Swinburne University of Technology

Collaborative action possibilities and constraints in emergent public digital service platforms: A solution design knowledge contribution.

A Thesis submitted by

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Abstract

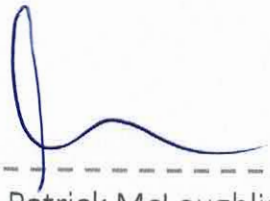
In order to make progress on complex social and health problems, public health is increasingly adopting a collective impact approach. This is a structured approach that seeks to bring people and organisations from multiple public health sectors together in collaborative relationships to improve public health outcomes. Even so, the existing fragmented and siloed nature of the Australian public health sector challenges and constrains the potential of this required supraorganisational collaboration. In this regard digital service platforms (DSPs) and their associated ecosystems enable new forms of collective digital interaction and organisation and present with the potential to assist in this collaborative endeavour. In public health such DSPs would invite diverse public health actors to digitally interact around shared service value propositions – greater public health service coordination and collaboration in this instance – with the objective of developing a viable ecosystem that would result in increased efficiency and effectiveness in public health service delivery. How such a platform is constructed, i.e. its design and configuration, is key to the establishment and evolution of this associated ecosystem. However, we lack solution design knowledge relevant to the design and emergence of DSPs and their ecosystems at a supraorganisational level in the public space. This thesis will address the problem of how to design for a DSP and associated ecosystem that would seek to advance supraorganisational service coordination and collaboration in this complex, public environment. The study seeks to advance our understanding of how DSP design may incentivise or disincentivise digital collaborative interaction (ecosystem development) in this public, supraorganisational landscape. Utilising a participative action design research (PADR) process method, situated within the design science research (DSR) methodology, a participative and iterative design process was followed to develop an instantiation from which the primary research artefact in the form of DSP design principles (nascent design theory) were abstracted. Service-dominant logic (S-D Logic) and social media affordances are adopted as a complementary knowledge base to inform the participative DSP design and the emergence and evolution of the associated ecosystem. Primary health care (PHC) service value creation, and consumption, based on the exchange of services, form the initial and primary value incentives for development of the associated ecosystem.

A PHC supraorganisational collaborative network in the greater Melbourne area provided the case study site. Findings from the case study generates artefact centred and non-artefact

centred solution design knowledge that improves our understanding of how to design and build for digital platform collaboration and coordination opportunities at this level. The non-artefact centred solution design knowledge advances our understanding of the environment, problem-space alignment and specifically, how relationships between users and key sector actors may impact on the establishment and development of the DSP and its associated ecosystem. This advances our understanding of both DSP design and the collaborative and governance mechanisms underpinning public health platform ecosystem emergence and evolution. The solution design knowledge generated provides a richer explanatory framework to explain the inherent constraints and collective action possibilities of DSP design and development and serves to grow the application knowledge base in this context.

Certification of Thesis

I certify that the ideas, results, analysis and conclusions reported in this dissertation are entirely my own effort, except where otherwise acknowledged. I also certify that the work is original and has not been previously submitted for any other award.
To the best of my belief, the thesis contains no material previously published or written by another person, except where due reference is made in the thesis itself.



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Endorsement

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List of Key Abbreviations

Abbreviation	Full Form
CIMO-Logic	Context/Intervention/Mechanism/Outcome Logic
CR	Critical Realism
DESRIST	Design Science Research in Information Systems and Technology
DHHS	Department Human Health Services
DP	Digital Platform
DSP	Digital Service Platform
DSR	Design Science Research
DSRM	Design Science Research Methodology
EST	Ecological System Theory
FR	Foundational Requirements
FP	Foundational Premise
G-D Logic	Goods Dominant Logic
ICT	Information and Communication Technologies
IS	Information Systems
IT	Information Technology
MF	Metatheoretical Foundations
PADR	Participatory Action Design Research
PCP	Primary Care Partnership
PHC	Primary Health Care
RQ	Research Question
SALUS	Roman God of Welfare
S-D Logic	Service-Dominant Logic

Chapter 1: Introduction

This thesis designs, develops and evaluates an