairly small enterprise here and I think it's more useful for me and probably speaking for many other small companies, that we have simple but effective reports that give us an analysis of our markets, starting from local, regional to the national trends. This is what we expect from an effective data system, the ability to reduce all that complexity by compiling, analysing, and presenting to use easy to use reports that give us the insights we need to do our businesses effectively.*

We did not employ an action research approach for this study because the first author's involvement was limited to observation and the provision of minimal informal input. Participants in these design workshops were representatives of the 46 firms that had been invited to take part in the project as well as the Main Trade Association's (MTA hereinafter) team that played the role of platform designers in the project. MTA's team was composed of data specialists and contract developers outsourced work as design experts during the workshops. Semi-structured interview with representatives of the 46 firms and the MTA's team. This included CEOs, Heads of Departments, Data & Insights specialists, company owners representing such organisations as providers of visitor experiences (skylines, ziptreks, canyon swings, etc.) airlines, airports, hotel chains, bus and tour operators, cycle-trail operators, restaurants, museums, and government departments.

Consequently, a rich dataset was developed that included various sources, *inter alia* include transcribed interviews, documents, workshop agendas and summary reports, notes taken during the workshops, and photographs of visual illustrations made by participants at the workshops. Data analysis followed an iterative and inductive approach, using concepts from inter-organisational platforms, platform designing, and technology frames of reference as an informing background. The units of analysis were key technology frames that were consistent and prominent from all the participating firms at each stage design stage. An open coding exercise was conducted by the first author whilst the other three authors participated in revising the emerging themes in several rounds of meetings at which all authors made sense of the analyses, debated and re-defined codes. In the end, four major design aspects about benefits, architecture, governance, and development emerged. For each of these design aspects, several technology frames of reference were held by participants (for an example of coding, see Table 24, p.153). Additionally, we also identified the associated strategies implemented at each design workshop to propel the design process forward by the platform designers (Figure 33, p.164).

It is important to note that only data on the research question regarding technology frames of reference and design actions was used in this paper, which is a subset of the larger dataset that covers many other research questions and variables in this ongoing program of research.

7.4 Results

7.4.1 Background

Regarding the challenges in the data space within tourism and hospitality, companies reported that there were inconsistent and multiple datasets, a limited industry level view about domestic tourism, problems regarding data quality, inconsistency, and a lack of a centrality in accessing regional and national trends in key areas such as tourism spending and visitor flows.

"The tourism data are basically available, but you need to know where to go. While all the data are listed and linked to from the MBIE website, there is no single format and new users would struggle to know which collection to use for what purpose. Some data sets are distributed in forms that allow easy manipulation by mid-level users (e.g., the pivot tables for the Regional Tourism Estimates) but most are not. There is limited availability of the microdata. A few innovative and well-regarded interactive tools have been built but with only limited coverage of the data."

"We see that understanding the digital marketing space and customer insights will play an ever-growing role in influencing visitor preferences. We thus see the need to participate in the project for these reasons - there is a potential to access greater data at granular level and also unique data sets from organisations that we were previously not directly connected to. But, apart from that, having a shared IT infrastructure of some sort allows us to network and collaborate fully as an ecosystem of tourism in New Zealand."

Interviews with small enterprises and their representatives such as restaurants, holiday homes, backpacking, and skyline & canyon swing operators confirmed that they do not currently use data solutions because they are expensive, and they do not have internal IT capabilities. But as small enterprises scale their scope and operations, owners reported that they struggle to keep an overview of what is happening in each venue or local market. They would also benefit from simple-to-use data insights from visualisations of graphs or and simplified reports.

"A one-stop-shop of tourism insight should be at the centrepiece of the future tourism system. The system should include non-tourism data where this adds value."

"In our institution, we've got about six different places where we go and look for data. And unless you're collecting it yourself, which of course is incredibly expensive and sometimes not that accurate, you are heavily reliant on government data and that government data is often two, maybe three months behind when you actually need the information."

For larger organisations, their main concern was access to raw data that would allow them to apply their own internal analyses. Whilst they had robust internal systems for analysing their internally produced data, they had limited access to holistic insights about the operations of SMEs which were numerous and occupied a larger share of the tourism and hospitality market. They are unable to collect sufficiently accurate data from the consumers or other tourism and hospitality firms. They were also concerned about the quality of the data available from such sources as local authorities and government departments.

"I can't see how we're going to get an accurate picture of volume until we're starting to get some oversight of the volumes going through our airports, our train stations, our buses, all those types of things."

"Yes, we use all sorts of different data. And have, yeah, have a really strong desire to understand how we can take our current customer data, anonymise it, and then bring in other data sources to help us think about what the future might look like, and how we can adapt ourselves at a business model level, to change for the future. Yeah."

A data services platform would therefore be especially valuable if it would integrate data from different information systems and provide and consistent and coherent source of up-to-date raw data, forecasting and reporting options. They were willing to invest into a common data platform that would integrate data from small firms and provide representative market-level insights. However, even though both large and small firms were aware of potential opportunities for combining data, and of a platform ecosystem solution, they were also skeptical about the challenges that such a set up would bring, particularly on such areas as competition in local markers, protection of sensitive & confidential data, alignment of internal company goals to those of a common data platform, and generally, whether such a solution was achievable.

7.4.2 Platform Benefits & Value Expectations

At the start of the project, firms were trying to figure out the benefits for participating in the project. Essentially how it would provide value to their organisations. Technology frames at this stage where mainly about the intended platform's benefits & value (and future use). The existence of both large and small firms, all of them coming from different businesses within the tourism and hospitality sector meant that their goals regarding the intended platform were diverse, and their interests and incentives for participation were also different. Companies involved in the study included airlines, airports, motorhomes, restaurants, private sector corporates, and local tourism organisations, and other trade associations for SMEs such as holiday homes and bed & breakfast providers. MTA's team of platform designers faced an organising challenge of aligning the different frames about the platform's expected benefits, so that a convincing value proposal that would match the goals of multiple target firms could be achieved and thereby promote incentives for participation. Aligning conflicting the goals would also reduce uncertainty risk and speculation about what the platform would offer to each individual's firm. The key question that arose from interviewing many of the participants was: *How will the platform technology benefit my firm?*

Noticing the different benefits and value expectations, the design team visited each of the 46 firms, discussing with their senior management and data experts, asking about their priorities regarding the

platform. From this exercise, they developed an Insight Framework, which articulated the current state of the industry regarding data, their desired future state, and the benefits that the aspired platform would generate to the firms (see Table 25 below). The Framework was thus used to provide a foundation for the design project for which firms could refer to and compare their expected value versus what the platform was expected to offer.

Having consulted firms individually during the development of the Insight Framework, the design team decided to hold a design workshop that would bring together representatives of the firms into one room *"to iron out what they **key priorities and values** were".* As noted by the MTA's project leader:

> *"To move the project forward, a clear and unifying industry voice is needed to determine priorities for the platform from all the various goals that were put forward by members, and for establishing mechanisms for undertaking these priorities."*
>
> *"[MTA], with the support of industry, has led development of this tourism data Insight Framework. It aims to drive changes so that tourism businesses and stakeholders have the quality knowledge needed to make better informed decisions and achieve better outcomes. In this project, extensive work has been completed to understand the current state of tourism data systems, what the industry wants from a future insight system and the actions needed to bridge that gap. Insight includes all types of data, analysis and strategic research that generates knowledge to support tourism decision-making. It also includes the release and dissemination of insight to users."*

Table 25: *Tourism Insight Framework (Extracted from the MTA's Project Framework)*

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At the design workshop, firms were asked to deliberate on what they thought to be the **main priorities** of the data platform. The end result of the activity was a list of priorities set, an extract of which is shown in Table 26 below.

> *"To achieve clarity and agreement from the participating members in the tourism industry about the main priorities for the intended platform and provide the strategy for addressing these priorities we developed, documented and circulated a Tourism Data Domain Plan. These strategic topics and initiatives were identified following consultation with the members. The domain plan provides the foundations for deciding on where the greatest needs are in terms of tourism data essential for key decision making."*

Setting the project framework and priorities not only helped to ground the project and showcase its promises, but it also progressed it by shifting the frames of mind of the participants from thinking about benefits towards thinking about that the actual platform technology would look like. Participants who had initially indicated willingness to participate and excited about the values set in the framework and the priorities targeted, soon began to ask about the key features that the intended platform would deliver. Head of a restaurant chain succinctly captured these sentiments:

> *"At this stage, the Insight Framework although promising, it's quite abstract. We want to know what this technology will offer to the chain of restaurants that we represent. What will be the key features and how will these promote services to a casual diner downtown or the premium restaurant in central city? We have yet to be shown some diagram that shows us this technology and where we might fit in. And that's worrying."*

Table 26: *Priorities set by the participants. Data extracted from MTA's Project Report*

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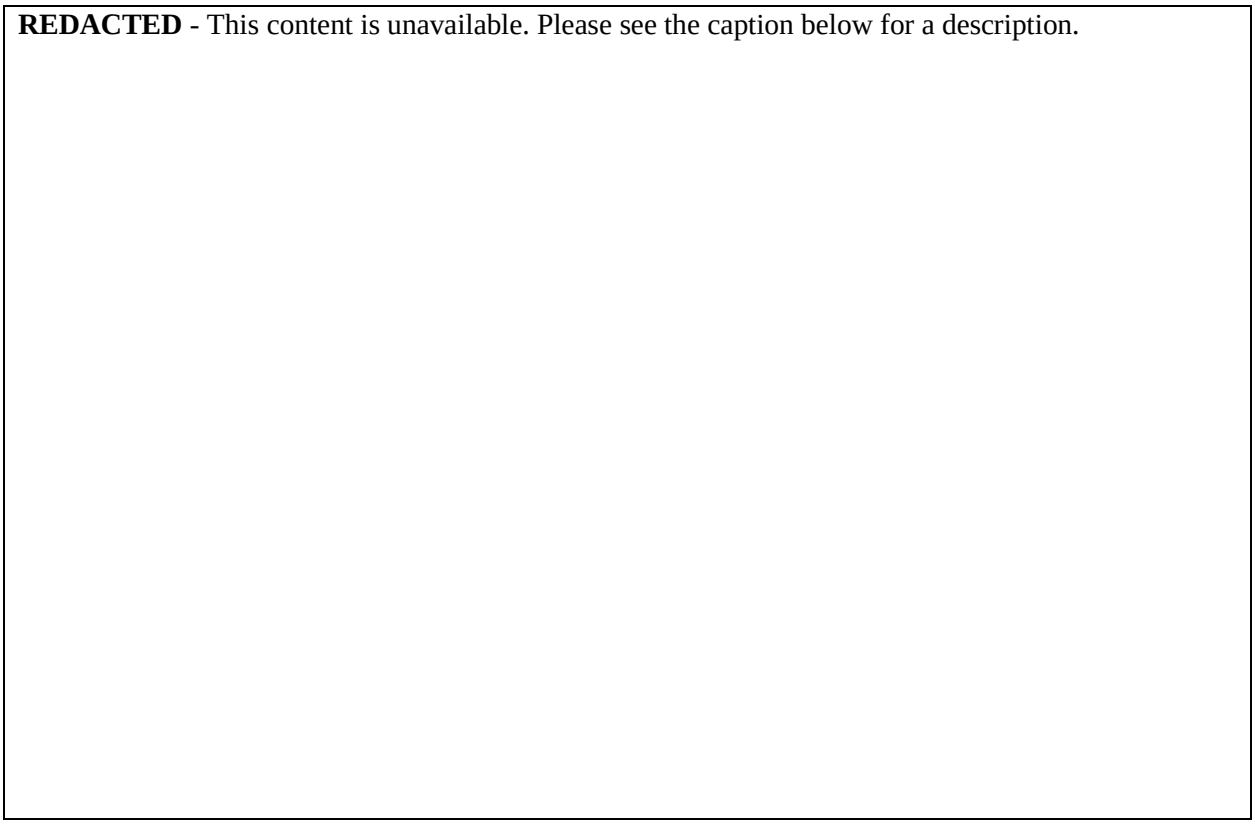

Figure 29: *Different benefits and opportunity expectations stated by participants*

This signalled the need for coring the platform by designing its architecture, leading to the holding of design workshop 2, which focused on Architecture and Data Design. Our findings thus suggest that **design coring** creates concrete business opportunities that are a feasible basis on which to recruit contributors as well as drive the design project as the benefits of participation become visible rather than speculative. Without a clear deliberation about the description of the platform being developed, there existed information and knowledge deficits regarding design features of the aspired platform between the platform sponsor (MTA) and platform users (i.e., participating firms) that can act as a barrier to the progression of the project.

7.4.3 Architecture and Data Design

The second design workshop focused on the design of the platform, particularly regarding how it would be configured, and the structure of data output expected as these were the areas that most firms had divergent choices on (see Table 27, p.160). At this design workshop, the key question was: *What is the architecture of the platform being designed, and will be the format and content of its data output?*

There were different frames about the overall platform configuration, technical restrictions on access, structure, and content of data output (also see Figure 29, p.159) as well as the technical standards that would be followed. There appeared to be a 'cognitive distance' at two relationship levels: one, between the participating firms and another between the MTA's design team and the firms. For instance, there were very different mental representations of envisioned platform such that when each of the representatives of the participating firms were asked to draw an illustration of what they envisioned, they came up with very different diagrams that represented their mental pictures (see Figure 30, p.161).

This activity of making **visual illustrations** was a design practice that helped to identify that there was a cognitive distance between both the firms and the MTA's design team. It enabled the participants to collectively think about ways to start reducing that distance. In the deliberations that took place in the second design workshop, participants were clear that they had varying choices and expectations about the content of the data that the platform would focus on. Naturally, those firms working in the accommodation sector sought to emphasise accommodation data, and so did the firms in transportation, tour providers, airlines, and small businesses – they all wanted their areas of focus to be the key content of data that the platform would focus on (Figure 31, p.161 captures some of these data areas). Faced with this conundrum, and after rounds of deliberations at the workshop, participants & the MTA resolved to organise firms into groups, to focus on designing the structure and content of datasets peculiar to their firms. Thus, **design groups** emerged. Airlines and airports focused on international visitor data, hotel chains and holiday homes focused on accommodation data, local tourism organisations focused on regional tourism estimates for volumes in visitors and spending, and so on. This naturally led to **modular design** thinking as each dataset area could be considered as a module or component at this design stage.

Table 27: *Divergent issues in technology frames about platform architecture and data design*

Design Aspect	Technology Frame	Design Choices
Architecture and Data Design	Overall platform configuration or structure	Centralisation *vs.* de-centralisation
		Integration *vs.* fragmentation and/or partial integration
	Technical restrictions on access	Technical openness *vs.* technical control
	Structure of data output and analytics	Raw data *vs.* statistics and reports output
		Different choices between various data forecasting and estimating models
	Data content	Emphasising domestic tourism data *vs.* international tourism data
		Multiple datasets from different tourism sectors such as accommodation, airlines, airports, tour providers etc.
	Standards choices	Different choices between multiple technical standards for data

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Figure 30: *Members' illustrative visualisations of the envisioned data platform*

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Figure 31: *Participants deliberating on data choices to be included in the platform*

Source: *Case data from workshop deliberations – permissions by MTA*

Key to some abbreviations in the figure

CAM	Commercial Accommodation Monitoring	CAS	Cash Analysis System
MRTEs	Monthly Regional Tourism Estimates	CDS	Customised Data Services
IVS	International Visitor Survey	RTOs	Regional Tourism Organisations

Reducing the cognitive distance between the disparate actors and the central organisation leading the development of the platform was therefore important. The platform designers realised that there was a

need to create common understanding about the platform and what it would offer. To achieve this, he organised regular meetings at which the vision about the platform and its features were discussed and refined, including the priories for each organisation and how these would eventually fit into a comprehensive data services suite of the platform.

7.4.4 Governance

Having deliberated on the architecture of the platform, the next deliberations became about designing the governance areas of the platform, and here too, there were divergent choices between the participants, most of them reflective of their heterogeneous backgrounds. Key governance questions that sum up the concerns and deliberations at this workshop were: *Who will have access to which data and how will that access be controlled to ensure security and protect data privacy?*

Frames about openness, particularly regarding who will access the platform and contribute to it were on a sliding scale between large and small organisations and between public and private firms. Smaller organisations naturally preferred open solutions - because of their size, they did not have a lot of proprietary data to worry about control as much as larger well-established organisations did. In the same way, public institutions that have been perennial providers of open data in the country naturally preferred openness whilst private organisations were averse and wished to control their proprietary assets. For the latter, even if they were to contribute, they still wanted to know which governance mechanisms would be used to restrict access to data on the platform. Their concerns can be summed:

> *"I am concerned that most people here are jumping in the openness bandwagon without carefully thinking about the implications. Most firms here have informally been sharing data in some way, but through corporate agreements of some sort. I am not sure how some form of access controls will be implemented via the platform. I think we need to have honest discussions about that."*

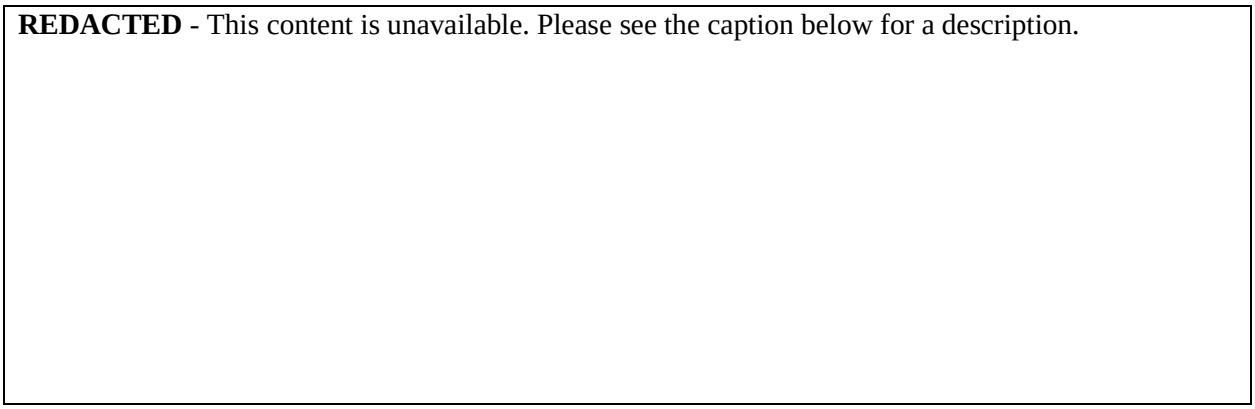

Figure 32: *Governance issues*

7.5 Discussion

The analysis enabled us to **(RQ1)** identify the various TFR held by the firms participating in the design process of an inter-organisational platform in the tourism industry. The case showed that frames used by participants varied over time, as the project progressed. The analysis also identified **(RQ2)** the co-influences and associates between the TFRs and the collective design actions observed during the design process of the platform.

Research highlighted that participants came to the project with a variety of technology frames. It also showed that these were not static. Some frames could be altered during interactions. In addition, depending on the stage of the development process, participants were moving from using one frame to using another, reflecting different types of goals at each stage. At each stage, understanding these frames enabled designers to measure the level of commonality in participants expectations. Understanding the frames at play at each stage also helped the designer to anticipate the types of questions and discussions to address during the workshops and related activities and assess when it was time to move to a subsequent stage.

We uncovered a co-influence process between TFRs, and joint actions taken in the collective design process of an inter-organisational data platform. While participants came to the design process with an interest in improving data sharing for the common good of the industry, they still had to bridge the cognitive distance that separated them about what digital artefact to build, how to build it, and how to govern it. Using TFR (Orlikowski and Gash, 1994) enabled us to make these initial positions and their respective distances explicit. The design process involved collective, joint design actions that, in an incremental fashion, targeted various architecture design options and governance aspects of the platform under construction. Thus, distinct technological frames existed in the organisational groups participating in a collective design process. We found evidence for mechanisms and effects that help to combine these frames, so that both congruence and at times divergence became apparent. Series of joint decisions at design workshops increasingly moved organisations toward a consensus.

Such consensus was not always uniform across organisations. At times, this also made it clear to some organisations that the cognitive gap between some organisations could not be bridged leading to disengagement with some aspects of the project. This led designers to realise that ‘unified’ congruence was too difficult to achieve because of conflicting priorities and expectations among participants and thus revert to an approach that progressed the design process. This is illustrated by the formation of design groups that were based on ‘shared’ frames between groupings of organisations. Thus, instead of trying to fully achieve unified congruence, some level of divergence was accommodated through organising the firms to address different parts of the core and modules of the platform (see Table 27, p.160 and Figure 31, p.161).

Our analysis showed the importance of specific joint design actions in working through frame divergence. Those joint actions involved the early development of a project framework, defining and codifying priorities as well as agreeing on user values that set a concrete foundation of the project. Once the foundation of the project was clear, the priorities were set, and the values are defined, participating firms were given an opportunity to decide on committing resources and time as they could see if the set priorities and general vision of the project matched with their organisational goals and strategic vision. This resolved differences or found intersections in participants' frames about the expectations of the platform. It helped clarify how the platform would be useful and beneficial to each individual firm participating, the rationale of each firm's participation in the design project, and what was required for each firm to realise the promised benefits.

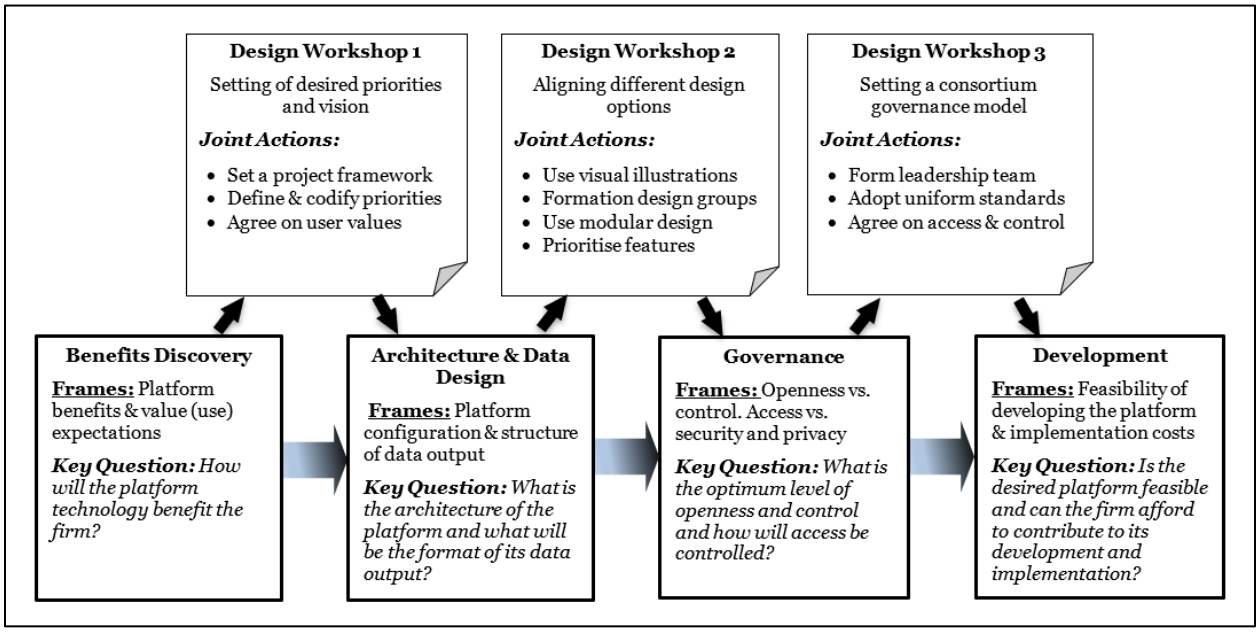

Figure 33: *Co-influences of technology frames and joint design actions practised during a collective design process of an inter-organisational data platform. Created by author.*

From this observation, we concluded that even though participating firms may have heterogenous characteristics and come with different benefit expectations, any contestation arising as a consequence of this heterogeneity was addressed by grounding the project's foundation and defining and codifying priorities. This also had an effect of reframing how each firm viewed the benefits by adjusting their own internal expectations or leaving the project altogether such that those that remained was clearly to continue participating. In this way frame congruency was also achieved about the benefits of the aspirational platform being developed.

Therefore, not one single frame was enforced but mutual understanding was developed that progressed the design process. There were divergent frames regarding benefits, architecture, and governance because each firm was influenced by its own organisational frame. This was compounded by the heterogenous nature of the participating firms: large, medium, and small enterprises coming from such businesses as airlines, airports, hotel chains, bed and breakfast, local tourism organisations, visitor experience providers, and government departments. Practices for aligning their different frames about the aspired data platform thus became central to the collective designing process. A technology frames perspective allowed to understand how incongruency from such heterogeneity can be reduced during a collective design process.

Understanding the heterogeneity among the frames adopted by different participants at different stages helps explain why the core of the platform may have been smaller than one could have expected. If most of the participants had adopted very similar TFR during each stage, we would have concluded to a great similarity of views on all stages of the process. this could have allowed the definition of a large core for the platform. As the data extracted from the case showed, the participants came to each stage with a variety of TFR. This would explain why the core chosen for the platform was relatively small, and why modules were chosen for development, corresponding to intersections between TFR from sub-groups within the industry. Understanding the TRF therefore helps explain the high level of modularity chosen for the platform.

7.6 Conclusion

Our study has some limitations. Case study research is always limited in generalisability, interpretive research even more so. Specific frame content may not be transferred across cases, but the results suggest a framing structure which is of a more general nature. It is unknown if the incremental process we uncovered, of moving from benefits discovery to architecture and data design, to governance, and to development can be found in other industry contexts (Figure 33, p.164). Yet, our observations did show that this progression allowed to demonstrate the value of the joint platform initiative to the participating firms, and thus to secure commitment for an eventual development of the platform. It remains an empirical question if the designers had oriented joint actions toward resolving frame divergence around governance prior to platforms architecture would have led to similar congruence. Agreeing on what needs to be built via boundary objects (Bergman, Lyytinen, & Mark, 2007) such as low fidelity prototypes in the form of models and mock-ups are likely to render more concrete the conversation around an ambiguous digital artefact, and subsequently facilitate conversations around how to govern the digital artefact. This aspect of our process model is an open question for future empirical research.

Notwithstanding the limitations, this paper offers a number of methodological and theoretical contributions. It is the first study that we know that looks at how design practices help working through divergence in technology frames via real time observations, starting from the inception of an inter-organisational platform. Recent studies (e.g., de Reuver, Sørensen & Basole, 2017) note a dearth of research in platform ecosystems that assesses real-time platform development projects that involve multiple institutions taking part, with a perspective that covers an entire industry sector. Additionally, other researchers have called for longitudinal work on framing processes that details and extends the effects of TFRs in real-time projects rather than taking a retrospective perspective (Harnisch, Kaiser & Buxmann, 2013). We thus think this paper offers valuable insights that were not available from alternative methodological approaches for the IS community. On a theoretical level, we demonstrated the applicability and suitability of TFR theory to inter-organisational platform design, adding a layer by demonstrating co-influences between TFRs and design practices that can propel collective design process in an IS project. This specifies and extends knowledge on IT framing processes.

Our research is also of relevance for practice. We studied the design process for an inter-organisational platform covering a whole organisational field. Our case findings although unique, have insights to IT project managers working with design projects that involve heterogenous groups and require multi-layered negotiations and consensus. Our descriptions of the co-influences and association between frames and design actions can be useful in order to optimise the design process activities and decisions. Understanding the frame of mind of the actors can enable platform designers to take responsive action which in turn influences how the actors frame their perspective of the technology under development. Including different perspectives right from the start of the platform design project enabled firms to make quick and informed decisions about whether they would participate. For platform start-ups, the various frames we surface in our analyses are important to know of.

Whilst our study is limited by the fact that we could only observe the design process, and not the implementation, future research that compares these two interrelated phases of platform development will be useful. We encourage case studies that allow immersive observation of the IS design processes, particularly in inter-organisational platforms, as this research is limited yet it has a potential to generate rich insights into a phenomenon that most organisations are grappling with. This approach brought up granular details that we could have missed had we just taken a superficial approach to data collection (e.g., by simply interviewing participants without observing the deliberations at design workshops).

7.7 References

Abelson, R. P. (1981). "Psychological status of the script concept." *American Psychologist*, 36(7), 715.

Agarwal, R., & Tiwana, A. (2015). Evolvable Systems: Through the Looking Glass of IS. *Information Systems Research*, 26(3), 473-479.

Baldwin, C. Y., & Woodard, C. J. (2009). "The architecture of platforms: A unified view." In A. Gawer (Ed.), *Platforms, markets, and innovation* (p.19–44). Cheltenham, UK: Edward Elgar.

Benbasat, I., Goldstein, D. K., & Mead, M. (1987). "The case research strategy in studies of information systems." *MIS Quarterly*, (11:3), p.369-386.

Boudreau, K. (2010). Open platform strategies and innovation: Granting access *vs.* devolving control. *Management Science*, 56(10), 1849-1872.

Bygstad, B., & Hanseth, O. (2018). Transforming digital infrastructures through platformisation. in *European Conference on Information Systems* (ECIS), Portsmouth, UK, 2018, Paper 74 p.1-13.

Chiasson, M. W., & Davidson, E. (2005). Taking industry seriously in information systems research. *MIS Quarterly*, 29(4), 591-605.

Constantinides, P., Henfridsson, O., & Parker, G. G. (2018). Introduction—Platforms and Infrastructures in the Digital Age. *Information Systems Research*, 29(2), 381-400.

Davidson, E. J. (2002). Technology frames and framing: A socio-cognitive investigation of requirements determination. *MISQ Quarterly*, 26(4), 329-358.

Davidson, E. J. (2006). A technology frames perspective on information technology and organisational change. *The journal of Applied Behavioural Science*, 42(1), 23-39.

Davidson, E. J., & Pai, D. (2004). Making sense of technology frames: Promise, progress, and potential. In *Information Systems Research* (p.473-491). Springer, Boston, MA.

de Reuver, M., Nederstigt, B., & Janssen, M. (2018). "Launch strategies for multi-sided data analytics platforms." in *Proceedings of the 26th European Conference on Information Systems*, (ECIS 2018), Portsmouth, UK.

de Reuver, M., Sørensen, C., & Basole, R. C. (2017). "The digital platform: A research agenda." *Journal of Information Technology*, 33(2), 124-135.

de Reuver, M., Verschuur, E., Nikayin, F., Cerpa, N., & Bouwman, H. (2015). Collective action for mobile payment platforms: A case study on collaboration issues between banks and telecom operators. *Electronic Commerce Research and Applications*, 14(5), 331-344.

Gawer, A. (2014). Bridging differing perspectives on technology platforms: Toward an integrative framework. *Research Policy*, 43(7), 1239-1249.

Ghazawneh, A., & Henfridsson, O. (2013). Balancing platform control and external contribution in third-party development: the boundary resources model. *Information Systems Journal*, *23*(2), 173-192.

Gioia, D. A. (1986). "Symbols, scripts, and sensemaking: Creating meaning in the organisational experience." *The Thinking Organisation*, 49, 74.

Goldbach, T., Benlian, A., & Buxmann, P. (2018). Differential effects of formal and self-control in mobile platform ecosystems: Multi-method findings on third-party developers' continuance intentions and application quality. *Information & Management,* 55(3), 271-284.

Harnisch, S., Kaiser, J., & Buxmann, P. (2013). Technological Frames of Reference in Software Acquisition Decisions: Results of a multiple case study. in *Proceedings of the 34th International Conference on Information Systems (ICIS 2013)*, Milan, Italy.

Jarvenpaa, S., & Markus, M. L. (2018). Genetic platforms and their commercialisation: Three tales of digital entrepreneurship. In: *Proceedings of the Proceedings of the 51st Hawaii International Conference on System Sciences (HICSS, 2018)*, Hawaii, USA.

Khalil, S., Winkler, T. J., & Xiao, X. (2017). Two Tales of Technology: Business and IT Managers' Technological Frames Related to Cloud Computing. 38th *International Conference on Information Systems (ICIS 2017),* Seoul, South Korea.

Lin, A., & Silva, L. (2005). The social and political construction of technology frames. *European Journal of Information Systems,* 14(1), 49-59.

Mark, G., Lyytinen, K., & Bergman, M. (2007). Boundary objects in design: An ecological view of design artifacts. *Journal of the Association for Information Systems*, 8(11), 546-568.

Menold, N. (2009). How to use information technology for cooperative work: Development of shared technology frames. *Computer Supported Cooperative Work (CSCW),* 18(1), 47.

Mishra, A. N., & Agarwal, R. (2010). Technology frames, organisational capabilities, and IT use: an empirical investigation of electronic procurement. *Information Systems Research,* 21(2), 249-270.

Ondrus, J., Gannamaneni, A., & Lyytinen, K. (2015). "The impact of openness on the market potential of multi-sided platforms: a case study of mobile payment platforms." *Journal of Information Technology,* 30(3), 260-275.

Orlikowski, W. J. (1992). Learning from notes: Organisational issues in groupware implementation. In *Proceedings of the 1992 ACM conference on Computer-supported cooperative work* (p.362-369).

Orlikowski, W. J., & Gash, D. C. (1991). Changing frames: Understanding technology change in organisations. Centre for Information Systems research (CISR) WP N0. 236

Orlikowski, W. J., & Gash, D. C. (1994). Technology frames: making sense of information technology in organisations. *ACM Transactions on Information Systems (TOIS),* 12(2), 174-207.

Parker, G., & Van Alstyne, M. (2018). Innovation, openness, and platform control. *Management Science*, *64*(7), 3015-3032.

Pettigrew, A. M. (1990). "Longitudinal field research on change: Theory and practice." *Organisation Science*, 1(3), 267-292.

Puri, S. K. (2006). Technology frames of stakeholders shaping the SDI implementation: A case study from India. *Information Technology for Development,* 12(4), 311-331.

Steinfield, C. W., Markus, M. L., & Wigand, R. T. (2005). Exploring interorganisational systems at the industry level of analysis: evidence from the US home mortgage industry. *Journal of Information Technology*, 20(4), 224-233.

Tiwana, A. (2014). *Platform ecosystems: aligning architecture, governance, and strategy.* Waltham, MA: Morgan Kaufmann, Elsevier.

Tiwana, A. (2018). Platform synergy: Architectural origins and competitive consequences. *Information Systems Research*, *29*(4), 829-848.

Tiwana, A., Konsynski, B., & Bush, A. A. (2010). Research commentary—Platform evolution: Coevolution of platform architecture, governance, and environmental dynamics. *Information Systems Research*, 21(4), 675-687.

Um, S., Yoo, Y., & Wattal, S. (2015). The evolution of digital ecosystems: A case of WordPress from 2004 to 2014. in *Proceedings of the International Conference on Information Systems, (ICIS 2015)*, Fort Worth, TX, USA.

Wessel, M., Thies, F., & Benlian, A. (2017). "Opening the floodgates: the implications of increasing platform openness in crowdfunding." *Journal of Information Technology*, 32(4), 344-360.

Young, B. W., Mathiassen, L., & Davidson, E. (2016). "Inconsistent and incongruent frames during IT-enabled change: An action research study into sales process innovation." *Journal of the Association for Information Systems,* 17(7), 495-520.

Chapter 8: In-depth Exploration of Critical Mass Issues

Critical Mass in Inter-Organisational Platforms

When an idea reaches critical mass
there is no stopping the shift its presence will induce.
– Marianne D. Williamson

Abstract

This paper examines how the critical mass challenge manifests itself during inter-organisational platform development. In previous research, critical mass is treated as an issue that occurs after platform launch. Strategies proposed, such as tactful pricing, opening the platform, user onboarding, and side-switching assume the platform to have already been launched. They may not work well in conditions where the platform is still under development. Over a two-and-a-half-year time-period, this study traced the development of a data platform in a revelatory case within the New Zealand tourism sector. It revealed five critical mass issues faced by the platform sponsor in phases of development that occur before platform launch: (i) attracting initial interest, (ii) aligning heterogenous goals, (iii) sustaining commitment to the project (iv), negotiating architecture design, and (v) sustaining commitment to implementation. These findings provide a foundation for problematising critical mass theory and its boundary conditions in inter-organisational platform development.

Keywords: Inter-organisational platforms, Inter-organisational systems, Platforms, Critical mass

8.1 Introduction

Platforms have become iconic organisational forms of the 21st century that drive innovation by configuring socio-technical systems that link resources, services, business actors, and users in various organisational areas (Parker, Van Alstyne & Choudary, 2016). Data platforms offer services such as data analytics & visualisation, and field-level forecasts between multiple firms (de Reuver, Nederstigt & Janssen, 2018; Jarvenpaa & Markus, 2018). They enable economies of scale because as many organisations participate, the scale of data resources and services also increases thereby increasing the value of such resources for each participating firm (de Reuver et al., 2018). This is an attractive option to small firms that may not afford owning or operating data services, and to larger firms that may not be able to access complete industry-level data. It also creates valuable opportunities to external stakeholders such as government agencies, suppliers, and tech innovators who may want to know industry-level trends or to provide technological innovations on existing data systems.

When a whole organisational field intends to launch a data platform, it faces a critical mass challenge about how to form consensus on many issues such as goals, strategy, design, and implementation. This is because inter-organisational relations often present conflicting interests and goals (Schirrmacher, Ondrus & Kude, 2017; de Reuver et al., 2018). In order to launch such a platform, a *sufficient number* of firms need to join together and form a network with enough resources and capacity to effectively share data services and the costs associated with their development and maintenance. The benefits discussed earlier can only be achieved if a *sufficient number* of firms joins such a network and contributes to it.

A platform sponsor working with multiple firms and leading the development of an inter-organisational platform needs to coordinate a mass of users from multiple target firms. Available literature on strategies for launching platforms appear to concentrate on the event of the platform launch itself rather than the full length of processes that occur before launching. Thus, the launch is often treated as an *event* rather than a *process* (Evans & Schmalensee, 2010, p.3-4) with minimal investigations into how a platform sponsor achieves a critical mass between multiple firms before a launch is possible, when the platform is still an aspirational goal. This could be because current research about platform launch tends to focus on one-to-many type of platforms rather than those that are many-to-many and inter-organisational in nature (Thomas, Autio & Gann, 2014, p.208).

In addition, strategies proposed to create a critical mass are often built either on conceptual work or on ex-post studies of successful platforms. For instance, authors looked at opening the platform to users and providing extensive boundary resources to contributors (Ondrus, Gannamaneni & Lyytinen, 2015), using pricing strategies and first party content subsidies (Hagiu & Spulber, 2013), as well as user onboarding and side switching strategies (Schirrmacher, Ondrus & Kude, 2017; Stummer, Kundisch & Decker, 2018). Empirical studies that longitudinally investigate the ways in which a platform sponsor enacts practices to generate a critical mass of users in an organisational field, and how such practices inform design decisions as a platform is being developed are still largely sparse.

The objective of this paper is to analyse how challenges to generate critical mass emerge during inter-organisational platform development. We look at the platform sponsor's practices for coordinating multiple participating firms, and the issues that arise and must be dealt with at each developmental phase. We explore conjectures about when critical mass issues arise and how the platform sponsor responds to them using data from observations of the real-time development of an inter-organisational platform. Thus, we problematise the boundary conditions (Alvesson & Sandberg, 2011) of the critical mass theory in the context of inter-organisational platforms. The rest of the paper is structured as follows: (i) a theoretical background, (ii) a description of the research methods, (iii) presentation of findings, (iv) a discussion of the implications of the findings, and (vi) a conclusion.

8.2 Theoretical Background

8.2.1 Platform Ecosystems

Platform ecosystems are organisational forms that link resources, services, business actors, and users (Parker, Van Alstyne & Choudary, 2016). Platform managers deal with two main layers of the platform: architecture and governance (Tiwana et al., 2010). Key technology features that form the base of platform architectures are extensibility of the core, modularity and decomposability of components, inter-dependence of functions, and flexible standards (Baldwin & Woodard, 2009). Thus, the technological architectures of a platform are seen as extensible software that allow developers to innovate by adding new modules for consumers, and creating environments for online collaboration, content co-production hubs, data hubs, social networking sites, and crowdsourcing (Tiwana et al., 2010). The governance level considers business models, decision rights, and rules of interaction created to manage the platform ecosystem.

As intermediaries, platforms are sustained by the number of users who innovate, transact, and interact in value adding activities. These users include all contributors such as developers, creators, innovators, and consumers. Platforms become more valuable as more users join due to network effects (Parker, Van Alstyne & Choudary, 2016). With direct network effects, the platform becomes more valuable if users in the same user group join, whilst indirect network effects imply that the value of the platform depends on the users in other groups. Thus, platforms often emerge from and are affected by dynamics in markets dominated by network externalities (Anderson, Parker & Tan, 2014).

For this study, we distinguish between two types of platforms. Type I platforms are created and then offered to developers and consumers for use. Most consumer-facing platforms such as operating systems, web browsers, app stores, online marketplaces, and e-commerce fit in this category. In Type I, platform development is done with minimal involvement of external parties. The platform is only offered to contributors and consumers after its development, which means that the platform sponsor wields control in its design and faces minimal challenges in addressing design and development issues from external parties before launch. Type II platforms sit between multiple institutions and act as inter-organisational systems (IOS) through which multiple firms interact and share resources and services (see Table 28, p.172).

In some ways, the development process for type II platforms is more challenging. They often need to be developed through consensus, shared design choices, negotiated standards, and consortium governance models that require balancing of multiple goals (e.g., Markus & Bui, 2012; de Reuver et al., 2018). Our study focuses a specific type of an *inter-organisational* platform for sharing data resources and data services between firms.

Table 28: *Platform ecosystems & inter-organisational platforms*

Type I: Platform Ecosystems	Type II: Inter-Organisational Platforms
Platform sponsor's organisational environment is different form the platform's ecosystem environment	Platform sponsor's environment is merged with platform ecosystem's environment.
Platform sponsor is the overall designer and IP rights holder. Some IP rights are owned by third parties.	Platform design and IP rights are negotiated and distributed between participating firms.
Platform sponsor sets the direction and controls a major part of the underlying platform technology. Some modules are owned by contributors.	The direction of the platform is negotiated, and control of the underlying technology is shared and/or distributed between firms.
Sponsor provides overall organising structure for the platform via ecosystem governance rules. Contributors can contest some rules and have lateral power (i.e., not hierarchically controlled).	Overall organising structure for the platform is negotiated. The sponsor implements these via "consortium" governance rules.
Business association is transactional. Contributors do not necessarily need to be in a relationship with the platform sponsor.	Business association is relational. Participants enter a business relationship with other organisations.
Examples: Airbnb, Uber, Mozilla Firefox, Apple Appstore, Android OS, Apple iOS.	[20]Examples: SURFsara, Nallian, and customised solutions from Salesforce.

8.2.2 Inter-Organisational Systems (IOS)

Inter-organisational platforms build on the concept of inter-organisational systems (IOS) developed in IS literature since the 1990s (e.g., Bakos, 1991; Munkvold, 1999; Johnston & Gregor, 2000). These studies showed that organisations benefit from collaboration through IS-based inter-firm synergies that enable information, innovation, processes, services, and other resources to be seamlessly shared between firms (Markus, 2007). For example, computer-aided reservation systems enabled airports, airlines, border agencies, and affiliated services to offer seamless services to passengers by connecting passenger data between these institutions. Some benefits such as open and uniform standards that allow inter-connection of devices can only be achieved if major actors agree to use the standards for the products and services they offer (Wigand, Steinfield & Markus, 2005).

Research also shows that IOS generate challenges. One challenge faced by providers of IOS is how they can attract firms to use them. The provider of an IOS needs to show that the benefits for joining, for example by using a specific standard or sharing a particular technology, outweigh switching costs for a firm that had internal or alternative systems for the services being offered through the IOS (Markus, 2007).

[20] Most platforms here are not as common and public as in Type I. They often have a limited scope of targeted firms, usually within the same industry, and are often custom built.

Organisations may find it difficult to adopt a new IOS if they have higher dependence on their internal systems, which increases switching costs (Zhu, Kraemer, Gurbaxani & Xu, 2006). Another challenge area is a governance problem that involves the coordination of multiple independent players who may be competing, have different goals, interests, and incentives (Johnston & Gregor, 2000; Markus & Bui, 2012). The provider of an IOS would need to negotiate some form of consensus between firms in such areas as design, standards, and shared processes (Wigand, Steinfield & Markus, 2005; Markus & Bui, 2012). To achieve coordination and control, the IOS provider needs to be trusted by the targeted firms, and such trust often rests in the IOS provider's IS capabilities and competencies, leadership, and unifying vision, as well as the ability to provide concessions on design choices and standards (Ibrahim & Ribbers, 2009).

Data platforms are a specific type of platform that inherits several IOS attributes. Such platforms offer services such as data ingestion & integration, data analytics & visualisation, templates for data gathering, data sharing & synchronised reporting, and field-level forecasts (de Reuver et al., 2018; Jarvenpaa & Markus, 2018). Data platforms generate economies of scale by affording small firms that could not afford the cost of owning a comprehensive suite of data services as a single firm, to achieve this through collaboration with other firms. Larger firms also benefit from accessing comprehensive data that they would otherwise not without collaborating with other firms. In the case of data platforms, direct network effects are created when benchmarking features of the platform improve as more firms join the platform. Indirect network effects are created as aggregated market level insights for interested parties outside participating firms are generated as more firms join the platform.

8.2.3 The Critical Mass Challenge

The theory of critical mass has its roots in sociology and is often used to explain collective behaviour amongst individuals using common goods (Oliver, Marwell and Teixeira, 1985). The theory explains the conditions under which reciprocal behaviour gets started and becomes self-sustaining (Markus, 1987). Granovetter (1978, p.1420) referred to critical mass as a "threshold" of actors who must 'show an interest' or 'make a decision' before other actors follow suit. In order to warrant reciprocal behaviour, not only is the 'amount' of initial interests or decisions important, but also who makes those decisions (e.g., firm type and size), and the nature of their decisions (e.g., reputation and influence). This in turn determines whether other parties will be triggered to follow. Applied to platforms, the theory proposes the issues and conditions that must be addressed to attract participation of a *sufficient number* of users or contributors to make the platform self-sustaining (Evans & Schmalensee, 2010).

From the onset of development, a major concern for a platform sponsor is how to attract both contributors to the platform and users of the products and services generated by its contributors (Parker, Van Alstyne & Choudary, 2016). Developing and launching inter-organisational platforms is particularly

challenging because of existing conflicting interests and goals (Schirrmacher, Ondrus & Kude, 2017; de Reuver et al., 2018). If there are few firms participating, the economies of scale may not be reached, transaction costs remain high, and it becomes difficult to justify switching costs for those firms that already have an existing solution. Therefore, practices for coordinating firms to create a critical mass are vital for its successful development and eventual launch.

Like any other platforms, inter-organisational platforms also exhibit network effects, but unlike Type I platforms (Table 28, p.172) that can attract users at a global scale, inter-firm platforms have a limited scope of targeted firms, usually within the same organisational field. Thus, if major firms, for instance in the adoption of a standards platform, were to reject the initiative, such a standard would not take off (Markus & Bui, 2012). Where there are a mix of firms, some may wait to see if their allies, competitors, or influential firms are participating (de Reuver et al., 2018). This gives rise to the so-called 'chicken-n-egg' problem, but with a game-theoretic twist. In order to attract firms to join, the platform needs to have a significant number of other firms that have already joined (Evans & Schmalensee, 2010). Platform providers in an inter-organisational setting must break this paralysing dynamic where prospective firms wait for other firms to participate prior to making a commitment.

Learning from both IOS and platform literatures, we observe another unique challenge to the critical mass problem in the development and launching of inter-organisational platforms. They seem to require a critical mass much earlier in their development process than other types of platforms. In Type I platforms (Table 28, p.172), the development of the platforms largely occurs internally, meaning that their users have little or no participation in the development phases of the platform. Also Type I platforms often require the platform to launch first, then the issue of attracting users to join comes after, which places the critical mass question after the platform itself has been launched. Thus, platform launch is possible before user onboarding (Evans & Schmalensee, 2010). However, we posit that, in inter-firm platforms (Type II), a critical mass of firms needs to be achieved earlier in their development process, and this is dependent on how the platform sponsor can steer the various organisations into fully participating.

Thus, practices proposed by previous research about generating a critical mass, which assume an already existing platform, may not work well in conditions where the platform is an aspirational goal between firms with different governance regimes. Such practices include opening the platform's resources using flexible standards, open codes, and less restrictive boundary tools (e.g., APIs and SDKs) (Ondrus, Gannamaneni & Lyytinen, 2015); onboarding users in a specific strategic order (Schirrmacher, Ondrus & Kude, 2017); tipping adjacent markets (Gawer & Cusumano, 2008); and using creative pricing models (Hagiu & Spulber, 2013; Stummer, Kundisch & Decker, 2018). It is still unknown what are the practices that platform sponsors can rely on to attract participants in an inter-organisational context, and when they should be relied upon.

8.3 Research Methodology

To problematise (Alvesson & Sandberg, 2011) critical mass theory and explore its boundary conditions (Whetten, 1989) in inter-organisational platform development, we used data from a longitudinal, revelatory case study. The study is part on an on-going longitudinal research covering a two-and-half-year period (August 2017 – February 2020), documenting unfolding events as 46 organisations in the tourism sector in New Zealand worked together to develop an inter-organisational platform for sharing data services and resources. The questions about *how* and *why* a phenomenon operates the way it does and the behaviour of the actors driving it in its context are well founded justifications of IS case study inquiries (Benbasat et al., 1987). Additionally, recent studies (e.g., de Reuver, Sørensen & Basole, 2017) note a dearth of research in platform ecosystems that assesses real-time platform development projects that involve multiple institutions taking part, with a perspective that covers an entire industry sector. This case was selected for its uniqueness, depth of access, and its potential to generate new insights to platform development (Benbasat et al., 1987).

Access was made available to the researchers early in the platform sponsor's project, creating an opportunity to immerse and observe the nuances of platform development via participating in various workshops and interviewing the key players as the project evolved. Semi-structured interviews were conducted with representatives of the 46 organisations that were participating in the platform development project. These include providers of visitor experiences (skylines, ziptreks, canyon swings, etc.) airlines, airports, hotel chains, bus and tour operators, cycle-trail operators, restaurants, museums, and government departments. All interviews followed a semi-structured protocol, lasted 30-75 minutes, and were recorded and transcribed. Interviewees were encouraged to describe their engagement with the Main Trade Association (MTA) – the platform sponsor in the project. They described their motivations (or lack of) for participation, their data-driven practices, challenges in building ecosystem level data platform in the tourism sector, required technical and organisational capabilities, and their perspective on the overall feasibility of the project. To triangulate and complement interview data, one of the researchers also participated in key workshops and meetings, which enabled participatory observation during the project. Documentary evidence was also collected (see Table 29, p.176).

Data analysis was inductive, with concepts from platform ecosystems, inter-organisational systems, and critical mass used as an informing background to the study. The units of analysis were critical mass issues facing the platform sponsor, eliciting practical responses at each development phase. The first part of coding was intended to capture the key phases of the platform development processes, indicating *which* and *when* critical mass issues emerged in phases of the platform development processes. The second part of coding captured the practices that were used by the MTA as well as how they were received and

responded to by the participating firms. Data coding and analysis was iterative, with multiple meetings in which all authors looked for consistent themes, deliberated on emerging codes and their categorisations. We made sense process analyses, debated, and redefined codes. The end result was an agreement of the key phases of development emerging from our process analysis and five associated critical mass issues faced at each stage, all of which can be seen in Table 30 (p.180). It is important to note that only data on the research question regarding critical mass was used in this paper, which is a subset of the larger dataset that covers many other research questions and variables in this ongoing program of research.

Table 29: *Summary of sources of evidence*

Primary Sources	**Explanation**	**Interviews**
Interviews with representatives of the 46 org. & the MTA	Interviews included CEOs, Heads of Departments, data and insights specialists, owners, and representatives of organisations participating in the project.	50+
Secondary Sources	**Explanation**	**Documents**
Steering Committee Notes	Meeting agendas and notes with action items, discussion, and decision actions	500+ pages
Meeting Notes	Meeting agendas, presentations and notes from general and other MTA led Platform Development meetings	
Web Page Content	Content from MTA's official website. Includes content from related government websites such as Ministry of Business Innovation and Employment (MBIE) and Statistics New Zealand	
Press Releases articles	Official press releases and news/journalistic content about the platform development project	
Field Events	**Explanation**	**Participants**
Tourism Data Workshop	Workshop facilitated by MBIE, Wellington and Auckland	50+
U of Canterbury Tourism Research Team Meeting	Facilitated by the MTA, Christchurch	10
West Coast LH Meeting	Facilitated by the MTA, West Coast	25
CECA & RTOs Meeting	Facilitated by the MTA, Palmerston North	11
Tourism Data Hui	Workshop facilitated by MBIE, Wellington and Auckland	50+

8.4 Results

8.4.1 Brief Case Description

Through their Main Trade Association (MTA), a network of 46 organisations from the New Zealand tourism sector started a project to develop a platform ecosystem for sharing data services and

resources. The companies reported challenges such as multiple datasets from various sources, a limited industry-level view about domestic tourism, and problems regarding quality and consistency in key data such as tourism spending, visitor volumes and visitor flows. Interviews with representatives of small enterprises such as restaurants, holiday homes, backpackers, and skyline & canyon swing operators confirmed that they were not using many data services because of the cost and skills needed. They struggled to keep an overview of what was happening in their local markets. To them, simple-to-use aggregated data insights from visualisation tools, graphs, and simplified reports would be beneficial. For larger firms, their main concern was access to granular, raw data that would allow them to conduct their own analyses. Whilst they had robust internal systems for analysing their internally produced data, they had limited access to data from the industry, particularly small enterprises that occupied a large share of the tourism market. They were also concerned about the quality of the data available from local authorities and government departments.

8.4.2 Critical Mass Issues during Platform Development

We found that the MTA (platform sponsor) faced critical mass issues early before platform launch. These were at various stages during the evolution of the project, starting from the initial discovery phase, during the development of strategic goals, the formation of business networks around the project, the design of the platform, and when implementation began (see Table 30, p.180). Here we outline critical mass issues faced by the MTA at each phase and the practices used to deal with them.

Attracting initial interest: In the first phase of the project the MTA made efforts to make sense of the organisational field and discover the various data interests of the firms. The critical mass issue appeared to be about how to convince them and have a large enough group of firms with interest in the project. The MTA developed a framework of the platform agenda – a document which spelt out the potential of the proposed platform to the data space in the tourism sector. With this document, the MTA's project leader went on a 'gentle crusade', telling a compelling story to convince prospective firms to participate. He noted:

> *"There definitely is an understanding of the current limitations in the data space, but there are also various proposed solutions from different quarters. So, to draw firms to this project, we are informing tourism businesses of our plans. We have* ***developed this Insight Framework as a comprehensive*** *guide to our agenda."*

Aligning heterogenous goals: Having garnered initial interest, in the second phase of the project, the MTA was faced with a different issue – all the interested firms had different goals about data, relating

to their own internal operations. At this stage, the MTA sought to create a unifying strategic vision of the platform that considered the heterogeneity of those goals. Through a series of workshops, the MTA had discussions with representatives from each prospective firm. In the discussions, the MTA sought to understand the various strategic goals about data that each firm was concerned with. Key priorities were ranked and 'quick wins', and long-term solutions were discussed during the workshops. A data priorities framework that harmonised different goals and linked them to the strategic vision of the platform was a key output of the deliberations at this stage. As noted by the MTA's project leader:

> *"To move the project forward, a clear and unifying industry voice is needed* ***to determine priorities*** *for the platform from all the various goals that were put forward by members, and for* ***establishing mechanisms for undertaking these priorities****."*

Sustaining commitment to the project: In the third phase the MTA faced another challenge – sustaining commitment to the project by the firms. Some firms were hesitant to commit their time on the project despite having shown initial interest and agreed with the strategic direction of the project. Some firms expressed that they were not sure if the MTA had capacity to lead the project, and others were distrustful that other firms would not contribute their time, staff, and resources as much as they did. Additionally, some firms felt 'disconnected' to other participants. Sentiments such as these were raised:

> *"The project makes sense to us, and the value is undeniable. But, for such a technical project that requires the staff time of our IT experts and data specialists, we can only do so much.* ***To fully commit our staff time to the project would mean that other companies need to do the same.*** *But, as of now we don't know what other firms are doing. Are they as willing as we are?"*

To resolve this and sustain commitment, the MTA developed a business network of firms in the project. A **leadership panel**, **technical group**, and **general members forum** was developed which required regular meetings to discuss contentious issues and find areas of cooperation and commitment. This developed mutual trust and closer ties between the firms.

Negotiating architecture design: In the fourth phase, the MTA faced the challenge of attaining consensus between different design choices of the platform presented by each firm. For instance, whilst large firms were interested in a design that emphasised raw data as output, smaller firms were interested in simplified templates and reports that they could easily use without having to make further analyses as they largely lacked the capacity and capabilities to do so. Their divergent views on this can be summed:

> *"For us, we would like data in basically granular, raw format. Data that we can analyse and do stuff with. Because we have the capabilities and teams to do so. … we may need to integrate it with our own internal data and work with it with our own models."*

"We are looking for a place where latest reports about trends in the market are posted regularly by key players, giving us a market analysis that we need to benchmark ourselves."

Private firms sought more controlled standards to protect their data assets whilst public institutions and smaller enterprises sough flexible standards. One public sector provider of tourism services indicated:

"… we are working hard to offer our customers easy, simple, efficient ways to build innovative connections with us. Our APIs use the RESTful interface and JSON format to allow our customers to openly and seamlessly interface with our systems. But, in the previous meeting, I got the sense that our private partners don't seem to resonate well with open standards. They are more protective of their proprietary assets."

There were also disagreements about whether levels of access would be controlled between participating firms, with larger firms seeking selective access whilst smaller firms sought open access. In a design workshop, representatives of the firms drew diagrams to illustrate what they envisioned about the design, architecture, and features of the platform. They all had diverse representations of the future platform some seeking integrated and centralised architectures whilst others sought distributed configurations. To achieve consensus the MTA used the design workshops as an opportunity to develop a core architecture that adapted the various propositions of the firms. This enabled coring of the platform design and created common understanding of the architecture. The MTA needed a large enough consensus from the firms that would support its eventual development. At this stage, the MTA made crucial decisions to remove less-desirable design options. This saw some firms' choices being prioritised whilst other choices were not met.

Sustaining commitment to implementation: In the fifth phase, the MTA faced another commitment challenge – this time it was about sustaining participation in the implementation of various artefacts of the platform. Firms at this stage had agreed with the strategic vision of the platform and its proposed architecture. They were now required to commit significant resources such as their staff time and skills to develop some aspects of the platform's core technologies. Some firms were interested in working on specific parts of the platform that were aligned to their businesses whilst others had limited resources to contribute. The MTA needed to organise them in a way that would enable each one to contribute. Firms were grouped together into smaller technical taskforces to work on specific modules according to their strengths, capacities and declared areas of interest.

Table 30: *Summary of critical mass issues*

Phase	Critical Mass Issue	Question(s) framing	Views of Participating Firms	Sponsor's Practices	Explanation
Phase 1: *Initial discovery & sensemaking*	Attracting Initial interest (Governance Issue)	What are the incentives of the players? Which players and complementary interests can be aligned and satisfied through the platform? Can these players form a sustainable group enough to pursue the project?	Each firm was concerned with finding out if their internal interests about data would be served better by the platform.	Selling a compelling story to attract initial interest	To create initial interest from a first group, large enough to pursue the platform agenda, the sponsor told a compelling story about how the platform would solve the data issues and transform the data space in the sector. The sponsor identified players and complimentary interests that could be aligned and satisfied through the envisioned platform (i.e., discovery). Sensemaking and feasibility studies were carried out at this stage.
Phase 2: *Development of Strategic Goals for the Platform*	Aligning Heterogenous Goals (Governance Issue and Architecture Issue)	What are the various strategic goals about data for all the interested players? Which goals can be harmonised / linked into a strategic vision for the platform? What number of players are willing to rally behind the new harmonised goal/vision of the platform?	Firms were concerned with finding out if their internal goals about data would be met through the sponsor's vision of the platform. Some firms found that their goals for data were different whilst others were aligned.	Aligning conflicting goals and developing a strategic vision of the platform	The sponsor sought uniform ways to harmonise different goals and link them to the strategic vision for the platform. The sponsor encouraged participation by meeting with the various internal goals of the interested organisations. The effort was to develop a unifying strategic vision of the platform. This required a large enough number of players that were willing to rally behind the goal/vision. Several leadership panel meetings were held at this stage.
Phase 3: *Formation of Business Networks*	Sustaining Commitment (Governance Issue)	Which players are willing to commit to project-term business relationship? Is there a large enough group of firms within the business network formed around the project to sustain it?	Some firms were hesitant, distrustful of the MTA, and generally needed convincing that the MTA had both leadership and capacity "to pull it off."	Playing a leadership role and creating confidence and trust in leadership:	The sponsor sought to maintain sufficient relationships around the platform development project. The sponsor sought to build trust and confidence in the leadership of the project and strengthen relations between participating firms. To achieve this, workshops and meetings were held to discuss contentious issues and find areas of cooperation and commitment.
Phase 4: *Architecture Design*	Negotiating Architecture Design (Architecture Issue)	What are the various features, standards, and architecture desired? Which design, standards and architecture options suit a sustainable group of players, and which options are less desirable (e.g., have high adoption costs)?	In various workshops, representatives of the firms illustrated what they envisioned about the design, architecture, and features of the platform. They all had diverse representations of the future platform.	Coring the platform design, and creating a common understanding of the architecture	The sponsor sought to maintain a balance in the architecture, features, and standards of the platform to suit a large enough group of players who would support its eventual development. The sponsor made crucial decisions to remove less-desirable design options. This saw some firms' choices being prioritised whilst other choices were not met (e.g., those that had high switching costs, demanded unique standards, or simply did not have enough backing from other firms)
Phase 5: *Development of platform artefacts*	Sustaining Commitment to Implementation (Governance Issue)	How can the various artefacts of the platform architecture be developed and implemented? Who will deal with which specific parts of the platform development processes and how can they be promoted?	Firms were interested in working on specific aspects of the platform that were aligned to their businesses.	Implementation tactics such as grouping firms to develop specific aspects matching their capacities	When the development process of specific artefacts or parts of the platform began, sought to attract participation in the development process and implementation of the various artefacts. Firms were grouped together into smaller technical taskforces to work on specific modules according to their strengths, capacities and declared areas of interest.

8.5 Discussion & Conclusion

Our analysis revealed that in inter-firm platforms, a critical mass is needed at various stages before launch, and for the launch process itself to continue. In our case, it was a not single-period event occurring after platform launch. We found that critical mass challenges emerge in different ways, as a series of different issues that the platform sponsor must address at different platform development phases. In *Phase 1* it was important for the sponsor to understand which interests were available at conception, and who made those interests, as well as how varied they were. In *Phase 2* it was important to establish which firms agreed (or disagreed) with the strategic vision of the platform, and what was the content of those disagreements. In *Phase 3* the sponsor needed to know which firms were willing to commit to the project for the length of the development process, their firm-size, reputation, and influence over other firms. In *Phase 4* the sponsor needed to align the various design choices made by the firms, and to also understand their motivations, their commitment, and capacities to support those choices. In *Phase 5* the platform sponsor needed to sustain commitment to the implementation of several aspects of the platform. Thus, there were many points at which gathering a critical mass was required when the platform itself was an aspirational goal.

Another key observation is that, apart from considering the number of firms that were participating at each stage, the sponsor considered whether the nature of interests, consensuses, levels of negotiations, and influences that were achieved would be able to sustain the project as it evolved. Previous research tends to treat critical mass as having a quantitative property whose function is the number of users to an ***n***-threshold level (c.f. Evans & Schmalensee, 2010; Granovetter 1978). In our case, we noticed qualitative properties such as reputation, interests, commitments, digital capabilities, goals, consensuses, and decisions, all of which were crucial in determining whether sustainability is achieved to move to the next phase. Some properties were of the users' aspirations (e.g., interests and goals), their actions (e.g., choices and decisions), their qualities (size, influence, and capabilities), and others were of the relationship between users (e.g., consensuses). Here there is an opportunity for future research that considers the influence of these properties in warranting reciprocal behaviour needed to achieve a critical mass (Markus, 1987).

We observed from our findings that practices addressed in previous research, such as the use of first party content subsidies and creative pricing options (Hagiu & Spulber, 2013; Stummer, Kundisch & Decker, 2018) are not available to the platform sponsor as the platform itself will still be under development. Onboarding strategies only become possible after platform launch (de Reuver et al., 2018; Schirrmacher, Ondrus & Kude, 2017). Tipping adjacent markets (Gawer & Cusumano, 2008) was also not possible as the project had a limited scope of firms within a single sector. Similarly, opening-up the platform to attract users and contributors assumes that launch would have already occurred (Ondrus, Gannamaneni & Lyytinen, 2015).

Thus, practices of the platform sponsor were different from what we learn from previous research about gathering a critical mass. They are more concerned with steering firms with heterogenous goals and profiles towards participation. These included (i) selling a compelling story about how to solve an existing problem, (ii) aligning conflicting goals & developing a strategic vision, (iii) playing a leadership role, (iv) creating a common understanding of design choices, and (v) amassing commitment at implementation. Convincing firms to participate requires active management and deliberate practices before a platform is launched.

Limitations of the study pertain to the single and ongoing nature of the case study. Whilst the project has evolved well to the extent that we have observed, the ultimate success of the platform in unknown. In addition, although our initial conjectures appear to be supported by the data, similar research is still scant and needed to corroborate findings. Although we observed critical mass issues that the platform sponsor dealt with, we are yet to fully examine how each issue manifests itself, and how it can be measured. Future research can examine how such properties as influence, reputation, and negotiations can affect how decisions are interpreted by firms, which affects reciprocal behaviour needed to achieve a critical mass.

8.6 References

Alvesson, M., & Sandberg, J. (2011). "Generating research questions through problematisation." *Academy of Management Review*, 36(2), 247-271.

Anderson Jr, E. G., Parker, G. G., & Tan, B. (2014). "Platform performance investment in the presence of network externalities." *Information Systems Research*, 25(1), 152-172.

Bakos, J. Y. (1991). "Information links and electronic market-places: the role of inter-organisational information systems in vertical markets." *Journal of Management Information Systems*, 8(2), 31-52.

Baldwin, C. Y., & Woodard, C. J. (2009). "The architecture of platforms: A unified view." In A. Gawer (Ed.), *Platforms, markets, and innovation* (p.19–44). Cheltenham, UK: Edward Elgar.

Benbasat, I., Goldstein, D. K., & Mead, M. (1987). "The case research strategy in studies of information systems." *MIS Quarterly*, (11:3), p.369-386.

de Reuver, M., Nederstigt, B., & Janssen, M. (2018). "Launch strategies for multi-sided data analytics platforms." in Proceedings of the *26th European Conference on Information Systems*, Portsmouth, UK.

de Reuver, M., Sørensen, C., & Basole, R. C. (2017). "The digital platform: A research agenda." *Journal of Information Technology*, 33(2), 124-135.

Evans, D. S., & Schmalensee, R. (2010). "Failure to launch: Critical mass in platform businesses." *Review of Network Economics*, *9*(4), 1-33.

Gawer, A., & Cusumano, M. A. (2008). "Platform leaders." *MIT Sloan Management Review*. MIT Sloan School of Management: Boston, MA, USA, 68-75.

Granovetter, M. (1978). Threshold models of collective behaviour. *American Journal of Sociology*, 83(6), 1420-1443.

Hagiu, A., & Spulber, D. (2013). "First-party content and coordination in two-sided markets." *Management Science*, 59(4), 933-949.

Ibrahim, M., & Ribbers, P. M. (2009). "The impacts of competence-trust and openness-trust on interorganisational systems." *European Journal of Information Systems*, 18(3), 223-234.

Jarvenpaa, S., & Markus, M. L. (2018). “Genetic platforms and their commercialisation: Three tales of digital entrepreneurship.” in *Proceedings of the 51st Hawaii International Conference on System Sciences*, Hawaii, USA.

Johnston, R. B., & Gregor, S. (2000). “A theory of industry-level activity for understanding the adoption of interorganisational systems.” *European Journal of Information Systems,* 9(4), 243-251.

Markus, M. L. (1987). “Towards a ‘critical mass’ theory of interactive media: universal access, interdependence, and diffusion.” *Communications Research*, 14 (5), 491-511.

Markus, M. L. (2007). “Building successful interorganisational systems.” In *Enterprise Information Systems* VII, p.31-41. Springer, Dordrecht.

Markus, M. L., & Bui, Q. N. (2012). “Going concerns: the governance of interorganisational coordination hubs.” *Journal of Management Information Systems,* 28(4), 163-198.

Munkvold, B. E. (1999). “Challenges of IT implementation for supporting collaboration in distributed organisations.” *European Journal of Information Systems,* 8(4), 260-272.

Oliver, P., Marwell, G., & Teixeira, R. (1985). “A theory of the critical mass. I. Interdependence, group heterogeneity, and the production of collective action.” *American Journal of Sociology,* 91(3), 522.

Ondrus, J., Gannamaneni, A., & Lyytinen, K. (2015). “The impact of openness on the market potential of multi-sided platforms: a case study of mobile payment platforms.” *Journal of Information Technology*, 30(3), 260-275.

Parker, G. G., Van Alstyne, M. W., & Choudary, S. P. (2016). *Platform revolution: How networked markets are transforming the economy and how to make them work for you.* WW Norton & Co.

Schirrmacher, N. B., Ondrus, J., & Kude, T. (2017). “Launch strategies of digital platforms: Platforms with switching and non-switching users.” in *European Conference on Information Systems*, Guimarães, Portugal, June 5-10, 2017, p.658-673.

Stummer, C., Kundisch, D., & Decker, R. (2018). “Platform launch strategies.” *Business & Information Systems Engineering*, 60(2), 167-173.

Tiwana, A. (2015). “Platform desertion by app developers.” *Journal of Management Information Systems*, 32(4), 40-77.

Tiwana, A., Konsynski, B., & Bush, A.A. (2010). “Research commentary—Platform evolution: Coevolution of platform architecture, governance, and environmental dynamics.” *Information Systems Research*, 21(4), 675-687.

Whetten, D. A. (1989). “What constitutes a theoretical contribution?” *Academy of Management Review*, 14(4), 490-495.

Wigand, R. T., Steinfield, C.W., & Markus, M. L. (2005). “Information technology standards choices and industry structure outcomes: The case of the US home mortgage industry.” *Journal of Management Information Systems*, 22(2), 165-191.

Zhu, K., Kraemer, K.L., Gurbaxani, V. & Xu, S.X. (2006). “Migration to open–standard inter–organisational systems: network effects, switching costs, and path dependency.” *MIS Quarterly*, 515-539.

Chapter 9: Conclusions

Contributions to Theory & Practice

A theory can be proved by an experiment.
But no path leads from an experiment to the birth of a theory
– Albert Einstein

9.1 Introduction

This chapter takes stock of the contributions made by this research to theory and practice. Addressing the research questions set from the start (see ***Section 3.3***, Table 6, p.42) fulfilled the primary goal of this research***: to work towards developing a nascent theory of IOP development processes that occurs through collective action.*** It also created avenues for future research. Through case data we were able to reconstruct key events, activities, and actions that highlight IOP development processes. We made sense of this data by identifying and defining key process concepts. Additionally, we developed propositions and illustrative process models of actions & and socio-cognitive influences to IOP development. Key insights were derived from examining these models, such as how collective organising, designing and decision making are practised; how technology frames and cognitive distances may be resolved; and the critical thresholds needed to drive IOP development processes. The rest of the chapter discusses these contributions in detail, separating between theoretical and practical contributions, discussing limitations of the study, and ending with suggestions for future research paths.

9.2 Contributions to Theory

This study builds on previous research on IOP development through collective action. (e.g., Nikayin, et al., 2012; 2013; de Reuver et al., 2015; 2018). Previous studies have investigated how collective action for IOP development can be started (de Reuver et al., 2015; 2018; Nikayin, et al., 2012; 2013; Klein & Schellhammer, 2011; Leong, Pan, Newell & Cui, 2016; Schreieck, Wiesche & Krcmar, 2017), launch strategies (de Reuver et al., 2018; Schirrmacher, Ondrus & Kude, 2017), what causes other organisations to participate (Vassilakopoulou et al., 2017), and the reasons for failure through discontinuance and dissolution of collective action (de Reuver et al., 2015). The bulk of these studies take a variance approach by illustrating the interaction of variables and their causalities (c.f. Nikayin, et al., 2012; 2013; de Reuver et al., 2015).

We have taken a process perspective that has seldom been investigated save for a handful of studies (c.f. Fürstenau, Auschra, Klein & Gersch, 2019). ***The primary contribution of this study is to have created theoretical building blocks towards a nascent theory of IOP development processes that occurs through collective action.*** These building blocks are presented in Figure 34 (p.185), and can be articulated as follows:

(i) Examining and specifying the unique problem space of platform development that occurs in inter-organisational settings and through collective action.

(ii) Identifying and defining seventeen fundamental process concepts and constructs in IOP development that occurs though collective action.

(iii) Developing process models that illustrate actions and activities of IOP development in platform domains such as designing architecture, governance, openness & control, and creating a value system.

(iv) Developing a socio-cognitive process model of technology frames of references (TFRs) that provides a visual representation the co-influences between TFRs and design practices that can propel collective design process. This illustrated how frame incongruences and cognitive distances may be resolved through joint actions at different design stages.

(v) Problematising critical mass, by using our case data to raise questions and to confront original theoretical ideas about critical mass – the outcome variable in collective action (see Figure 34 below).

These building blocks are a significant step towards a nascent theory of IOP development through collective action. They already provide useful insights and knowledge of how IOPs are constructed in conditions of heterogeneity and coopetition requiring collective organising.

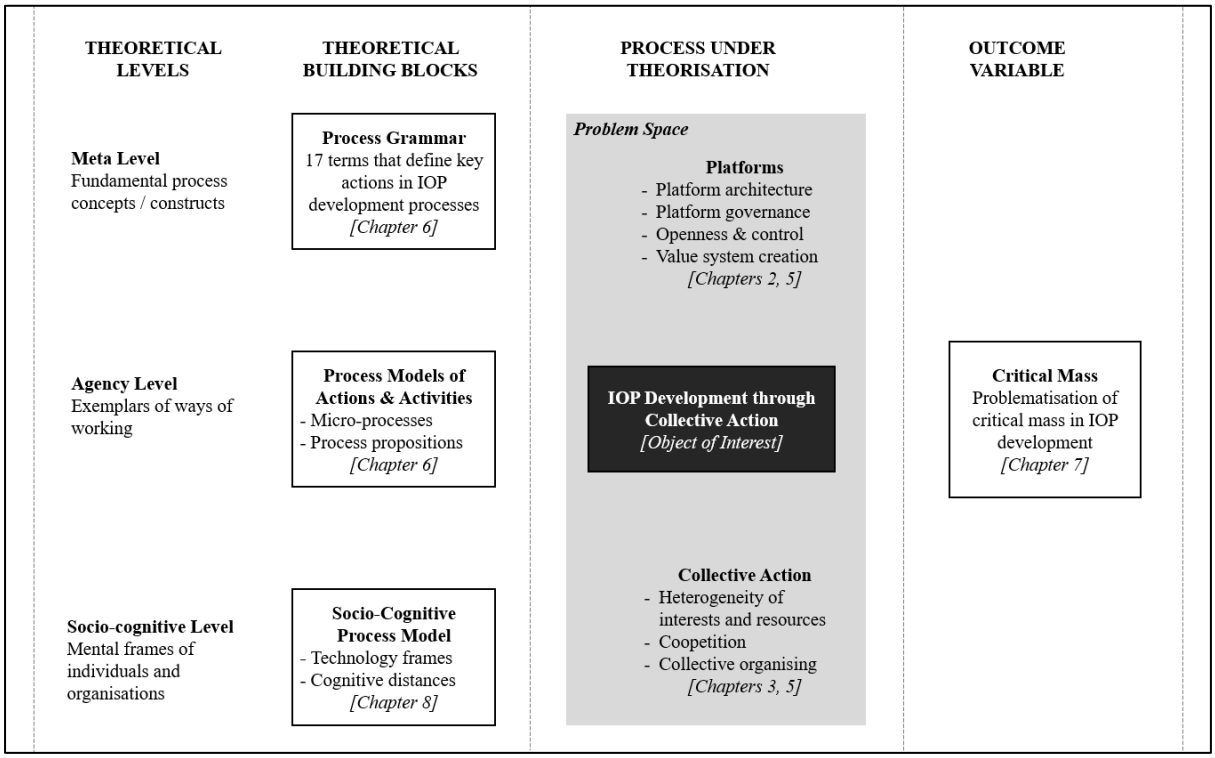

Figure 34: *Overview of theoretical contributions. Created by author.*

9.2.1 Problem Space [Chapters 2,3,5]

In order to develop building blocks towards a theory of IOP development processes, we started off by examining the context conditions of platform development that occurs in inter-organisational settings and through collective action. Two main problem spaces were of particular interest: platforms and collective action. Here we summarise our findings from examining these two problem spaces.

Regarding the platforms, we discovered that a modular architecture emerged out of IOP development, which reflects collective organisation in (i) resource complementarities, (ii) member interests, (iii) pre-existing business connections, and (iv) organisation's type of businesses. We found that varied governance options emerged that required members to deliberate on their offerings such as decision rights, membership type, and data governance. We also found that there was emphasis of openness at first and considerations for some parts of the platform close over time. In particular members favoured an arrangement where top-layer components and features would be open with exceptions (e.g., data transfer, data formats, API management system, data apps), whilst lower layer components would be closed with exceptions (e.g., foundational infrastructure and core processing systems). The value propositions for the data IOP included providing a single point of access to data from disparate sources, inter-organisational data integration, inter-organisational complementarities in developing data systems, long term cost-savings, knowledge transfer, resource re-use (i.e., through economies of scale), and cultivating inter-organisational innovation.

Regarding collective action, we found that heterogeneity of interests created alignment issues that were addressed by sensemaking, coordination, and deliberation before decision making. Heterogeneity of resources was beneficial to collective action because it increased complementarities but required that the leading organisation align members according to those complementarities. It contributed to nesting at design stages, and this was useful in creating specialised sub-groups that attracted third-party developers and innovators. Coopetition dynamics were consistent throughout the IOP development processes – but were not as acute as we have observed from previous research. In general, strategic management by the leading organisation was used to harmonise member goals and resolve differences.

9.2.2 Fundamental Process Concepts [Chapter 6]

In order to theorise (Weick, 1995) IOP development through collective action, this study identified, and defined process concepts of activities carried out by actors (see Table 20, p.112). Theoretically, identification of these process activities provides fundamental concepts that form new 'process grammar' (Lee, Wyner, & Pentland, 2008; Pentland & Rueter, 1994) in IOP development through collective action. As a building block, these terms specify and define the concepts and constructs (or Dubin's "units" see Holton & Lowe, 2007) that, at meta-level, provide meanings to key phenomena of interest in the theory (Gregor, 2006). Many different types of constructs are possible in

theoretical building, in our case, these constructs were derived from observational data in the case (see Gregor, 2006 p.620).

9.2.3 Process Models of Actions & Activities [Chapter 6]

Process models of actions and activities were another building block towards a theory of IOP development through collective action. At agency level, the process models provide exemplars of development processes (see Figure 34, p.185). They capture and illustrate how activities unfolded, highlighting how parallel activities by members and management practices by the leading organisation interacted and co-influenced group organisation, decisions, and the trajectory taken in domains such as architecture and governance. By organising the process activities into goal-oriented and domain specific process models (e.g., setting strategic goals or and designing technical standards see ***Sections 6.3***), this research illustrates micro-processes of how IOP development occurs through collective action. For instance, it shows when management practices such as coordination of members was necessary, and when self-organisation was more effective. Process models also show the thresholds needed to reach actions such as decisions, and to propel collective design processes. Such visual-graphical illustrations were particularly attractive for abstracting theoretical insights from process data because they allow the simultaneous representation of multiple dimensions, and they can easily be used to show precedence, parallel processes, and the passage of time (Langley, 1999 p.700).

9.2.4 Socio-Cognitive Process Model [Chapter 7]

The third building block is a socio-cognitive process model of collective designing (see Figure 33, p.164), which provides a theorisation of how the technology frames of actors shape IOP development processes. The research highlighted that participants came to the project with a variety of technology frames. It also showed that these were not static. Some frames could be altered during interactions. In addition, depending on the stage of the development process, participants were moving from using one frame to using another, reflecting different types of goals at each stage. Thus, at different development stages, understanding these frames enabled designers to measure the level of commonality in participants' expectations. Understanding the frames at play at each stage also helped the designers of the IOP to anticipate the types of questions and discussions to address during the workshops and related activities, and to assess when it was time to move to a subsequent stage. This illustrated how frame incongruences and cognitive distances may be resolved through joint actions at different design stages (Davidson, 2002; 2006; Gioia, 1986). On a theoretical level, we demonstrated the applicability and suitability of TFR theory (Orlikowski and Gash, 1994) to IOP development through collective action, adding a layer by demonstrating co-influences between TFRs and design practices that can propel collective design process.

9.2.5 Critical Mass [Chapter 8]

Apart from defining fundamental concepts, developing process models of actions and activities, and socio-cognitive dynamics, we also problematised (Alvesson & Sandberg, 2011; Whetten, 1989) the outcome variable in collective action for IOP development i.e., critical mass. Critical mass explains the conditions under which reciprocal behaviour gets started and the thresholds at which this becomes self-sustaining (Markus, 1987; Granovetter1978). This problematisation enabled us to explore the boundary conditions of critical mass in the context of IOP development though collective action. This revealed five critical mass issues faced by a platform sponsor in phases of development that occur before platform launch: (i) attracting initial interest, (ii) aligning heterogenous goals, (iii) sustaining commitment to the project (iv), negotiating architecture design, and (v) sustaining commitment to implementation (see Table 30 p.180). We also discovered that critical mass is a recurrent phenomenon rather than a once off even that occurs after platform launch as framed in previous research. By proposing a new view of critical mass, we not only built a block to IOP development theory, but simultaneously used our case data to raise questions and to confront original theoretical ideas about critical mass (Andersen & Kragh, 2010 p.52).

9.3 Contributions to Practice

For practitioners seeking to create new IOPs, this research provides insights that go beyond previous research on business models by shifting from product and service platforms and describing the business models of inter-organisational data platforms. It also adds perspectives useful to project managers and platform technopreneurs by explaining how early-stage data IOP development processes may be managed in similar situations.

9.3.1 Importance of Context

Before giving recommendations to practitioners, findings from this research suggests that practitioners should identify the type of situation they are in. As observed from our exploration of the boundary conditions of this case (see ***Section 6.5.2***), collective groups and IOPs are all different despite having some generic characteristics. It is important for practitioners, both at leadership and membership level in a collective group, to understand the broad context they are in. This is especially so for industry IOPs intended to cover an entire organisational field – it is important to establish the state of the industry. We found that a highly cohesive industry with pre-exiting connections between organisations will likely present manageable challenges if trust relations are maintained. Leaders of IOP development projects also need to consider potential threats to their leadership role and establish a strategy to maintain it through cultivating ties with key organisations in the collective. Organisations that have pre-existing connections or association with a leading firm are likely to be accommodative and committed.

In general, moderately competing organisations that aspire for cooperation will stay in collective action throughout the development process.

Regarding the collective group, it is important to think about how many participants are targeted and who the key players are. In our study, key organisations such as airlines, airports, large private sector corporates and government agencies were the earliest targeted members who formed the critical mass needed to attract others to join. The project started off with **15** members and grew to **46** members over time by attracting other members (see Table 21, p.122). We thus recommend IOP development practitioners to find out which players can be replaced (to mitigate exits), and which players are key and irreplaceable (without which the intended IOP either fails or loses significant value). They can do this by reviewing organisational profiles to establish interest and resource profiles. This will also be useful in recognising complementarities, matching, and coaching organisations during design activities.

Another point to note here is that phases of IOP development require different practices to manage development processes by a collective group. Some key questions to ask here are as follows. What is this phase supposed to achieve? Who are the key players at this stage? What should be the preoccupation of the leader, members, partners, and third parties at this stage?

9.3.2 Recommendations

In the beginning oof the project, promote discovery and sensemaking. The leading organisation should try to ascertain how much the members know about the project. This includes the information resources available and how can they be accessed to support members with key insights and knowledge that gets them up-to-speed. Delays in doing this will likely leave actors with a risky information gaps and assumptions that may trigger exits. At this stage there is a high degree of misunderstandings of things in the project. Members can often be referring to the same technical terms but meaning different things because their technology frames of reference (which are based on their organisational practices) are different. Promote identifying, discovering & sensemaking processes that bridge these 'cognitive distances.' If you are a member, this is time to discover what you do not know and to settle assumptions and concerns that you may have. You should move to the next phase once the project promises a potential to benefit your firm in some way. Key questions to ask are: How different are the benefits you expected and those presented? What are other opportunities?

Start with a small group. Another observation from this study, which we recommend platform technopreneurs and managers is to start the IOP development project with a small group of key members that have complementary resources. This creates a dedicated group, or initial 'critical mass' needed to attract other members. In our case the group started off with **15** members and went on to attract **46** others as the project evolved (see Table 21, p.122). Starting small partially addresses the free rider problem by starting with highly interested and resourceful contributors. It is the efforts of these

contributors that generates the "bandwagon effect" (Marwell & Oliver, 1993) by attracting others to join and contribute to collective action.

Create and maintain trust relations with members. A future leader or sponsor of an IOP under development by a collective group needs to have trust relations with members in the organisational field for which the platform is intended. In our case the leading organisation being a trade association, had a pre-existing position of trust and influence. We also found that such trust generated affective commitment to the project. This adds evidence to previous studies of IOP development through collective action that highlighted the importance of building trust in mitigating power struggles and maintaining a symbiotic balance between competition and cooperation required to make collective action successful (de Reuver et al., 2015; Gawer & Cusumano, 2002).

Coordinate members during deliberations and design activities. Coordinate members by aligning them according to complementarities of resources and interests. This is important particularly during design stages. It promotes nesting of members with complementarities that are useful for specialisation (see Figure 16, p.110). It is important to follow up besting activities with coalescing activities to synthesise and integrate outcomes from sub-group activities. This mitigates against possible drift from the project by semi-autonomous sub-groups specialising on specific components of the platform.

Differentiate strategies for dealing with complicated and complex decision points. We found that complicated decisions – although difficult – have outcomes that are certain and whose optimality can be determined through deliberations. The role of such deliberations should be to generate evidence for the optimal choice between a range of available options (e.g., whether to standardise data formats or depend on integration engines). However, complex decisions have high uncertainty and outcomes whose optimality is difficult to determine. These are such decisions choosing the right governance model from a range of possible options. In such cases, to move things forward, promote democratic processes especially if member representatives have a high degree of strategic and knowledge. Ranking, nominations and voting can be used to select choices in such circumstances. However, it is also important to recognise unique positions of organisations when key decisions are to be made through voting. If needed broker deals that retain losing members, especially if exits can have detrimental effects on the future value of the platform to other members.

Remember that some members will leave. Whilst all measures possible should be taken to retain members, it is important to remember that the nature of collective action especially withing highly heterogenous groups is such that some actions will cause members to leave. Some members will leave despite best efforts to keep the in the group. It is better to let some members go if this enables the group to move forward than to retain them to the detriment of the whole group.

Involve government institutions. We especially recommend involvement of government institutions in data platform projects intended to cover whole economic sectors and have a potential for boosting economic activities such as tourism. We observed that the government institutions can play

multiple roles. They can (partially) sponsor the project by means of funding & subsidies. Second, government institutions can support the development process by directing their multiple agencies (e.g., ministries, statistics agencies, hospitality boards, local authorities etc.) to work with industrial partners in the project. Third, the government agencies can develop policies and guidelines that directly and indirectly support the implementation and future use of the IOP (e.g., the Tourism Data Domain Plan created by MBIE, and Statistics New Zealand's Open Data Policies that were meant to promote government-industry collaboration in the IOP project). Fourth, involving the government institutions can encourage other organisations to join the project setting the IOP under development for future network effects.

Finally, use management practices that are fit for each development phase. Practitioners need to formulate dissimilar practice strategies for different phases of IOP development (Figure 24, p.121). For instance, while a platform can be closed to third-party developers during the development phase, opening up APIs once it is established may be useful in attracting third-party contributions.

9.4 Limitations & Future Research Paths

As with any other research, this research has some limitations. Whilst this was an in-depth case study covering an organisational field, there exists contextual limitations to the extent that findings and insights gained can be transferred to different contexts. In ***Section 6.4.2*** we provided a detailed explanation of some key contextual differences and how these further generate new research paths. In summary, specific processes identified in the organisation of collective action, generating a critical mass, and aligning technology frames in IOP development can be quite different in other contexts. However, our findings suggest that in similar contexts, the process structures are of a more generic nature. The seventeen concepts identified in studying IOP development processes are a first endeavour known to the researcher that provides "process grammar" (Lee, Wyner, & Pentland, 2008; Pentland & Rueter, 1994) to IOP development processes that occur through collective action. Together with other building blocks developed in this study, they provide key ingredients for future research to build a more formal process theory of IOP development through collective action.

The single nature of this case means that in our study of technology frames, it is unknown if the incremental process we uncovered, of moving from benefits discovery to architecture and data design, to governance, and to development can be found in other industry contexts. Yet, our observations did show that this progression allowed to demonstrate the value of the joint platform initiative to the participating firms, and thus to secure commitment for an eventual development of the platform. It remains an empirical question if the designers had oriented joint actions toward resolving frame divergence around governance prior to platforms architecture would have led to similar congruence. This aspect of our socio-cognitive process model of technology frames is an open question for future empirical research.

In the study of critical mass issues, we observed critical mass issues that the platform sponsor dealt with but did not go on to fully examine how each issue manifests itself, and how it can be measured. For instance, we noticed qualitative properties such as reputation, interests, commitments, digital capabilities, goals, consensuses, and decisions, all of which were crucial in determining whether sustainability is achieved to move to the next phase. Some properties were of the users' aspirations (e.g., interests and goals), their actions (e.g., choices and decisions), their qualities (size, influence, and capabilities), and others were of the relationship between users (e.g., consensuses). Future research can examine how such properties can affect how decisions are interpreted by firms, which affects reciprocal behaviour needed to achieve a critical mass.

Another limitation is that this research is based on data gathered in the development stages for an inter-organisational data platform. Therefore, the findings largely provide insights on the formative stages of IOPs and may not necessarily address process and practice issues in other stages of IOP evolution (e.g., scaling), neither does it represent an evaluation of a fully operational IOP. However, both platform and collective action literatures show that the start-up challenge in developing IOPs makes it critical that IS research develops knowledge on the ways in which platforms in inter-organisational settings can be initiated. We have contributed to that effort.

Future research can use the process propositions in this study to illustrate the extent to which our findings are comparable to other contexts of IOP development. Where opportunities arise, we encourage more process studies on collective action that involve multiple institutions taking part, with a perspective that covers an entire organisational field. Additionally, we call for longitudinal work on IOP development processes that details how collective action occurs in 'real-time' with a potential to offer nuances that retrospective studies (that form the bulk of previous research) may not offer.

References

Agarwal, R., & Tiwana, A. (2015). Evolvable Systems: Through the looking glass of IS. *Information Systems Research*, 26(3), 473-479.

Alvesson, M., & Sandberg, J. (2011). Generating research questions through problematisation. *Academy of Management Review*, 36(2), 247-271.

Andersen, P. H., & Kragh, H. (2010). Sense and sensibility: Two approaches for using existing theory in theory-building qualitative research. *Industrial Marketing management*, 39(1), 49-55.

Bakos, J. Y. (1991). A strategic analysis of electronic marketplaces. *MIS Quarterly*, 15(3), 295-310.

Baldwin, C. Y., & Clark, K. B. (2006). The architecture of participation: Does code architecture mitigate free riding in the open-source development model? *Management Science*, *52*(7), 1116-1127.

Baldwin, C. Y., & Woodard, C. J. (2009). The architecture of platforms: A unified view. In A. Gawer (Ed.), *Platforms, markets, and innovation* (p.19-44). Cheltenham, UK: Edward Elgar.

Barley, S. R. (1990). Images of imaging: Notes on doing longitudinal field work. *Organisation Science*, 1(3), 220-247.

Basole, R. C., & Karla, J. (2011). On the evolution of mobile platform ecosystem structure and strategy. *Business & Information Systems Engineering*, 3(5), 313.

Basole, R. C., & Karla, J. (2012). Value transformation in the mobile service ecosystem: A study of app store emergence and growth. *Service Science*, 4(1), 24-41.

Benbasat, I., & Zmud, R. W. (2003). The identity crisis within the is discipline: defining and communicating the discipline's core properties. *MIS Quarterly*, *27*(2), 183-194.

Benbasat, I., Goldstein, D. K., & Mead, M. (1987). The case research strategy in studies of information systems. *MIS Quarterly*, 369-386.

Benlian, A., Hilkert, D., & Hess, T. (2015). How open is this platform? The meaning and measurement of platform openness from the complementors' perspective. *Journal of Information Technology*, 30(3), 209-228.

Berger, P. L., & Luckmann, T. (1966). *The social construction of reality.* Auckland: Penguin Books.

Blaschke, M., Haki, K., Aier, S., & Winter, R. (2018). Capabilities for digital platform survival: Insights from a business-to-business digital platform. In: *Proceedings of the 39th International Conference on Information Systems*, (ICIS 2018), San Francisco, USA.

Boudreau, K. J. & Hagiu, A. (2009). Platform rules: multi-sided platforms as regulators. In: Gawer, A. (Ed.) *Platforms, markets, and innovation*. Cheltenham, UK: Edward Elgar Publishing.

Boudreau, K. J. (2010). Open platform strategies and innovation: Granting access *vs.* devolving control. *Management Science*, 56(10), 1849-1872.

Boudreau, K. J. (2017). Platform boundary choices & governance: Opening-up while still coordinating and orchestrating. In: *Entrepreneurship, innovation, and platforms*. Emerald Publishing Limited.

Campbell, D. T. (1969). Ethnocentrism of disciplines and the fish–scale model of omniscience. *Interdisciplinary Relationships in the Social Sciences*, 328, 348.

Cennamo, C., & Santaló, J. (2019). Generativity tension and value creation in platform ecosystems. *Organisation Science*, 30(3), 617-641.

Choi, G., Nam, C., & Kim, S. (2018). The impacts of technology platform openness on application developers' intention to continuously use a platform: From an ecosystem perspective. *Telecommunications Policy*, 43(2), 140-153.

Constantinides, P., Henfridsson, O., & Parker, G. G. (2018). Introduction: Platforms and infrastructures in the digital age. *Information Systems Research*, 29(2), 381-400.

Darke, P., Shanks, G., & Broadbent, M. (1998). Successfully completing case study research: combining rigour, relevance, and pragmatism. *Information Systems Journal*, 8(4), 273-289.

Davidson, E. J. (2006). A technology frames perspective on information technology and organisational change. *The Journal of Applied Behavioural Science*, 42(1), 23-39.

Davis, M. S. (1971). That's interesting! Towards a phenomenology of sociology and a sociology of phenomenology. *Philosophy of the Social Sciences*, 1(2), 309-344.

de Reuver, M., Nederstigt, B., & Janssen, M. (2018). Launch strategies for multi-sided data analytics platforms. In: *Proceedings of the 26th European Conference on Information Systems*, (ECIS 2018), Portsmouth, UK.

de Reuver, M., Sørensen, C., & Basole, R. C. (2017). The digital platform: A research agenda. *Journal of Information Technology*, 33(2), 124-135.
de Reuver, M., Verschuur, E., Nikayin, F., Cerpa, N., & Bouwman, H. (2015). Collective action for mobile payment platforms: A case study on collaboration issues between banks and telecom operators. *Electronic Commerce Research & Applications*, 14(5), 331-344.
Dubé, L., & Paré, G. (2003). Rigor in information systems positivist case research: current practices, trends, and recommendations. *MIS Quarterly*, 27(4), 597-636.
Eaton, B., Elaluf-Calderwood, S., Sørensen, C., & Yoo, Y. (2015). Distributed tuning of boundary resources. *MIS Quarterly*, 39(1), 217-244.
Eisenhardt, K. M. (1989). Building theories from case study research. *Academy of Management Review*, 14(4), 532-550.
Eisenhardt, K. M., & Graebner, M.E. (2007). Theory building from cases: Opportunities and challenges. A*cademy of Management Journal*, 50(1), 25-32.
Eisenmann, T., Parker, G. G., & Van Alstyne, M. (2011). Platform envelopment. *Strategic Management Journal*, 32: 1270–1285.
Evans, D. S., & Schmalensee, R. (2010). Failure to launch: Critical mass in platform businesses. *Review of Network Economics*, 9(4), 1-33.
Foerderer, J., Kude, T., Schütz, S., & Heinzl, A. (2014). Control versus generativity: A complex adaptive systems perspective on platforms. In: *Proceedings of the 35th International Conference on Information Systems*, (ICIS 2014), Auckland, New Zealand.
Fürstenau, D., & Auschra, C. (2016). Open digital platforms in health care: Implementation and scaling strategies. *Proceedings of the 37th International Conference on Information Systems*, (ICIS 2016), Dublin, Ireland.
Fürstenau, D., Auschra, C., Klein, S., & Gersch, M. (2019). A process perspective on platform design and management: evidence from a digital platform in health care. *Electronic Markets*, 29(4), 581-596.
Garud, R., Jarzabkowski, P., Langley, A., Tsoukas, H., Van de Ven, A., & Lê, J. (2020). Process research methods: A conversation among leading scholars. In: Crook, T. R., Lê, J. K., & Smith, A. D. (Eds.). (2020). *Advancing methodological thought and practice*. Bingley, UK: Emerald Group Publishing.
Gawer, A. (2014). Bridging differing perspectives on technological platforms: Toward an integrative framework. *Research Policy*, 43(7), 1239-1249.
Gawer, A. (2015). What drives shifts in platform boundaries? An organisational perspective. In: *Academy of Management Proceedings*, (1), 13765.
Gawer, A., & Cusumano, M. A. (2002). *Platform leadership: How Intel, Microsoft, and Cisco drive industry innovation* (Vol. 5, p.29-30). Boston, MA: Harvard Business School Press.
Gawer, A., & Cusumano, M. A. (2014). Industry platforms and ecosystem innovation. *Journal of Product Innovation Management*, 31(3), 417-433.
Gawer, A., & Henderson, R. (2007). Platform owner entry and innovation in complementary markets: Evidence from Intel. *Journal of Economics & Management Strategy*, 16(1), 1-34.
Ghazawneh, A., & Henfridsson, O. (2013). Balancing platform control and external contribution in third-party development: the boundary resources model. *Information Systems Journal*, 23(2), 173-192.
Goldbach, T., Benlian, A., & Buxmann, P. (2018). Differential effects of formal and self-control in mobile platform ecosystems: Multi-method findings on third-party developers' continuance intentions and application quality. *Information & Management*, 55(3), 271-284.
Granovetter, M. (1978). Threshold models of collective behaviour. *American Journal of Sociology*, 83(6), 1420-1443.
Greenwood, B., & Agarwal, R. (2013). Two-sided platforms and HIV incidence among the digitally disadvantaged. In: *Proceedings of the International Conference on Information* Systems, (ICIS 2013), Milan, Italy.
Gregor, S. (2006). The nature of theory in information systems. *MIS Quarterly*, 30(3), 611-642.
Grisot, M., Hanseth, O., & Thorseng, A. A. (2014). Innovation of, in, on infrastructures: articulating the role of architecture in information infrastructure evolution. *Journal of the Association for Information Systems*, 15(4), 197-219.

Guo, X., Reimers, K., Xie, B., & Li, M. (2014). Network relations and boundary spanning: Understanding the evolution of e-ordering in the Chinese drug distribution industry. *Journal of Information Technology*, 29(3), 223-236.

Gustafsson, J. (2017). *Single case studies vs. multiple case studies: A comparative study.* Academy of Business, Engineering and Science. Halmstad University Halmstad, Sweden.

Hackney, R., Burn, J., & Salazar, A. (2004). Strategies for value creation in electronic markets: towards a framework for managing evolutionary change. *The Journal of Strategic Information Systems,* 13(2), 91-103.

Hagiu, A. & Spulber, D. (2013). First-party content and coordination in two sided markets. *Management Science,* 59(4), 933-949.

Hagiu, A., & Wright, J. (2015). Multi-sided platforms. *International Journal of Industrial Organisation*, 43, 162-174.

Hardin, R. 1982. *Collective action.* Baltimore, MD: John Hopkins University.

Heckathorn, D. D. (1993). Collective action and group heterogeneity: voluntary provision versus selective incentives. *American Sociological Review,* 329-350.

Hoffman, R., Yeh, C. (2018). *Blitzscaling: The lightning-fast path to building massively valuable companies.* London, UK: Haper Collins Publishers.

Holton, E. F., & Lowe, J. S. (2007). Toward a general research process for using Dubin's theory building model. *Human Resource Development Review*, 6(3), 297-320.

Huber, T. L., Kude, T., & Dibbern, J. (2017). Governance practices in platform ecosystems: Navigating tensions between co-created value and governance costs. *Information Systems Research,* 28(3), 563-584.

Hukal, P. (2017). On the role of module interdependencies in platform evolution. In: *Proceedings of the International Conference on Information Systems,* (ICIS 2017), Seoul, South Korea.

Ibrahim, M., & Ribbers, P. M. (2009). The impacts of competence-trust and openness-trust on inter-organisational systems. *European Journal of Information Systems*, 18(3), 223-234.

Inoue, Y., & Tsujimoto, M. (2018). New market development of platform ecosystems: A case study of the Nintendo Wii. *Technological Forecasting and Social Change*, 136, 235-253.

Jacobides, M. G., Cennamo, C., & Gawer, A. (2018). Towards a theory of ecosystems. *Strategic Management Journal,* 39(8), 2255-2276.

Jacobides, M. G., Knudsen, T., & Augier, M. (2006). Benefiting from innovation: Value creation, value appropriation and the role of industry architectures. *Research Policy,* 35(8), 1200-1221.

Jarvenpaa, S., & Markus, M. L. (2018). Genetic platforms and their commercialisation: Three tales of digital entrepreneurship. In: *Proceedings of the Proceedings of the 51st Hawaii International Conference on System Sciences,* (HICSS 2018), Hawaii, USA.

Jarzabkowski, P. A., Lê, J. K., & Feldman, M. S. (2012). Toward a theory of coordinating: Creating coordinating mechanisms in practice. *Organisation Science*, 23(4), 907-927.

Jha, S. K., Pinsonneault, A., & Dubé, L. (2016). The evolution of an ICT platform-enabled ecosystem for poverty alleviation: The case of eKutir. *MIS Quarterly*, 40(2), 431–445.

Kapoor, R., & Agarwal, S. (2017). Sustaining superior performance in business ecosystems: Evidence from application software developers in the iOS and Android smartphone ecosystems. *Organisation Science*, 28(3), 531-551.

Karhu, K., Gustafsson, R., & Lyytinen, K. (2018). Exploiting and defending open digital platforms with boundary resources: Android's five platform forks. *Information Systems Research,* 29(2), 479–497.

Katz, M. L., & Shapiro, C. 1994. Systems competition and network effects. *Journal of Economic Perspectives*, 8(2), 93-115.

Kim, H. J., Kim, I., & Lee, H. (2016). Third-party mobile app developers' continued participation in platform-centric ecosystems: An empirical investigation of two different mechanisms. *International Journal of Information Management,* 36(1), 44–59.

Klein, S. & Schellhammer, S. (2011). Developing IOIS as collective action: a cross-country comparison in the health care sector. In: *Proceedings of the 44th Hawaii International Conference on System Sciences,* (HICSS 2011), Hawaii, USA.

Koh, T. K., & Fichman, M. (2014). Multihoming users' preferences for two-sided exchange networks. *MIS Quarterly,* 38(4), 977-996.

Langley, A. (1999). Strategies for theorising from process data. *Academy of Management Review*, 24(4), 691-710.
Langley, A. (2007). Process thinking in strategic organisation. *Strategic Organisation,* 5(3), 271-282.
Langley, A. (2009). Studying processes in and around organisations. In: Buchanan, D., & Bryman, A. (Eds.). *The Sage Handbook of Organisational Research Methods*. Sage Publications Ltd.
Langley, A., Smallman, C., Tsoukas, H., & Van de Ven, A. H. (2013). Process studies of change in organisation & management: Unveiling temporality, activity, and flow. *Academy of Management Journal,* 56(1), 1-13.
Lee, A. S. (1989). A scientific methodology for MIS case studies. *MIS Quarterly,* 13(1), 33-50.
Lee, C., Lee, D., & Hwang, J. (2015). Platform openness and the productivity of content providers: A meta-frontier analysis. *Telecommunications Policy*, 39(7), 553-562.
Lee, J., Wyner, G. M., & Pentland, B. T. (2008). Process grammar as a tool for business process design. *MIS Quarterly*, *757*-778.
Leong, C., Pan, S. L., Newell, S., & Cui, L. (2016). The emergence of self-organising e-commerce ecosystems in remote villages of China: a tale of digital empowerment for rural development. *MIS Quarterly,* 40(2), 475-484.
Malone, T. W., Yates, J., & Benjamin, R. I. (1987). Electronic markets and electronic hierarchies. *Communications of the ACM*, 30(6), 484-497.
Markus, M. L. 1987. Toward a "critical mass" theory of interactive media: Universal access, interdependence, and diffusion. *Communication Research,* 14(5), 491-511.
Markus, M. L., & Bui, Q. N. (2012). Going concerns: The governance of inter–organisational coordination hubs. *Journal of Management Information Systems*, 28(4), 163-198.
Marwell, G., & Oliver, P. (1993). *The critical mass in collective action*. Cambridge, UK: Cambridge University Press.
Marwell, G., Oliver, P. E., & Prahl, R. (1988). Social networks and collective action: A theory of the critical mass. III. *American Journal of Sociology*, 94(3), 502-534.
McIntyre, D. P., & Srinivasan, A. (2017). Networks, platforms, and strategy: Emerging views and next steps. *Strategic Management Journal,* 38(1), 141-160.
Medina, L. F., Sierra, L. F. M., & Medina, L. (2007). *A unified theory of collective action and social change*. Ann Arbor, MI: University of Michigan Press.
Medina, L.F. 2013. The analytical foundations of collective action theory: A survey of some recent developments. *Annual Review of Political Science*, 16, 259-283.
Menon, K., Kärkkäinen, H., & Wuest, T. (2017). Role of openness in industrial internet platform providers' strategy. In: *IFIP International Conference on Product Lifecycle Management* (p. 92-105). Springer, Cham.
Menon, K., Kärkkäinen, H., & Wuest, T. (2020). Industrial internet platform provider and end-user perceptions of platform openness impacts. *Industry and Innovation,* 27(4), 363-389.
Miles, M. B., Huberman, A. M., & Saldaña, J. (2018). *Qualitative data analysis: A methods sourcebook* (4th Ed.). Thousand Oaks, CA: SAGE Publications Inc.
Munkvold, B. E. (1999). Challenges of IT implementation for supporting collaboration in distributed organisations. *European Journal of Information Systems*, 8(4), 260-272.
Nandhakumar, J., & Jones, M. (1997). Too close for comfort? Distance and engagement in interpretive information systems research. *Information Systems Journal,* 7(2), 109-131.
NG, Y.S.E., Muthukannan, P., Tan, B., & Leong, C. (2017). Fintech platform development: A revelatory case study of a Chinese microloan start-up. In: *Proceedings of the 38th International Conference on Information Systems,* (ICIS 2017), Seoul, South Korea.
Nikayin, F., de Reuver, M., & Itälä, T. (2013). Collective action for a common service platform for independent living services. *International Journal of Medical Informatics,* 82(10), 922-939.
Nikayin, F., Itälä, T., & de Reuver, M. (2012). Collective action in a smart living platform ecosystem: The role of platform leadership and platform openness. In: *Proceedings of the International Conference on Mobile Business,* (ICMB 2012), Delft, The Netherlands.
Nikayin, F.A. (2014). *Common platform dilemmas: Collective action and the Internet of Things.* PhD Dissertation. Delft University of Technology: Next Generation Infrastructure Foundation.

Ojala, A., & Lyytinen, K. (2018). Competition logics during digital platform evolution. In: *Proceedings of the Proceedings of the 51st Hawaii International Conference on System Sciences,* (HICSS 2018), Hawaii, USA.

Oliver, P. E. & Marwell, G. (1988). The paradox of group size in collective action: A theory of the critical mass. II. *American Sociological Review*, 1-8.

Oliver, P. E., Marwell, G. & Teixeira, R. (1985). A theory of the critical mass. I. Interdependence, group heterogeneity, and the production of collective action. *American Journal of Sociology*, 91(3), 522.

Olson, M. (1971). *The logic of collective action: public goods and the theory of groups.* Cambridge, MA: Harvard University Press.

Ondrus, J., Gannamaneni, A. & Lyytinen, K. (2015). The impact of openness on the market potential of multi-sided platforms: a case study of mobile payment platforms. *Journal of Information Technology*, 30(3), 260-275.

Orlikowski, W. J. & Gash, D. C. (1994). Technology frames: making sense of information technology in organisations. *ACM Transactions on Information Systems (TOIS)*, 12(2), 174-207.

Österom, E. C. (1990). *Governing the commons: The evolution of institutions for collective action.* Cambridge, UK: Cambridge University Press.

Österom, E. C. (2009). Collective action theory. In: Boix, C. & Stokes, S.C. (Eds). *The Oxford handbook of comparative politics*. Oxford: Oxford Handbooks.

Österom, E. C. (2010). Beyond markets and states: polycentric governance of complex economic systems. *American Economic Review,* 100(3), 641-72.

Paré, G., Trudel, M. C., Jaana, M., & Kitsiou, S. (2015). Synthesising information systems knowledge: A typology of literature reviews. *Information & Management, 52*(2), 183-199.

Parker, G. G. & Van Alstyne, M. W. (2009). Six challenges in platform licensing and open innovation. *Communications & Strategies*, 74(2), 17.

Parker, G. G. & Van Alstyne, M. W. (2018). Innovation, openness, and platform control. *Management Science,* 64(7), 3015-3032.

Parker, G. G., Van Alstyne, M. W., & Choudary, S. P. (2016). *Platform revolution: How networked markets are transforming the economy and how to make them work for you.* WW Norton & Company.

Parker, G. G., Van Alstyne, M. W., & Jiang, X. (2017). Platform ecosystems: How developers invert the firm. *MIS Quarterly*, 41(1), 255-266.

Pentland, B. T., & Rueter, H. H. (1994). Organisational routines as grammars of action. *Administrative Science Quarterly*, 484-510.

Peppard, J., Galliers, R. D., & Thorogood, A. (2014). Information systems strategy as practice: Micro strategy and strategising for IS. *Journal of Strategic Information Systems*, 23(1), 1-10.

Pettigrew, A. M. (1985). Contextualist research and the study of organisational change processes. *Research Methods in Information Systems*, 1, 53-78.

Pettigrew, A. M. (1990). Longitudinal field research on change: Theory and practice. *Organisation Science,* 1(3), 267-292.

Pettigrew, A. M. (1992). The character and significance of strategy process research. *Strategic Management Journal*, 13(S2), 5-16.

Porch, C., Timbrell, G. T., & Rosemann, M. (2015). Platforms: A systematic review of the literature using algorithmic historiography. In: *Proceedings of the European Conference on Information Systems* (ECIS 2015), Münster, Germany.

Puri, S. K. (2006). Technology frames of stakeholders shaping the SDI implementation: A case study from India. *Information Technology for Development*, 12(4), 311-331.

Qiu, Y., Hann, I. H., & Gopal, A. (2013). From invisible hand to visible hand: platform governance and institutional logic of independent Mac developers, 2001-2012. In: *Proceedings of the 34th International Conference on Information Systems,* (ICIS 2013), Milan, Italy.

Richardson, S., Kettinger, W. J., Banks, M. S., & Quintana, Y. (2014). IT and agility in the social enterprise: a case study of St Jude Children's Research Hospital's "Cure4Kids" IT-platform for international outreach. *Journal of the Association for Information Systems,* 15(1), 1-32.

Rietveld, J., & Eggers, J. P. (2018). Demand heterogeneity in platform markets: Implications for complementors. *Organisation Science, 29*(2), 304-322.

Ruutu, S., Casey, T., & Kotovirta, V. (2017). Development and competition of digital service platforms: A system dynamics approach. *Technological Forecasting and Social Change*, 117, 119-130.

Saadatmand, F., Lindgren, R., & Schultze, U. (2017). Evolving shared platforms: An imbrication lens. In: *Proceedings of the 38th International Conference on Information Systems,* (ICIS 2017), Seoul, South Korea.

Saarikko, T., Jonsson, K. & Burström, T. (2014). Towards an understanding of entrepreneurial alertness in the formation of platform ecosystems. In: *Proceedings of the 22nd European Conference on Information Systems* (ECIS 2014), Tel Aviv, Israel.

Saarikko, T., Jonsson, K., & Burström, T. (2018). Software platform establishment: effectuation and entrepreneurial awareness. *Information Technology & People*, *32*(3), 579-602.

Saarikko, T., Westergren, U. H., & Blomquist, T. (2016). The inter-organisational dynamics of a platform ecosystem: Exploring stakeholder boundaries. In: *Proceedings of the 49th Hawaii International Conference on System Sciences,* (HICSS 2016), Hawaii, USA.

Schirrmacher, N. B., Ondrus, J., & Kude, T. (2017). Launch strategies of digital platforms: Platforms with switching and non-switching users. In: *Proceedings of the 25th European Conference on Information Systems,* (ECIS 2017), Guimarães, Portugal.

Schmeiss, J., Hoelzle, K., & Tech, R. P. (2019). Designing governance mechanisms in platform ecosystems: Addressing the paradox of openness through blockchain technology. *California Management Review*, 62(1), 121-143.

Schreieck, M., Wiesche, M., & Krcmar, H. (2017). The platform owner's challenge to capture value-insights from a business-to-business IT platform. In: *Proceedings of the 38th International Conference on Information Systems,* (ICIS 2017), Seoul, South Korea.

Setzke, S. D., Böhm, M., & Krcmar, H. (2019). Platform openness: A systematic literature review and avenues for future research. In: *Proceedings of the 14th International Conference on Wirtschafts-informatik*, February 24-27, 2019, Siegen, Germany.

Staykova, K. S., & Damsgaard, J. (2017). Towards an integrated view of multi-sided platforms evolution. In: *Proceedings of the 38th International Conference on Information Systems,* (ICIS 2017), Seoul, South Korea.

Steets, S. 2016. Taking Berger and Luckmann to the realm of materiality: Architecture as a social construction. *Cultural Sociology*, 10(1), 93-108.

Stefi, A., Berger, M., & Hess, T. (2014). What influences platform provider's degree of openness? Measuring and analysing the degree of platform openness. In: *Proceedings of the International Conference of Software Business*, (ICSOB 2014), Springer, Cham.

Steinfield, C. W., Markus, M. L., & Wigand, R. T. (2005). Exploring inter-organisational systems at the industry level of analysis: evidence from the US home mortgage industry. *Journal of Information Technology*, 20(4), 224-233.

Steins, N. A. & Edwards, V. M. 1999. Platforms for collective action in multiple-use common-pool resources. *Agriculture and Human Values*, 16(3), 241-255.

Tan, B., Pan, S. L., Lu, X. & Huang, L. (2015). The role of IS capabilities in the development of multi-sided platforms: The digital ecosystem strategy of Alibaba.com. *Journal of the Association for Information Systems,* 16(4), 248.

Teixeira, J., Mian, S. Q. & Hytti, U. (2016). Cooperation among competitors in the open-source arena: The case of OpenStack. In: *Proceedings of the International Conference on Information Systems,* (ICIS 2016), Dublin, Ireland.

Templier, M. & Paré, G. (2015). A framework for guiding and evaluating literature reviews. *Communications of the Association for Information Systems*, 37(1), 6.

Thomas, L. D., Autio, E. & Gann, D. M. (2014). Architectural leverage: putting platforms in context. *The Academy of Management Perspectives*, 28(2), 198-219.

Tiwana, A. (2014). *Platform ecosystems: aligning architecture, governance, and strategy.* Waltham, MA: Morgan Kaufmann, Elsevier.

Tiwana, A. (2015**a**). Evolutionary competition in platform ecosystems. Information Systems Research, 26(2), 266-281.

Tiwana, A. (2015**b**). Platform desertion by app developers. *Journal of Management Information Systems*, 32(4), 40-77.

Tiwana, A. (2018). Platform synergy: Architectural origins and competitive consequences. *Information Systems Research*, 29(4), 829-848.
Tiwana, A., Konsynski, B. & Bush, A.A. (2010). Research commentary—Platform evolution: Co–evolution of platform architecture, governance, and environmental dynamics. *Information Systems Research*, 21(4), 675-687.
Tsang, E. W. (2014). Case studies and generalisation in information systems research: A critical realist perspective. *The Journal of Strategic Information Systems*, 23(2), 174-186.
Udéhn, L. 1993. Twenty-five years with the logic of collective action. *Acta Sociologica*, 36(3), 239-261.
Um, S. & Yoo, Y. (2016). The co-evolution of digital ecosystems. *Proceedings of the International Conference on Information Systems* (ICIS 2016), Dublin, Ireland.
Um, S. Y., Yoo, Y., Wattal, S., Kulathinal, R. J. & Zhang, B. (2013). The architecture of generativity in a digital ecosystem: A network biology perspective. In: *Proceedings of the International Conference on Information Systems,* (ICIS 2013), Milan, Italy.
Um, S., Yoo, Y. & Wattal, S. (2015). The evolution of digital ecosystems: A case of WordPress from 2004 to 2014. In: *Proceedings of the International Conference on Information Systems*, (ICIS 2015), Fort Worth, TX, USA.
Van de Ven, A. H. (2007). Designing process studies. p.194–231. In: Van de Ven, A. H. *Engaged scholarship: A guide for organisational and social research.* Oxford University Press.
Van de Ven, A. H., & Poole, M. S. (1995). Explaining development and change in organisations. *Academy of Management Review*, 20(3), 510-540.
Van de Ven, A.H., & Poole, M.S. (2005). Alternative approaches for studying organisational change. *Organisation studies*, 26(9), 1377-1404.
Vardhan, H. (2015). *Platform failures: Lessons for strategic management*. Dissertation. Massachusetts Institute of Technology, Sloan School of Management.
Vassilakopoulou, P., Grisot, M., Jensen, T. B., Sellberg, N., Eltes, J., Thorseng, A., & Aanestad, M. (2017). Building national e-health platforms: The challenge of inclusiveness. In: *Proceedings of the 38th International Conference on Information Systems,* (ICIS 2017), Seoul, South Korea.
Vervest, P., Preiss, K., Van Heck, E., & Pau, L. F. (2004). The emergence of smart business networks. *Journal of Information Technology*, 19(4), 228-233.
Walsham, G. (1995). Interpretive case studies in IS research: nature and method. *European Journal of Information Systems*, 4(2), 74-81.
Wang, J., Guo, B., Wang, X., & Lou, S. (2020). Closed or open platform? the nature of platform and a qualitative comparative analysis of the performance effect of platform openness. *Electronic Commerce Research and Applications*, 44, 101007.
Wareham, J., Fox, P. B., & Cano Giner, J. L. (2014). Technology ecosystem governance. *Organisation science*, 25(4), 1195-1215.
Webster, J., & Watson, R. T. (2002). Analysing the past to prepare for the future: Writing a literature review. *MIS Quarterly*, 26(2), xiii-xxiii.
Weick, K. E. (1995). What theory is not, theorising is. *Administrative Science Quarterly*, 40(3), 385-390.
Wessel, M., Thies, F., & Benlian, A. (2017). Opening the floodgates: The implications of increasing platform openness in crowdfunding. *Journal of Information Technology*, 32(4), 344-360.
West, J. (2003). How open is open enough? Melding proprietary and open-source platform strategies. *Research Policy*, 32(7), 1259-1285.
Whetten, D. A. (1989). What constitutes a theoretical contribution? *Academy of Management Review*, 14(4), 490-495.
Wigand, R. T., Steinfield, C. W., & Markus, M. L. (2005). Information technology standards choices and industry structure outcomes: The case of the US home mortgage industry. *Journal of Management Information Systems*, 22(2), 165-191.
Woodard, C. J., & Clemons, E. (2014). Modelling the evolution of generativity and the emergence of digital ecosystems. In: *Proceedings of the 35th International Conference on Information Systems,* (ICIS 2014), Auckland, New Zealand.
Yin, R. K. (2013). Validity and generalisation in future case study evaluations. *Evaluation*, 19(3), 321-332.

Yin, R. K. (2018). *Case study research and applications: Design and methods.* (4th Ed). Thousand Oaks, CA: SAGE Publications Inc.

Yoffie, D. B., Gawer, A., & Cusumano, M. A. (2019). A study of more than 250 platforms a reveal why most fail. *Harvard Business Review*. 2019/05.

Zhang, N., Sia, S. K., & Lee, G. W. (2017). Sharing economy disruption and the quest for new institutional legitimacy. In: *Proceedings of the 38th International Conference on Information Systems*, (ICIS 2017), Seoul, South Korea.

Zhu, K., Kraemer, K. L., Gurbaxani, V. & Xu, S. X. (2006). Migration to open–standard inter–organisational systems: network effects, switching costs, and path-dependency. *MIS Quarterly*, 30, 515-539.

Zysman, J., & Kenney, M. (2018). The next phase in the digital revolution: intelligent tools, platforms, growth, employment. *Communications of the ACM*, 61(2), 54-63.

Appendix 1: Literature Review Selection Criteria Inclusion, Exclusion & Relevance

1. General criteria

1.1 Goal:

Papers that explain the … of platform ecosystems (as socio technical IS/IT artefacts)

processes involved in …	• Conception • Designing • Launching • Development

Such papers may have implications in strategic management, economics, and organisational theory, but the core focus is the platform ecosystem.

1.2 Definition:

- *An organisational form based on a socio-technical configuration of interdependent actors and resources that (1) is not fully hierarchically controlled, (2) has the architectural attributes of modularity, evolvability and scalability, and (3) governs the creation, exchange, and capture of value, such as services and content, through interactions, transactions, complementarities, and innovation.* (Tiwana et al., 2010; Gawer, 2014; Constantinides et al., 2018; Jacobides et al., 2018).

- Categories of platforms (Gawer, 2014; Parker, Van Alstyne & Choudary, 2016):
    - Platforms as digital markets:
        - Coordinator of transactions between buyers and sellers of labour, resources, money
        - Examples: Airbnb, Uber, Kickstarter, Builderscrack, TaskRabbit, Topcoder, Spotify, Google (search/ads), but there are also "traditional" industry platforms such as the SABRE airline reservation systems which is basically a market coordinator between airlines and travel sales agents
    - Platforms as technological architectures:
        - Integrator of complex technological systems, which may include products, services, systems, and complements. Such platforms are conduit for innovation: complementors add value to the core of the platform, by speeding up innovation and serving user needs. Such platforms have varying degrees of openness.
        - Examples: Android & **R** are open-source examples. Software companies such as Xero and SAP have a private core that is protected, but a peripheral part of the architecture is open to complementors.
    - Platforms as databanks/repositories
        - Data commons that aggregate and coordinate large-scale data, varied datasets, from various sources

        - Examples: Science repositories of genetic data, economic and financial data banks (de Reuver, Nederstigt & Janssen, 2018; Jarvenpaa & Markus, 2018).
    - Platforms as collaborative institutions[21]
        - Coordinator of distributed agents (individuals, organisations) that pursue a collective endeavour. The platforms attempt to facilitate collective action and distributed (crowd-based) organising.

1.3 Search terms or labels:

- Synonyms for "platform" may include (depending on how they are used):
    - Inter-organisational (information) systems – IOS
    - Digital hubs (e-hubs), data hubs
    - Ecosystems, digital ecosystems
    - Electronic markets (trading platforms, electronic commerce)
    - Variations on these words

2. Other criteria for exclusion

- If the paper uses the word 'platform' to refer to its English semantics, as a 'pivot', 'stage' or 'podium' it would be out of context and should be excluded.
    - For instance, how Burton-Jones & Grange (2012) discuss that their emerging theory "…extends existing research, provides a rich ***platform*** for research on effective use, and how it contributes back to the theory..."; or how Dernbecher & Beck, (2017) demonstrate that "…mindfulness provides a meaningful ***platform*** for generating knowledge."
- The word 'ecosystem' has gained popularity as a synonym for "environment" in recent years. If an article that treats 'ecosystem' just as the context in which to study some other phenomena (e.g., consumer behaviour, firm strategy), then it should be excluded.
    - Example: Ahuja & Chan (2016) who attempted to answer the question: How do firms develop frugal IT capabilities ***in a resource-constrained ecosystem?*** The ecosystem environment they discuss is not necessarily the platform ecosystem targeted by this review and therefore such a paper should be excluded.
- If the paper is about individual behaviour of the actors on a platform, but the study has limited implications for the conception, design, launching & development of the platform itself, it should be excluded (e.g., how to run a successful campaign on Kickstarter, the factors that lead to YouTube video popularity, the factors that explain app success on the Apple app store)
- If the paper simply uses the word 'platform' to essentially refer to a traditional type of an organisational IS such as an enterprise resource planning software, supply chain or employee portal, it should be excluded.
    - Examples include Fedorowicz, (1992) who developed a taxonomy of organisational support systems (OSS)[22]; Elbanna (2010)[23] who studied the project boundaries of ERP implementation. These papers at times refer to these information systems as 'platforms', but these were out of the context of our research.

[21] As we put specially emphasis in including papers studying this type of platforms

[22] Dernbecher, S., & Beck, R. (2017). The concept of mindfulness in information systems research: A multi-dimensional analysis. *European Journal of Information Systems*, 26(2), 121-142.

[23] Elbanna, A. (2010). Rethinking IS project boundaries in practice: A multiple-projects perspective. *The Journal of Strategic Information Systems*, 19(1), 39-51.

Appendix 2: Summaries of Reviewed Papers – Quantitative Research Papers

Paper & Research Question	Methods	R.	Evidence Strength	Dependent Variables	Independent Variables	Key Issues	Summary of Findings
Paper: Baldwin, C. Y., & Clark, K. B. (2006). The architecture of participation: Does code architecture mitigate free riding in the open-source development model? Management Science, 52(7), 1116-1127. **Research Question(s):** *Does code architecture mitigate free riding in the open-source development model? From a theoretical perspective, what are the interactions between the open-source development process and the design and structure of codebases?*	**Econometric Analyses.** **Used a stylised model & examples from different platforms**	-	-	Developers' participation in collective action: *open-source platform development process*	Option values: *in platform architecture* Modularity: *in platform architecture*	Architecture features *vs.* willingness to participate (in development processes)	Modularity and option values embedded in the architecture of a codebase affects developers' incentives to work within a collective action framework of developing an open-source platform.
Paper: Goldbach, T., Benlian, A., & Buxmann, P. (2018). Differential effects of formal and self-control in mobile platform ecosystems: Multi-method findings on third-party developers' continuance intentions and application quality. Information & Management, 55(3), 271-284. **Research Questions(s):** *What are the differential effects of formal and self-control modes on third-party developers' behaviours (i.e., continuance intentions) and performance outcomes (i.e., application quality) in mobile platform ecosystems?*	**Experiment & Survey**	+	$\beta = 0.24$ $p < 0.010$	Continuance intentions	Self-autonomy *(Third party developers)*	Formal control *vs.* self-control	Enhancing developers' self-control on a platform increases platform stickiness by enabling continuance of participation by third party developers as the platform evolves. It also leads to their higher perception of self-autonomy which has a potential to increase their performance in terms of application quality
		+	$\beta = 0.41$ $p < 0.001$	Self-Autonomy *(Third party developers)*	Self-control *(Third party developers)*		
Paper: Rietveld, J., & Eggers, J. P. (2018). Demand heterogeneity in platform markets: Implications for complementors. Organisation Science, 29(2), 304-322. **Research Question(s):** *How does the evolution of a platform's user base from one dominated by early adopters to one dominated by late adopters affect performance outcomes for complementary products?*	**Platform Transaction Data Analysis**	-	2.2% decrease in sales $p < 0.01$	Performance *(Unit sales of video games)*	Launching a platform to a mixed pool of early and late platform adopters	*Tensions between user groups* Early adopters *vs.* late adopters	Complement app success as a platform evolves is influenced by demand-side heterogeneity in preferences and behaviour among users. Stage in a platform's life cycle has an effect on the potential performance (i.e., sales) that a new complementary app may gain. Platform growth in terms of number of users (installed base) affects its performance variably between poorly and well performing apps
		-	19% decrease in sales ($p < 0.01$)	Performance *(Unit sales of video games)*	Fully diffused platforms		
		–	Gap between the unit sales of flop games and star games widened by 17% ($p < 0.05$)	Performance *(Sales between flop & star video games)*	Platform diffusion		
Paper: Choi, G., Nam, C., & Kim, S. (2019). The impacts of technology platform openness on application developers' intention to continuously use a platform: From an ecosystem perspective. Telecommunications Policy, 43(2), 140-153. **Research Question(s):** *How does the manner in which Android's openness to both applications and devices influence the intentions of application developers to participate in Android platform continuously?*	**Survey**	+	$\beta = 0.488$ $p < 0.001$	Continuance intentions	Perceived usefulness	Openness *vs.* control	Provides insights on how to attract and retain developers as the platform evolves. Usefulness and satisfaction of application developers are preceding indicators of continuous participation of application developers in an Android platform. The openness of Android to applications directly influences the perceived usefulness and satisfaction of application developers. This indicates that the decision of Android application developers to continuously participate in the platform can be encouraged by the platform openness of Android.
		+	$\beta = 0.390$ $p < 0.01$	Continuance intentions	Perceived satisfaction		
		+	$\beta = 0.298$ $p < 0.01$	Perceived usefulness	Platform openness		
		+	$\beta = 0.285$ $p < 0.01$	Perceived satisfaction	Platform openness		
Paper: Hukal, P. (2017). On the Role of Module Interdependencies in Platform Evolution. In: Proceedings of the International Conference on Information Systems, (ICIS 2017), Seoul, South Korea. **Research Question(s):** *How do module interdependencies affect platform ecosystem evolution?*	**Source Code Analysis (source code changes, 3488 commits across 99 modules)**	+	~10-25% Commits	Changes in existing modules	Adaptation commit events *(creating / replacing dependencies)*	Dependence *vs.* interdependence Generative design *vs.* strategic oversight	Changes to the resource base of a module without implications for its functionality, are in general more frequent in existing modules. Code corrections in existing models are more frequent and remain so throughout. New modules display fewer corrections with a declining relative frequency over time. Code extension is high at the beginning and low at the end for both existing and new modules. This evidence suggests that the introduction of novel functionality does not merely co-occur with dependencies, but substantially relies on them.
		+	> 25% Commits	Changes in existing modules	Correction commit events *(bug fixes, deactivating function, etc.)*		
		-	< 25% Commits	Changes in new modules	Correction commit events *(bug fixes, deactivating function, etc.)*		
			Both >25% at the beginning & <5% at the end	Changes in existing modules	Extension commit events *(adding new functionality)*		
Paper: Parker, G.G. & Van Alstyne, M.W. (2018). Innovation, Openness, and Platform Control. Management Science, 64(7), 3015-3032. **Research Question(s):** *Suppose that a firm in charge of a business ecosystem is a firm in charge of a micro economy. To achieve the highest*	**Game Theory**	+	-	Platform openness	Increase in developer value-addition and resource reusability		Except when there is a high technical risk, when a platform starts to absorb external innovation, resource re-usability and increase in developer value-addition, it should increase its openness as such absorption occurs in order to be more profitable. As such, external complementation should co-evolve
		–	-	Platform openness	Increase in technical risk		
		+	-	Platform openness	Innovation absorption		

Paper & Research Question	Methods	R.	Evidence Strength	Dependent Variables	Independent Variables	Key Issues	Summary of Findings
growth rate, how open should that economy be? To encourage third-party developers, how long should their intellectual property interest last?		+	-	Platform openness	Innovation openness	Openness *vs.* control	with platform openness. This enhances platform stickiness and reduces spillovers of innovation to 'unbounded' developers. IP protection should favour the platform relative to add-on apps because the sponsor would lack the means to control developers in later stages if its own IP rights expired in earlier periods. Expiration of platform IP would effectively convert developer decisions to the condition of operating under open standards.
		+	-	Externally generated IP ceded by third party developers	Innovation openness		
		-	-	IP protection for a third-party app	Duration (time)		
		+	-	IP protection for the platform	Duration (time)		
Paper: Kapoor, R., & Agarwal, S. (2017). Sustaining superior performance in business ecosystems: Evidence from application software developers in the iOS and Android smartphone ecosystems. Organisation Science, 28(3), 531-551. **Research Question(s):** *How does the structural and evolutionary features of a platform ecosystem shape the extent to which participating complementor firms can sustain their superior performance?*	**Archival / Database Extract Analysis**	+	β = -0.691; -0.784 in different models $p < 0.01$	Performance: *(measured by complementors' position in the performance stratum)*	Ecosystem complexity	Dependence *vs.* interdependence Ecosystem complexity *vs.* platform / module performance	Evidence from Apple's iOS and Google's Android smartphone ecosystems supports arguments that higher ecosystem complexity helps app developers sustain their superior performance, and that this effect is stronger for more experienced firms. In contrast, platform transitions initiated by Apple and Google make it more difficult for app developers to sustain their performance superiority, and this effect is exacerbated by the extent of ecosystem complexity.
		+	β = -0.008; -0.027 in different models $p < 0.01$	Performance: *(measured by complementors' position in the performance stratum)*	Developer-firm's app development experience		
		-	$\beta = -0.016$; $p < 0.10$	Sustainability: *(of a developer firms' performance)*	Developer-firm's app development experience		
Paper: Ruutu, S., Casey, T., & Kotovirta, V. (2017). Development and competition of digital service platforms: A system dynamics approach. Technological Forecasting and Social Change, 117, 119-130. **Research Questions(s):** *What are the stages associated with platform development and platform-based competition as it evolves from initial growth? What are the challenges associated with the initial platform growth phase? How do platforms fail/achieve a critical mass and monopoly position in the market?*	**Systems Dynamics Modelling and Simulation**	-	-	Adopter fraction growth	User adoption reaction time	Contributor *vs.* consumer onboarding (chicken or egg)	Possibilities for easy, low cost, and short-term experimentation with a platform can make initial advertising campaigns more effective and increase platform adoption. However, these factors can also decrease the reaction time of adopters and increase the discard rate once external advertising campaigns end. The reason is that due to open interfaces end user adopters of one platform benefit from service provider adopters of a competing platform. Thus, the users benefit from greater cross-side network effects.
		+	-	Self-sustaining growth	Duration of advertising efforts		
		+	-	Growth rate of platform adoption	The availability of open interfaces		
Paper: Inoue, Y., & Tsujimoto, M. (2018). New market development of platform ecosystems: A case study of the Nintendo Wii. Technological Forecasting and Social Change, 136, 235-253. **Research Question(s):** *How does the action of platform providers that are exploring new markets influence the decision making of complementors and lead to the rapid decline of the platform ecosystem? How does the action of platform providers that are exploring new markets influence the decision-making of consumers and lead to the rapid decline of the platform ecosystem?*	**Database Extract Analysis** **Japanese video game market database: https://f-ism.net/**	+	$\beta = 1.46$ $p < 0.01$	Risk averse behaviour of complementors	The action of a platform provider to explore a new market	Contributor *vs.* consumer onboarding (chicken or egg)	A software ecosystem with risk-averse / conservative developers may face rapid decline in complementary activities when it decides to join a new market. Also, by exploring a new market without direct competition with another platform provider (with similar services, e.g., games in this case), the platform faces reduced indirect network effects existing from competition in an already established market.
		+	$\beta = 2.23$ $p < 0.01$	Software provision by complementors (*number of new apps*)	Platform provider remaining in an existing market		
		-	$\beta = 0.65$ $p < 0.01$	Software provision by complementors (*number of new apps*)	The action of a platform provider to explore a new market		
		x	-	Consumer purchases (*software sales*)	Software attributes of a platform in a new market		
		+	-	Consumer purchases (*software sales*)	Complementor's reputation in a new market		
Paper: Parker, G.G., Van Alstyne, M.W., & Jiang, X. (2017). Platform ecosystems: How developers invert the firm. MIS Quarterly, 41(1), 255-266. **Research Question(s):** *Why might developers cause a shift in the organisational form of platform providers?*	**Econometric Analyses and Stylised facts using examples from multiple platform firms**	-	-	-	Openness *vs.* control	Openness *vs.* control	Developers, by their actions and interactions with the offerings (boundary resources such as APIs, SDKs, code libraries, templates, etc) provided by a platform provider, present tensions that cause the provider to continuously shift their offerings and control configurations (e.g., control over intellectual property).
Paper: Wessel, M., Thies, F., & Benlian, A. (2017). Opening the floodgates: The implications of increasing platform openness in crowdfunding. Journal of Information Technology, 32(4), 344-360. **Research Question(s):** *How does relinquishing input control affect the platform participants and their behaviour? How are the drivers of campaign success affected by the change in input control?*	**Platform Transaction Data Analysis** *232,011 Kickstarter campaigns*	-	-	Campaign Success (Crowdsourcing)	Policy chance (on openness and control)	Openness *vs.* control	Evidence from this natural experiment suggests that although policy changes on openness and control generally increased campaigns – if the policy change is meant to increase openness then this would degrees the number of backers (in general terms external 'investors' on the platform offerings).
Paper: Um, S., & Yoo, Y. (2016). The co-evolution of digital ecosystems. Proceedings of the International Conference on Information Systems (ICIS 2016), Dublin, Ireland. **Research Question(s):** *Under what conditions, do new external APIs create structural diversification of an existing digital ecosystem?*	**Source Code Analysis** *Measurement of structural mutation using a Survival Model*	+	4.8% increase $p < 0.01$	Probability of being APIs of newly emerged clusters of add-on products in a platform ecosystem.	Degree of connectedness of an external API	Stability *vs.* malleability Modularity *vs.* integration Standardisation *vs.* variety	The study found that increased range of external APIs' connectivity is the key to diversifying the base structure of a platform ecosystem. Shows that APIs with a high frequency of use are more likely to become APIs in the newly emerged ecosystem cluster. APIs stayed longer in a digital ecosystem will have more probability to interact with diverse APIs.
		+	0.6% moderate increase $p < 0.01$	Probability of being APIs of newly emerged clusters of	Frequency of connections of an external API		

Paper & Research Question	Methods	R.	Evidence Strength	Dependent Variables	Independent Variables	Key Issues	Summary of Findings
				add-on products in a platform ecosystem		Generative design *vs.* strategic oversight	External APIs offered from companies that produce a large number of APIs are not necessarily likely to play a critical role in the emergence of new clusters in the model. However, the result implies that individual API's functional usefulness is more important than the reputation and size of the platform company that offers the large number of APIs.
		+	0.1% marginal increase p < 0.01	Probability of being APIs of newly emerged clusters of add-on products in a platform ecosystem	Older external APIs		
		x	-1.3% negative p < 0.01	Probability of being APIs of newly emerged clusters of add-on products in a platform ecosystem.	External APIs by firms that produce a large number of APIs		
Paper: Kim, H. J., Kim, I., & Lee, H. (2016). Third-party mobile app developers' continued participation in platform-centric ecosystems: An empirical investigation of two different mechanisms. International Journal of Information Management, 36(1), 44–59. **Research Question(s):** *Considering the characteristics of exchange relationship between platform owners and third-party developers, what are the factors that lead third-party mobile app developers to continue affiliation with a particular platform (i.e., continued participation)?*	**Survey**	+	β = 0.45, t = 5.43 p < 0.01	Impact on continued intention to develop apps on the platform	Relationship satisfaction	Dependence *vs.* interdependence	Relationship buildings is important for a platform owner as it can positively influence third party developers' choice to work in a specific platform continuously as the platform evolves, i.e., increases platform stickiness and developers' dedication. As the perception of termination costs for a developer increases, they become more dependent on it and this reduces their intentions to leave.
		+	β = 0.20, t = 2.14 p < 0.05	*Third-party developers' relationship satisfaction*	*Revenue sharing attractiveness*		
		+	β = 0.30, t = 3.59 p < 0.01	*Third-party developers' relationship satisfaction*	*Market demand*		
		+	β = 0.33, t = 3.37 p < 0.01	*Third-party developers' relationship satisfaction*	*Usefulness of development tools provided by the platform owner*		
		+	β = 0.16, t = 1.83 p < 0.1 moderate impact	*Third-party developers' relationship satisfaction*	*Next, review process fairness*		
		x	β = −0.09, t = 1.04 Not Supported	*Third-party developers' relationship satisfaction*	*The usefulness of online forums supported by the platform owner*		
		+	β = 0.33, t = 1.96 p < 0.05, H9	Third-party developers' dependence on the platform	Termination costs		
		+	β = 0.21, t = 2.15 p < 0.05	*Third-party developers' perception of termination costs*	*Extent of learning about the platform*		
		+	β = 0.28, t = 2.74, p < 0.01, H8)	*Third-party developers' perception of termination costs*	*Extent of setup activity*		
		+	β = 0.20, t = 2.49 p < 0.05	Impact on continued intention to develop apps on the platform	Third-party developers' dependence on the platform		
Paper: Um, S., Yoo, Y., & Wattal, S. (2015). The evolution of digital ecosystems: A case of WordPress from 2004 to 2014. In: Proceedings of the International Conference on Information Systems, (ICIS 2015), Fort Worth, TX, USA. **Research Question(s):** *What is the structure of the evolutionary pattern formed by a platform ecosystem as it changes over time?*	**Analysis of Source Code Data** *From WordPress*	+	-	Growth of a cluster in both depth and breadth	The number of cluster core components in a cluster	Modular features *vs.* core features	By exploring changes in the source code patterns of APIs in a digital platform, this study found that the evolution of a digital ecosystem represents a distinct structural interaction derived from the generative properties of APIs. Modularity is at the core of such generative properties.
		+	-	Growth of a cluster in a nonlinear manner in both depth and breadth	The number of cluster core components in a cluster		
		+	-	Growth of a cluster in both depth and breadth	The number of periphery digital components		
		+	-	Growth of a cluster in a non-linear manner	The number of periphery digital components		
Paper: Tiwana, A. (2015**a**). Evolutionary competition in platform ecosystems. Information Systems Research, 26(2), 266-281. **Research Question(s):** *How does the interplay between an extension's modularisation and input control exercised over it by the platform owner shape its market performance?*	**Archival / Database Extract Analysis**	+	β = 0.26, t-value = 4.18 p < 0.001	Market performance measured as an extension's active user count	Evolution of an extension	Modularity *vs.* control	The study explored how complementarities between input control and a platform extension's modularisation influences the performance of a platform. its performance in a platform market. Empirical results showed that such complementarity fosters performance by accelerating an extension's continuous evolution.
		+	β = 0.27 t-value = 4.34 p < 0.001	Market performance measured by an extension's performance (using ratings)	Evolution of an extension		
		x		Speed of evolution of a modular extension	Clan control over an extension		
		x		Speed of evolution of a modular extension	Output control over an extension		
		+	β = 0.117 t-value = 1.997 p < 0.05	Influence on the extension's subsequent evolution	Complementarity between extension modularisation and input control		

Paper & Research Question	Methods	R.	Evidence Strength	Dependent Variables	Independent Variables	Key Issues	Summary of Findings
Paper: Woodard, C. J., & Clemons, E. (2014). Modelling the evolution of generativity and the emergence of digital ecosystems. In: Proceedings of the 35th International Conference on Information Systems, (ICIS 2014), Auckland, New Zealand. **Research Question(s):** *Can key features of generative systems evolve endogenously (i.e., without the influence of coordination and foresight)?*	**Experimental** *Agent based modelling*	-	-	-	-	Modularity *vs.* integration Generative designs *vs.* strategic oversight	The major insight drawn from the study is that key features of generative systems can themselves evolve endogenously without the need for coordination or foresight and be able to satisfy diverse consumer preferences. With this reasoning, platforms can be driven at the base design level to evolve generatively to meet consumer demands, without necessarily employing additional foresight at business level.
Paper: Um, S. Y., Yoo, Y., Wattal, S., Kulathinal, R. J., & Zhang, B. (2013). The architecture of generativity in a digital ecosystem: A network biology perspective. In: Proceedings of the International Conference on Information Systems, (ICIS 2013), Milan, Italy. **Research Question(s):** *What is the underlying structure of generativity in an open digital ecosystem? How do individual modules in a digital ecosystem interact with one another to produce an ever-evolving ecosystem landscape? What are the patterns of control in design in an open digital ecosystem?*	**Source Code Analysis** *13,491 WordPress plug-ins written in PHP code*	+	Visual analysis of a co-expression network	Formation of genetic foundation	Volatility and Vibrancy in API clusters	Modularity *vs.* integration Generative designs *vs.* strategic oversight dependence *vs.* interdependence	By interaction and function, at the base level, architectures of plug-ins can self-organise into those that from the genetic code of the platform and those that complement and influence changes over time. Thus, there can be an architecture of generativity without a central authority.
		+	Visual analysis of a co-expression network	Degree of interaction	Clusters of plug-ins		
		+	Visual analysis of a co-expression network	Self-organisation of modules	Interaction and functionality		
Paper: Basole, R. C., & Karla, J. (2011). On the evolution of mobile platform ecosystem structure and strategy. Business & Information Systems Engineering, 3(5), 313. **Research Question(s):** *How do global inter-firm platform ecosystems evolve in structure and strategy?*	**Network analysis of data from a Database Extract**	+	Increase by 11	Number of firms participating in platforms	Development in time	Modular dependence *vs.* interdependence Modularity *vs.* integration	Findings from this study indicate that modular interdependencies do not simply co-occur with new functionality in digital platforms, but drive the generation of such functionality, with a potential to generate incremental innovation as platform ecosystems evolve.
		+	Increase by 97	Strength of network ties	Development in time		
		+	$\beta = 1.187$ $p < 0.01$	Number of network operators	Development in time		
		+	$\beta = 0.976$ $p < 0.05$	Number of mobile device manufacturers	Development in time		
		+	From: 0.042 To: 0.081	Network density	Development in time		
		-	From: 0.6037 To: 0.5783	Network centralisation	Development in time		
Paper: Boudreau, K. J. (2010). Open platform strategies and innovation: Granting access *vs.* devolving control. Management Science, 56(10), 1849-1872. **Research Question(s):** What is the precise relationship between openness and innovation outcomes? How does incremental variation in platform control affect innovation outcomes? What is the nature and workings of the economic mechanisms set into motion by opening platforms?	**Survey**	+	$\beta = 1.15$ $p < 0.01$	Performance (device development rates)	Complementary hardware openness	Openness *vs.* control Standardisation *vs.* variety	Granting greater levels of access to independent developer firms produces up to a fivefold acceleration in the rate of new product development, depending on the precise degree of access and how access policy is implemented in a platform. Where operating system platform owners go on to give up control (beyond just granting access to their platforms) the incremental effect on new development was observed to be positive but smaller.
		x	$\beta = 0.07$ $p < 0.01$	Performance (device development rates)	Platform openness		
		+	-	Performance (device development rates)	Hardware openness		

Appendix 3: Summaries of Reviewed Papers – Qualitative, Conceptual & Review Papers

Paper	Research Question(s)	Methods	Key Issues	Summary of Findings
de Reuver, M., Nederstigt, B., & Janssen, M. (2018). Launch strategies for multi-sided data analytics platforms.	What are the utilities of launch strategies for informing design choices on a multi-sided platform offering data-analytics to firms within the hospitality industry?	Case Study	- Simultaneous *vs.* sequential user onboarding - Contributor *vs.* consumer onboarding (chicken or egg) - Same side vs cross side network effects	This research uses a design science approach to evaluate the utility of launch strategies for a multi-sided platform offering data analytics functionality in the hospitality industry. Researchers found that coring strategies are helpful in informing initial platform design decisions. Pricing and onboarding strategies are helpful for informing design choices, but considerable exploration and adjustments were needed along the way to effectuate the strategies.
de Reuver, M., Verschuur, E., Nikayin, F., Cerpa, N., & Bouwman, H. (2015). Collective action for mobile payment platforms: A case study on collaboration issues between banks and telecom operators.	How do platform characteristics affect collective action problems in setting up mobile payment platforms by banks and telecom operator?	Case Study	- Competition *vs.* cooperation - Heterogeneity *vs.* homogeneity - Collective interest *vs.* individual interest	Differing strategic objectives and interests create conflicts in a collective action for platform development between organisations that are disparate who may be seeking to create a common multi-sided digital platform. Such tensions can affect the developmental trajectory of the platform, from an initial success to cycles of conflicts that lead to dissolution
Eaton, B., Elaluf-Calderwood, S., Sorensen, C., & Yoo, Y. (2015). Distributed Tuning of Boundary Resources: The Case of Apple's iOS Service System.	How are the main tensions in technology ecosystems addressed in technology ecosystem governance? Are contradictory and complementary logics present in technology ecosystems? If so, how are they governed? How do boundary resources come into being and evolve over time?	Case Study	- Boundary resourcing *vs.* boundary securing - Flexible *vs.* closed boundaries - Contributor *vs.* end user boundaries - Provider desired features *vs.* user desired features	Analyses presented by the study reveals that boundary resources of service systems enabled by digital technology are shaped and reshaped through distributed tuning, which involves cascading actions of accommodations and rejections of a network of heterogeneous actors and artefacts. The study also shows that power has a dual role in the distributed tuning process of boundary resources in digital platforms. As a platform evolves and, providers need to pay attention to the tensions presented by the external contributors and as they respond to these tensions, they should also respond to the shifts caused by such responses, for instance by implementing new control measures and governance rules that fit with the new shift. Researchers offered a process model explaining the underlying mechanisms that account for the emergence and evolution of boundary resources offered by a platform ecosystem.
Foerderer, J., Kude, T., Schütz, S., & Heinzl, A. (2014). Control versus Generativity: A Complex Adaptive Systems Perspective on Platforms.	How does control impact the generativity of platforms?	Case Study	- Generativity *vs.* strategic oversight	Complex adaptive systems (CAS) such as those presented by the architecture of digital platforms present generative mechanisms of evolutionary development that can be negatively affected by control. Control of specific niches within a broader CAS potentially transforms the niche itself which can drive its contribution to the overall generativity of the platform. Niche control may present a better opportunity for exerting platform control whilst cultivating generativity.
Ghazawneh, A., & Henfridsson, O. (2013). Balancing platform control and external contribution in third-party development: the boundary resources model.	How can we understand the role of boundary resources in platform owners' efforts to cultivate third-party development?	Case Study	- Boundary resourcing *vs.* boundary securing	There is an inherent tension between resourcing and securing and achieving a balancing act between the two requires consideration of that tension. Third party developers drive the tension by voicing criticism to the platform owner if the current SDK is not open or has little resources to work with. This forces the platform owner to provide new resources or open up the platform, following up with securing it from exploitation
Hackney, R., Burn, J., & Salazar, A. (2004). Strategies for value creation in electronic markets: towards a framework for managing evolutionary change.	What is the theoretical relevance of continuous strategic analysis in E-markets?	Case Study	- Value creation *vs.* value capture - Provider desired strategy *vs.* stakeholder desired strategy (sponsors, complementors, contributors, users) - Strategic choices *vs.* environmental forces	Organisations need to achieve stable resource planning whilst following a rapidly changing strategic plan that considers environmental turbulence and evolutionary change episodes in platform evolution. Strategy is therefore emergent from practice responding to a changing environment.
Huber, T. L., Kude, T., & Dibbern, J. (2017). Governance practices in platform ecosystems: Navigating tensions between cocreated value and governance costs.	Are there ways of practicing ecosystem-wide governance that better address the dyadic governance tension than others, and if yes, why? Considering that governance practices can be more fluid than the relatively stable rules and values, how and why do governance practices change or remain stable over time?	Case Study	- Co-created value *vs.* governance costs	The study shows that governance of platform ecosystems is a process of considerable variation and modification in practicing ecosystem-wide rules and values. This developmental process co-evolves with value co-creation and governance costs. At early stages of platform growth, partnerships between platform owners and complementors follow strict guidelines as the platform owners seek to minimise governance costs. However, this hinders the growth of co-created value and innovativeness. Over time, complementors push back against the rules and regulations by showing their innovative potential, demonstrating the possibilities and opportunities that could be reached by co-creation; and that the current strict regime is insufficient to exploit that potential. When this happens, platform owners abandon their earlier position, and shift their strict stance to accommodate a grey area of governance that allows value co-creation to flourish. This in turn results in higher levels of co-created value, it is also associated with substantially higher governance costs.
Jha, S. K., Pinsonneault, A., & Dubé, L. (2016). The evolution of	How does an ICT platform-enabled ecosystem evolve over time and facilitate	Case Study	- Public *vs.* private value - Heterogeneity *vs.* homogeneity	Achieving scalability and co-ordination of public and private interests is challenging. Understanding the phases that a platform goes through in its developmental change is

Paper	Research Question(s)	Methods	Key Issues	Summary of Findings
an ICT platform-enabled ecosystem for poverty alleviation: The case of eKutir.	orchestrated actions from various societal actors to alleviate poverty? What are the key components of such an ecosystem and how do they influence each other?		- Collective interest *vs.* individual interest - Cooperation *vs.* competition	critical to strategic planning. These phases imply that there is some convergence amongst partners and an emergent challenge to balance public and private value. *What remains to be studied is how such convergence and divergent interests can be managed without creating a conflict that may lead to the dissolution of the platform before reaching later stages.* This study identified five stages in the life changes followed by a digital ecosystem - (i) Centralised service hub, (ii) Entrepreneur-led Distributed network, (iii) Community of Practice, (iv) Related Diversification, and (v) Broader Ecosystem Engagement
Karhu, K., Gustafsson, R. & Lyytinen, K. (2018). Exploiting and defending open digital platforms with boundary resources: Android's five platform forks	How do openness and related governance decisions render an ODP and its resources vulnerable to platform forking and how can the host use its resources to defend against it?	Case Study	- Openness *vs.* control - Flexible *vs.* closed boundaries	The paper addresses the question regarding how to manage the tension between control and openness in largely open platform using the case example of Android. Open platforms are more susceptible to threats from 'forkers' because of the accessibility of many resources which developers and innovators can accumulate and exploit (e.g., fork, hack, clone) to create a competing platform. Whilst competitors attack platforms by exploiting its shared resources and complements, platform providers defend by taking legal action after which competitors back off but soon find another method to circumvent the legal thrust.
Leong, C., Pan, S. L., Newell, S., & Cui, L. (2016). The emergence of self-organising E-commerce ecosystems in remote villages of China: a tale of digital empowerment for rural development.	How does the evolution of a self-organising digital ecosystem empower marginalised communities?	Case Study	- Provider desired strategy *vs.* stakeholder desired strategy (sponsors, complementors, contributors, users) - Strategic choices *vs.* environmental forces - Strategic choices *vs.* design choices	In resource scarce environments, orchestrating the development and successful evolution of a digital ecosystem requires both digital empowerment and participation of community-level actors. As it evolves, the digital ecosystem may have different affordances for different actors but has a common underlying effect of linking participants to digital resources.
NG, Y.S.E., Muthukannan, P., Tan, B., & Leong, C. (2017). Fintech Platform Development: A Revelatory Case Study of a Chinese Microloan Start-up.	How does the process of FinTech platform development unfold?	Case Study	- Provider desired strategy *vs.* stakeholder desired strategy (sponsors, complementors, contributors, users) - Strategic choices *vs.* environmental forces - Strategic choices *vs.* design choices	Financial Technology platforms follow staged sequences of changes in their form, structure, and strategies. The first stage involves coring the platform and encapsulating specific standards unique to the core architecture. After coring, the platform expands by empowering both contributors and users. After gaining traction, the platform then has capability to delegate (open up) to support a long tail of innovation and development by third-party contributors. The paper identifies three sequential stages that must be enabled and deliberately supported by strategy. These are: (i) value definition, (ii) stakeholder empowerment and (iii) co-evolution. Each of the stages are marked by the employment of various platform development strategies, which in turn, leads to a number of distinct platform configurations.
Nikayin, F., de Reuver, M., & Itälä, T. (2013)	What factors influence inter-organisational collaboration in the context of establishing common service platforms for independent living services? How and why do organisations providing assistive devices and related web services for elderly-independent living services collaborate and to share their resources and data on a common service platform?	Case Study	- Collective interest *vs.* individual interest - Openness *vs.* control - Dependence *vs.* interdependence - Heterogeneity *vs.* homogeneity	A central actor is a key agent in orchestrating common platform development. This means that their skills in negotiating and facilitating contributions, collaboration and participation can have an influence on whether the platform successfully emerges and evolves or not. This is coupled by the degree of openness of the platform, with a more open strategy being more favourable. What remains to be explored is the influence of firm interdependencies, which this study finds to be less significant. In different contexts, stronger connections between firms are seen as more important that the role of an external central agent (c.f. Guo, Reimers, Xie & Li, 2014).
Ojala, A., & Lyytinen, K. (2018). Competition Logics during Digital Platform Evolution.	How do digital platforms evolve when the organisation of the multi-layered platform architecture, and related control points, is modified through competitive moves? How does can a firm be able to manage the increased complexity of the platform?	Case Study	- Standardisation *vs.* interoperability - Openness *vs.* control	The study explains how a firm can evolve a digital platform from development stage. It shows that when technical and strategic bottlenecks are solved, a platform owner can expand control to strategically important layers of the platform stack. It shows that the complexity of the platform increases through a series of competitive moves. Complexity can be managed by increasing the standardisation of the platform interfaces, and by jockeying for a stronger position in critical parts of the platform stack.
Saarikko, T., Westergren, U. H., & Blomquist, T. (2016). The inter-organisational dynamics of a platform ecosystem: Exploring stakeholder boundaries	How can the inter-organisational dynamics between disparate actors in an IoT ecosystem be perceived and understood?	Case Study	- Collective interest *vs.* individual interest - Cooperation *vs.* competition	To successfully evolve and grow a platform within inter-organisational settings, understanding the dynamics of power relations and competence between dissimilar firms is important. This is even more so when such firms have different interests, incentives and resources whilst seeking to collaborate and derive benefits from common platform. By tracing four types of organisational boundaries: efficiency, power, competence and identity, this case study shows that firm boundaries are emergent, dynamic, and constantly negotiated between firms. Inter-firm platform providers should recognise these boundaries, and how (and why) they change as this forms a core part of inter-firm collaboration.

Paper	Research Question(s)	Methods	Key Issues	Summary of Findings
Shaikh, F. A., & Sia, S. K. (2018). Legitimacy Strategies in the Sharing Economy: The Case of Uber	How does the process of legitimation of Sharing Economies as new kinds of organisations occur?	Case Study	- Non-conformity *vs.* conformity to institutional norms and rules - Pursuit of stockholder welfare *vs.* social responsibility	Platforms as emerging forms of organisations create conflict and upset the status quo regarding traditionally accepted normative legitimacies and institutional logics. Their departure from normative forms of institutions and regulations means that they are constantly trying to legitimise their existence. This legitimisation process shifts both the platform's initial organisational structure and the normative rules and regulations that existed before their entry into a given market. This study provides the example of Uber which has faced legitimacy challenges on multiple fronts. On one front, traditional taxi-cab service companies allege unfair competition and the classification of ride providers as independent contractors not employees. On another front, regulators constantly conflict with Uber regarding local council ordinances of operation.
Skog, D., Wimelius, H., & Sandberg, J. (2018). Digital service platform evolution: how Spotify leveraged boundary resources to become a global leader in music streaming.	What are the architectural characteristics that govern digital service platform evolution and how are these leveraged to achieve strategic advantage?	Case Study	- Boundary resourcing *vs.* securing	The study shows that Service Platform grow by changing the configurations of their boundary resources which shape the behaviour of contributors, shift the scale of the platform, and progressively develops its evolution in punctuations according to each major change in those configurations.
Teixeira, J., Mian, S. Q., & Hytti, U. (2016). Cooperation among competitors in the open-source arena: The case of OpenStack.	How do competitors cooperate in the evolution of open-source ecosystems?	Case Study	- Cooperation *vs.* competition	IP protection is key to ensuring that both the platform owner and third-party companies enjoy benefits such as royalties from their IP. Balancing IP restrictions is important in platform governance. Evidence from this study suggests that development transparency and weak intellectual property rights allow firms to collaborate easily between multiple networks in the ecosystem of a platform. What remains to be explored is whether such a paradox (enabling co-operation and competition) should remain constant, or whether there are different phases through which IP restrictions can be reframed.
Wareham, J., Fox, P. B., & Cano Giner, J. L. (2014). Technology ecosystem governance.	How are the main tensions in technology ecosystems addressed in technology ecosystem governance? Are contradictory and complementary logics present in technology ecosystems? If so, how are they governed?	Case Study	- Standardisation *vs.* variety - Openness *vs.* control - Openness *vs.* autonomy - Collective interest *vs.* individual interest	The study surfaces three dialectical tensions that drive platform ecosystems. The three salient tensions are: standard–variety, control–autonomy, and collective–individual. Such paradoxical tensions may manifest as dualities, where tensions are framed as complementary and mutually enabling. Alternatively, they may manifest as dualisms, where actors are faced with contradictory and disabling "either, or" decisions. By identifying conditions in which complementary logics are overshadowed by contradictory logics, the study contributes to the understanding of the dynamics of technology ecosystems, as well as the effective design of technology ecosystem governance that can explicitly embrace paradoxical tensions toward generative outcomes.
Zhang, N., Sia, S. K., & Lee, G. W. (2017). Sharing Economy Disruption and the Quest for New Institutional Legitimacy.	How do dynamic processes in sharing economies shape the formation of new institutional legitimacy formation? What are the underlying issues of contestation in a sharing economy disruption?	Case Study	- Distinctiveness *vs.* normativity and conformity - Disruptive organising *vs.* legitimate organising - Profitability *vs.* social responsibility	Understanding how to deal with legitimacy issues is crucial in establishing a new platform, especially one that brings in a new highly innovative offering that challenges the normative status quo of existing practices and established socio-cultural cognition. Platforms that usher in new socio-cultural norms also create contestations regarding their legitimacy. The intensity of legitimacy contestations also varies with in context (place), and at different stages (time) of the platform evolution. The disruption of riding and rental services caused by Uber and Airbnb and, and the backlashes they have faced in various markets are good examples.
Basole, R. C., & Karla, J. (2012). Value transformation in the mobile service ecosystem: A study of app store emergence and growth.	How do mobile App Stores in the mobile service ecosystem emerge and grow? How do mobile app stores shape value production, distribution, delivery, and consumption?	Case Study (Longitudinal)	- Value creation *vs.* value capture	The structure and growth of platform ecosystems is driven by value transformation. This study shows that in mobile ecosystems, mobile application services or app markets are significant drivers of value transformation as they highly attract and distribute value in areas such as app development, content creation, content aggregation, portal provision and integration of payment service providers. Platform providers can challenge the status quo in app provision by harnessing value transformation through innovative ways of delivery app services which can favourably tilt competitive advantage.
Grisot, M., Hanseth, O., & Thorseng, A. A. (2014). Innovation of, in, on infrastructures: articulating the role of architecture in information infrastructure evolution.	Which conditions enable successful information infrastructure innovation?	Case Study (Longitudinal)	- Provider desired features *vs.* user desired features - Current stability *vs.* future generativity - Generative design *vs.* strategic oversight	Inductive cultivation strategy can support the development of evolvable platform infrastructure. Infrastructure design does not start with a full solution, but initially designed services respond to real user needs by experimenting with new modules and continuously reframing design choices and offerings. This allows enables the platform to address users' needs, usefulness and respond to evolutionary growth.
Guo, X., Reimers, K., Xie, B., & Li, M. (2014). Network relations and boundary spanning: Understanding the evolution of e-ordering in the Chinese drug distribution industry.	What is the role of network relations and boundary spanning in the evolution of an e-ordering platform in the Chinese drug distribution industry?	Case Study (Longitudinal)	- Disruption *vs.* status quo (legitimacy) - Centrally controlled shared platforms *vs.* distributed shared platforms - Disruption *vs.* legitimacy (status quo)	To successfully implement and evolve a platform in highly socially connected environment, external entities such as governments should consider that industry connections and practices are more resilient than may be assumed. Where firms have IS-based socially embedded relations, an external entity may be unable to establish a practice with arm's length relations, largely because of the deeply rooted relationship-based business environment.

Paper	Research Question(s)	Methods	Key Issues	Summary of Findings
Richardson, S., Kettinger, W. J., Banks, M. S., & Quintana, Y. (2014). IT and agility in the social enterprise: a case study of St Jude Children's Research Hospital's "Cure4Kids" IT-platform for international outreach	How can social enterprises leverage IT platforms to become more agile and improve performance?	Case Study (Longitudinal)	- Openness *vs.* control - Standardisation *vs.* interoperability - Agility *vs.* entrepreneurial alertness	There is a link between entrepreneurial alertness, IT-investment decisions, agility, and performance all of which are critical to platform development and evolution. Social enterprise platforms benefit from higher agility enabled by IT investments as well as entrepreneurial alertness. This study found the following links on how social enterprises can leverage IT platforms. The use of open-source tools to develop an IT platform led to quicker development of new IT capabilities. Quicker development of new IT capabilities leads to higher levels of operational agility. The use of an open-source architecture leads to fewer conflicting standards. The use of an open-source architecture leads to higher levels of flexibility resulting in higher levels of international access. Higher levels of international access leads to higher levels of partnering agility.
Saadatmand, F., Lindgren, R., & Schultze, U. (2017). Evolving Shared Platforms: An Imbrication Lens.	How do the participants' coopetitive behaviour and the platform's technology architecture reciprocally shape the evolution of a shared platform?	Case Study (Longitudinal)	- User interactions *vs.* design choices - Centrally controlled shared platforms *vs.* distributed shared platforms	In order to evolve shared platforms successfully, firms need to recognise them as social materials that are at the intersection of the evolution of both the technological architecture at its base and its interaction with human use patterns. Recognition of this overlap (imbrication) means that even the most recognised design principles (e.g., modular architecture) at design level may not yield expected outcomes (e.g. extensibility and scalability) if the human interactions overlapping on top of them (e.g. inter-firm bonds and cooperation) are not co-supported.
Tan, B., Pan, S. L., Lu, X., & Huang, L. (2015). The role of IS capabilities in the development of multi-sided platforms: The digital ecosystem strategy of Alibaba.com.	How do the IS capabilities of the platform sponsor influence, and co-evolve with the development of a platform over time?	Case Study (Longitudinal)	- Strategic choices *vs.* environmental forces - Strategic choices *vs.* design choices	Whilst a platform's development may be triggered by environmental factors, its emergence, growth & development changes require IS planning and IS strategy. It is important to recognise the initial stage in order to provide an appropriate strategy. Early-stage strategies are often associated with negotiating with several business actors and facilitating and environment that allows independent actors to collaborate and contribute resources required to create the technology and how to retain both interest and resources between multiple actors. Some of the key strategies in achieving this include encapsulating, delegating, meshing, and empowering platform development strategies.
Jarvenpaa, S., & Markus, M. L. (2018). Genetic platforms and their commercialisation: Three tales of digital entrepreneurship.	How do genetic platforms contribute to the changing models of biomedical research and clinical care?	Case Study (Multiple)	- Openness *vs.* control - Data security/privacy *vs.* data access - Standardisation *vs.* interoperability	In data-hub platforms, developmental change is stimulated by both the introduction of new data sets and the enhancement of design that introduces new socio-technical capabilities. New capabilities entail new functions and therefore new purposes all of which evolve the platform from its initial offerings. Key tensions in the design and development of data platforms are between providing secure and private data services and enabling access to data for use in research and other secondary purposes (not primary reason for why the data was created).
Vassilakopoulou, P., Grisot, M., Jensen, T.B., Sellberg, N., Eltes, J., Thorseng, A., & Aanestad, M. (2017). Building national e-health platforms: The challenge of inclusiveness.	How can inclusiveness be pursued in relation to the political orientation of platform development, the coordination of work among multiple contributors, and the handling of technical heterogeneity in an evolving e-Health Platform?	Case Study (Multiple)	- Inclusion *vs.* exclusion - Collective interest *vs.* individual interest	Socially driven platforms emphasise backbone infrastructure to connect diverse user needs. Network effects are less important than higher inclusion. Government-led and health platforms often follow this path. The strategy works well when the platform being developed is not driven by any market logic, not competitive and usually non-profit making in nature, for instance a national health platform or a community interaction platform. Such a strategy leverages long-term infrastructural needs of the platform rather than immediate network effects that can be gained by swift implementation.
West, J. (2003). How open is open enough? Melding proprietary and open-source platform strategies.	Are hybrid open-source strategies of proprietary platform vendors useful in making innovation successful and profitable?	Case Study (Multiple)	- Openness *vs.* control - Propriety *vs.* interoperability	A hybrid strategy that melds proprietary and open-source platform strategies may offer opportunities for developing new platforms for companies that are not market leaders and would like to tap into platform business. There remain open questions regarding how open is enough to balance proprietary control and support complementation especially for smaller firms and vendors.
Qiu, Y., Hann, I. H., & Gopal, A. (2013). From invisible hand to visible hand: platform governance and institutional logic of independent Mac developers, 2001-2012.	What is the effect of resource environment on the emergence and change of field-level institutional logic in the field of consumer software industry, particularly of Apple's desktop platform and its independent third-party developers?	Content Analysis	- Strategic choices *vs.* environmental forces - Institutional logic *vs.* field-level logic (on platform ecosystems)	Successful platform governance requires an understanding of the platform logic or mechanism driving its evolution. Platforms are emergent institutions and can be considered as a new form of organisation that are guided by different logics. This study explains the evolutionary changes of a platform from being guided by a primarily technological logic to a market exchange mechanism that broadened its base. Its sets a case example that shows that platform can evolve by shifting underlying logic driving it. Such a shift may require different governance mechanisms.
Gawer, A. (2014). Bridging differing perspectives on technology platforms: Toward an integrative framework.	What are the differing perspectives on technological platforms? How can platforms be usefully conceptualised?	Literature Review & Theoretical Discussion	- Institutional logic *vs.* field-level logic (on platform ecosystems)	Understanding platforms from an integrated perspective of evolving meta-organisations enables strategic thinking that is appropriate for various stages in the continuum of their developmental change. It also enables the conceptualisation of platform actors (contributors, complementors, users etc.) as evolving agents with multiple roles. In order to understand the multisided nature of platforms at institutional level, it is important to bridge the technological and economic understanding of platforms as both multi-sided intermediaries and technological architectures within the framework of evolving meta-organisations.

Paper	Research Question(s)	Methods	Key Issues	Summary of Findings
Saarikko, T., Jonsson, K., & Burström, T. (2018). Software platform establishment: effectuation and entrepreneurial awareness.	How do firms combine an entrepreneurial mind-set and technical proficiency in the establishment of a software platform?	Literature Review & Theoretical Discussion	- Provider desired strategy *vs.* stakeholder desired strategy	Opportunism plays an important role in attracting user participation especially in the entrepreneurial landscape Third party complementors look for quick wins at first rather than long term strategic goals. Also, assurance that relationships do not require on-going commitment is key to soliciting partners to contribute and participate in the beginning phases of platform emergence. Whilst platform complexity is important to handle various functions, it should remain a black box to end users who should only see or experience simple and effective solutions to their needs. IT product or innovation requires mechanisms for stakeholder acceptance in order to grow. Firm level entrepreneurial mind-set can contribute to the dissemination of novel IT across multiple domains of application
Staykova, K. S., & Damsgaard, J. (2017). Towards an integrated view of multi-sided platforms evolution.	How do Multi-Sided Platforms (MSPs) evolve over time?	Literature Review & Theoretical Discussion	- Strategic choices *vs.* environmental forces - Strategic choices *vs.* design choices	Considering that platforms change as a function of their attributes; platform managers need to consider the presence or absence of specific platform attributes and their reconfiguration as the platform changes over time. Platforms develop and change by various means. They grow, mature, transform and reconfigure. They also change by shifting their boundary, growing the user-base, introducing new features, geographical expansion as well as through mergers and acquisitions. The evolutionary process is mainly guided by infrastructure, constituencies, functionalities, and governance all of which determine Platform's evolutionary trajectory.
Tiwana, A., Konsynski, B., & Bush, A.A. (2010). Research commentary—Platform evolution: Coevolution of platform architecture, governance, and environmental dynamics.	How does (i) platform architecture (ii) Platform governance, (iii) internal fit between platform architecture and governance, (iv) environmental dynamics exogenous to an ecosystem, and (v) environmental fit between the endogenous attributes of an ecosystem (architecture & governance) and the dynamics of its exogenous environment influence the evolutionary dynamics of ecosystems and modules in platform settings?	Literature Review & Theoretical Discussion	- Strategic choices *vs.* environmental choices - Stability *vs.* malleability - Modularity *vs.* integration - Standardisation *vs.* variety - Interoperability *vs.* propriety - Generative designs *vs.* strategic oversight	For software platforms, at architectural level, it is important to pay attention to the design concepts of modularity, decomposition, and rules of interaction. This should have an internal fit with the governance mechanism used to manage the platform in areas of decision rights, control and balancing closed and openness. Both architecture and governance are affected by environmental dynamics such as convergence, envelopment, multihoming and complementor influence. It is important to recognise that platform elements (architecture, governance, and environment – and their constituent components) co-evolve as changes on one element effects changes on the other. Architecture design should be both stable enough to survive and malleable to accommodate changes effected by governance mechanisms (opening, closing, IP rules, etc.) and environmental dynamics (convergence, envelopment, multi-homing, complementor influence, etc.).
Vervest, P., Preiss, K., Van Heck, E., & Pau, L.F. (2004). The emergence of smart business networks.	What should be done to make the outcomes of business networks 'smart', and better than that of competitors?	Literature Review & Theoretical Discussion	- Value creation *vs.* capture - Cooperation *vs.* competition	Establishing smart business networks is an essential step in forming a digital ecosystem in inter-firm settings. These are interaction connections that improve participating firms by enabling value co-creation and appropriation. To achieve this, membership selection, establishment of common understandings, goal setting, interaction, risk and reward management, continual improvement and fault tolerance should be promoted. To be sustainable, such networks need to be supported by technological architecture, a rationally bounded group, information actors and resilient business connections. Actors within an SBN can complete, collaborate, and co-create with each other and may have multiple "home" networks.

Appendix 4: Participants List & Interview Sessions

No.	Location	[24]Organisation	Position in Organisation	Membership	Interview 1	Interview 2	Interview 3
1	Auckland	Auckland International Airport	Business Dev. Manager	ILP & Member	31 Minutes	53 Minutes	61 Minutes
2	Auckland	Air New Zealand	Insights Manager	ILP & Member	57 Minutes	53 Minutes	45 Minutes
3	Auckland	Tourism Info Ltd	Managing Director	ILP & Member	55 Minutes		
4	Auckland	HH Tours Ltd	Founder & Director	ILP & Member	48 Minutes		
5	Auckland	Horwath HTL Ltd	Managing Director	ILP & Member	64 Minutes		
6	Auckland	InterCity Ltd	General Manager	ILP & Member	47 Minutes	39 Minutes	
7	Auckland	New Zealand Cruise Association	Executive Director	ILP & Member	31 Minutes		
8	Auckland	Restaurants Association of New Zealand	Chief Executive Officer	Member	39 Minutes	73 Minutes	
9	Auckland	Tourism Holdings Limited (THL)	Chief Operating Officer	Member	32 Minutes		
10	Auckland	Tourism New Zealand (TNZ)	Industry Insights Specialist	Member	37 Minutes		33 Minutes
11	Christchurch	BYATA / YHA	Marketing Manager	Member	56 Minutes		
12	Christchurch	Christchurch New Zealand	Senior Economist	Member	57 Minutes		
13	Christchurch	Christchurch Airport	Project Director, Alibaba	Member	28 Minutes	75 Minutes	
14	Dunedin	University of Otago	Professor of Tourism	Member	56 minutes		
15	Dunedin	University of Otago	Manager	Member	38 Minutes		
16	Dunedin	Dunedin City Council	i-SITE Manager	Member	35 Minutes		
17	Dunedin	Dunedin City Council	Economic Dev. Manager	Member	32 Minutes		
18	Hamilton	Hamilton and Waikato Tourism	Chief Executive Officer	Member	47 Minutes	33 Minutes	
19	Invercargill	Venture Southland	Strategic Project Manager	Member	35 Minutes	55 Minutes	
20	Invercargill	Venture Southland	Tourism and Events Manager	ILP & Member	33 Minutes	46 Minutes	
21	Napier	Bed and Breakfast Association New Zealand	Association Secretary	Member	51 Minutes		
22	Nelson	Nelson Tasman Tourism	Chief Executive Officer	Member	54 Minutes		
23	Queenstown	Canyon Swing	General Manager	Member	39 Minutes		
24	Queenstown	Real Journeys	Business Intelligence Analyst	Member	49 Minutes		
25	Queenstown	Real Journeys	Capacity Manager	Member	37 Minutes		
26	Queenstown	Skyline	General Manager - Marketing	Member	35 Minutes		
27	Queenstown	Aotearoa Ziptrek	Business Owner & Director	ILP & Member	32 Minutes	38 Minutes	
28	Tauranga	Tourism Bay of Plenty	Chief Executive Officer	Member	55 Minutes		
29	Wellington	Main Trade Association (MTA)	Insight Specialist (**IOP Project Manager**)	PM Team & Member	60 Minutes	73 Minutes	61 Minutes
30	Wellington	Main Trade Association (MTA)	Chief Operating Officer	PM Team & Member	45 minutes	54 Minutes	45 Minutes
31	Wellington	Main Trade Association (MTA)	Chief Executive	PM Team & Member	43 Minutes	47 Minutes	77 Minutes
32	Wellington	Department of Conservation	Tourism Manager	Member	35 Minutes		
33	Wellington	Ministry of Transport	Principal Analyst	Member	40 Minutes		
34	Wellington	Ministry of Bus. Innovation & Employment	Principal Analyst for Tourism	ILP & Member	45 Minutes	44 Minutes	54 Minutes
35	Wellington	Immigration New Zealand (INZ)	Sector Manager (Tourism)	ILP & Member	30 minutes	63 Minutes	49 Minutes
36	Wellington	Statistics New Zealand	Analyst, Tourism	Member	44 Minutes	33 Minutes	39 Minutes
37	Wellington	AB & Associates	Consultant	Member	35 Minutes		
38	Wellington	Hospitality New Zealand (HNZ)	General Manager	ILP & Member	56 Minutes		
39	Wellington	Margin Fuel & KiwiRail	Pricing Contractor	Member	30 minutes		
40	Wellington	Museums Aotearoa	Executive Director	Member	41 Minutes		
41	Wellington	New Zealand Cycle Trails (NZCT)	General Manager	Member	45 Minutes		
42	Wellington	Regional Tourism New Zealand	Executive Director	ILP & Member	45 Minutes		
43	Wellington	Te Papa	Head of Audience Insight	Member	33 Minutes		
44	Wellington	Tourism Export Council (TEC)	Chief Executive Officer	Member	50 Minutes		
45	Wellington	Wellington Airport	Airline Development Manager	Member	47 Minutes		
46	Wellington	Victoria University of Wellington (VUW)	Senior Lecturer of Tourism	Consultant	56 Minutes		30 Minutes

[24] All participants signed consent agreements (Appendix 6&7). Some organisational names are pseudonymized to protect (potentially) personally identifiable information.

Appendix 5: Ethics Approval

Project Title: Development of Inter-Organisational Platforms

This research involved human participants in its activities. This included multiple interviews with participants, and observations of deliberations and activities at workshops, meetings, and other key events. Human ethics approval was sought and approved by the Human and Ethics Committee (HEC) of the School of Information Management at Victoria University of Wellington, New Zealand. The details for this approval are as follows:

HEC Reference IDs:	0000025608 (21/11/2017) & 0000025665 (20/02/2018)
Application Title:	Formation of Inter-Organisational Platforms
Primary Investigator:	Rodreck David, Principal Investigator
	PhD Information Systems Candidate
Supervisors (student research):	Dr Jean-Grégoire Bernard, Primary Supervisor
	Associate Professor Markus Luczak-Roesch, Co-Supervisor
	Professor Benoit A. Aubert, Honorary Research Associate
Approving Officer:	Dr Philip Calvert, HEC Chair, School of Information Mgt.

Any concerns regarding the nature of this project should be notified in the first instance to Rodreck David, Principal Investigator at:
xxx-xxx@vuw.ac.nz or phone +64-xx-xxx-xxx

Concerns regarding the ethical conduct in the research should be notified to: Associate Professor Susan Corbett, Convener Victoria University of Wellington Human Ethics Committee at:
xxx-xxx@vuw.ac.nz or phone +64-xx-xxx-xxx

Appendix 6: Consent Form 1 – Interview

Project Title: Development of Inter-Organisational Platforms

- I have read and understood the information provided about this research project in the Information Sheet
- I have had an opportunity to ask questions and to have them answered.
- I understand that notes will be taken during the interview and that it will also be audio-taped and transcribed.
- I understand that I will have an opportunity to review the transcribed notes of my interview and make amendments as I see fit.
- I understand that I may withdraw myself or any information that I have provided for this project up to four weeks after the interview, without being disadvantaged in any way.
- If I withdraw, I understand that any relevant information about myself including tapes and transcripts, or parts thereof, will not be used and will be destroyed.
- I agree to take part in this research.
- In the case, I want to be (please tick one):
  - O Named
  - O Identified by a pseudonym
  - O Not identified
- If CEO or founder of the organisation, I agree for my organisation to be:
  - O Named
  - O Identified by a pseudonym
  - O Not identified
- I understand that the recording, transcripts, and any documents I may provide from the interview session will be erased within TWO (2) years after the conclusion of the project.

Participant's signature:_____

Participant's name:_____

Participant's Contact Details (if appropriate): _____

_____

Date: _____

Note*: The Participant should retain a copy of this form.*

This research was approved by the Victoria University Ethics Committee under references 0000025608 (21/11/2017) & 0000025665 (20/02/2018).
Any concerns regarding the nature of this project should be notified in the first instance to Rodreck David, Principal Investigator at: xxx-xxx@vuw.ac.nz or phone +64-xx-xxx-xxx.
Concerns regarding the ethical conduct in the research should be notified to: A/Prof Susan Corbett, Convener VUW Human Ethics Committee xxx-xxx@vuw.ac.nz or phone +64-xx-xxx-xxx.

Appendix 7: Consent Form 2 – Documents & Other Information

Project Title: Development of Inter-Organisational Platforms

- I have read and understood the information provided about this research in the Information Sheet
- I have had an opportunity to ask questions and to have them answered.
- I understand that I will have an opportunity to review the transcribed notes of my contribution and make amendments as I see fit.
- I understand that I may withdraw myself or any information that I have provided for this project up to four weeks after my contribution, without being disadvantaged in any way.
- If I withdraw, I understand that any relevant information about myself or documents provided as such, including tapes and transcripts, or parts thereof, will not be used and will be destroyed.
- I consent to the use of any documentary material (spreadsheet datasets, memos, meeting minutes, white papers, press coverage, reports etc.) provided by me as a contribution to this research.
- I agree to take part in this research.
- I wish to receive a copy of the final report from the research (please tick one)

  Yes [ ] No [ ]

- If CEO or founder of the organisation, I agree for my organisation to be:
  - O Named
  - O Identified by a pseudonym
  - O Not identified

Participant's Signature:_____

Participant's Name:_____

Participant's Contact Details (for Final Report, email/mailing address):

_____

_____

_____

Date:_____

Note*: The Participant should retain a copy of this form.*

This research was approved by the Victoria University Ethics Committee under references 0000025608 (21/11/2017) & 0000025665 (20/02/2018).
Any concerns regarding the nature of this project should be notified in the first instance to Rodreck David, Principal Investigator at: xxx-xxx@vuw.ac.nz or phone +64-xx-xxx-xxx.
Concerns regarding the ethical conduct in the research should be notified to: A/Prof Susan Corbett, Convener VUW Human Ethics Committee xxx-xxx@vuw.ac.nz or phone +64-xx-xxx-xxx.

Appendix 8: Interview Guide

Project Title: Development of Inter-Organisational Platforms

Thank you for participating in this project.

Introduction

IT platforms are socio-technical systems that have extensible functions allowing external participation and contribution. They are characterised by a main core or hub which at varying degrees enables other complementary components to add value to the main core. This implies that the core technology brings together an ecosystem of various users such as complementors, third party developers, consumers (buyers, sellers, suppliers etc.) creating a network of users who contribute and benefit from using the platform as an intermediary.

Platform ecosystems are transforming the traditional organisational value chain creating new opportunities for inter-organisational synergies, value co-creation and collaboration. As part of the Formation of Inter-Organisational Platforms project, we are looking at the formation processes in platform creation. We also seek to understand how organisations align themselves to form, contribute and gain advantages from these new technologies.

This research has been approved by the Human Ethics Committee (HEC) of the Victoria University of Wellington.

Section A: Sample of questions we may ask you as the participant

This section seeks to understand the role that the participant plays platform development project, which their organisation is participating in. It also seeks to create a brief profile of the participant. Questions may include:

- What is your role in your organisation? How long have you been on this role?
- What part of the Tourism Insight Platform is your organisation involved with?
- What is your individual role in this initiative? What does your role entail?
- Who forms part of the members of your project team?
- Is there a timeline for this initiative? If so, at what phase in the timeline are you?
- How much has been your time commitment in this role so far?
- What activities have you been involved with during so far (past events)?
- What activities are you involved with during this time (current events)?
- What are the key issues at this point? How were they resolved? How could they be resolved?
- What has been the toughest so far? What bottlenecks do you anticipate?
- What are you and your team's plans and expectations over the next six months?
- How will you manage this with your existing responsibilities?

- Is there anything you would change about the way you have been involved in the Tourism Insight Platform project?
- What do you think you are particularly doing well? What do you think MTA is particularly doing well? What could be improved?

Section B: Sample of questions we may ask about inter-organisational collaboration

- Has the Tourism Insight Platform been discussed in your organisation? At what level? Has it been incorporated into organisation in any work planning or strategy?
- Do you have any previous connections with members in the project? If so, in what areas of business have you collaborated or worked together in the past?
- What are your views about the intended platform? How does your organisation (CEO, senior management, founder, etc.) view the project?
- What advantages do you see in the developing of an inter-organisational platform, or technology(s) for sharing data resources and services?
- With what companies are you actually collaborating on a daily basis?
- What were the main drivers for your company to start collaborating in this project? And what do you consider now as added value of this collaboration for your organisation? (e.g., new resources, customers, partners, insights, publicity)
- Looking into the future, do you think the project is required or necessary?
- How are decisions made about aspects of the platform which affect all participants?
- How is the project divided and coordinated amongst participants?
- Howe has your organisation prepared for changes (that may be) required to your as a result of participating in the Tourism Insight Platform initiative?
- What would your organisation be prepared to share/link/connect with other companies that you are intending to connect with / have not yet connected with?
- What would you like other organisations to share with you?
- How do you think your firm can share/connect/link with other organisations?
- What would you say are the benefits and drawbacks of your organisation's participation in inter-organisational platform formation?

The order and structure of questions may be variable to fit with your role in the organisation, and in the Tourism Insight Platform project. We are not aiming for a structured discussion, so feel free to talk about any other information you think is relevant.

We would like to contact you again after six months to ask how things are going – Would you consent to this? If so, we will again formally ask for your permission.

Yes, you can contact me again. [ ] No, do not contact me again. [ ]

Note: The Participant should retain a copy of this form.

This research was approved by the Victoria University Ethics Committee under references 0000025608 (21/11/2017) & 0000025665 (20/02/2018).

Any concerns regarding the nature of this project should be notified in the first instance to Rodreck David, Principal Investigator at: xxx-xxx@vuw.ac.nz or phone +64-xx-xxx-xxx.

Concerns regarding the ethical conduct in the research should be notified to: A/Prof Susan Corbett, Convener VUW Human Ethics Committee xxx-xxx@vuw.ac.nz or phone +64-xx-xxx-xxx.

Appendix 9: Participant Information Sheet

Project Title: Development of Inter-Organisational Platforms

Thank you for your interest in this research project. Please read this information sheet before deciding whether to take part or not.

What are IT Platforms?
IT platforms are socio-technical systems that have extensible functions allowing external participation and contribution. They are characterised by a main core or hub which at varying degrees offers affordances for other complementary components to add value to the main core. This implies that the hub or core brings together various users such as complementors, third party developers, consumers (buyers, sellers, suppliers etc.) creating a network that uses the platform as an intermediary.

What is the aim of the project?
This research seeks to investigate the early-stage formation processes and activities engaged by organisations during inter-organisational platform formation. We are interested in developing an understanding of the social, organisational, and technological challenges involved in mobilising a network of organisations around a common platform for the purpose of joint value creation.

How can you take part?
We invite members of your organisation involved in making decisions that affect your firm's contribution to the formation of the Tourism Insight Platform being spearheaded by the Main Trade Association (MTA). If you agree, we will conduct an interview in a place convenient for you. This interview will take approximately one hour and cover your experience of inter-firm platform formation. A follow-up interview may be requested to discuss how the project is proceeding. You can withdraw from the study for up to four weeks after the interview by sending an email to Rodreck David (rodreck.david@vuw.ac.nz). If you withdraw, your data will be destroyed.

What will happen to the information you give?
We will use pseudonyms and an approximate of position titles to represent the participants in this study. The organisation may decide if it wants its real name used or not. The interview transcripts, summaries and any recordings will be kept securely and destroyed five years after the research ends (to comply with relevant data protection laws). The data will only be accessible by the researchers and by an approved transcriber who would have signed a nondisclosure agreement.

What will the research project produce?
The information from this study will be used in publicly available academic publications, including (but not limited to) conferences, reports, and journal articles. Also, a copy of the final thesis will be deposited in the Library of the Victoria University of Wellington.

If you accept this invitation, what are your rights as a research participant?
If you do decide to participate, you have the right to:

- Choose not to answer any question
- Ask for the recorder to be turned off at any time during the interview
- Ask any questions about the study at any time
- Read over and comment on the transcript of your interview

If you have any questions or problems, who can you contact?
If you have any questions about the study, either now or in the future, please feel free to contact the principal researcher (information provided below) for more information.

Note: The Participant should retain a copy of this form.

This research was approved by the Victoria University Ethics Committee under references 0000025608 (21/11/2017) & 0000025665 (20/02/2018).
Any concerns regarding the nature of this project should be notified in the first instance to Rodreck David, Principal Investigator at: xxx-xxx@vuw.ac.nz or phone +64-xx-xxx-xxx.
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Appendix 10: Transcribing Confidentiality Agreement

Project Title: Development of Inter-Organisational Platforms

I , _____, agree to ensure that the audiotapes I transcribe will remain confidential to Rodreck David, Benoit A. Aubert, Jean-Grégoire Bernard, Markus Luczak-Roesch, and myself.

I agree to take the following precautions:

1. I will ensure that no person, other than Rodreck David, Benoit A. Aubert, Jean-Grégoire Bernard, and Markus Luczak-Roesch, hears the recording.
2. I will ensure that no other person has access to my PC.
3. I will delete the files from my PC once the transcription has been completed.
4. I will not discuss any aspect of the recording with anyone except Rodreck David, Benoit A. Aubert, Jean-Grégoire Bernard, and Markus Luczak-Roesch.

Signature:_____

Date:_____

Note: The Participant should retain a copy of this form.

This research was approved by the Victoria University Ethics Committee under references 0000025608 (21/11/2017) & 0000025665 (20/02/2018).
Any concerns regarding the nature of this project should be notified in the first instance to Rodreck David, Principal Investigator at: xxx-xxx@vuw.ac.nz or phone +64-xx-xxx-xxx.
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"It always seems impossible until it's done"

– Nelson Mandela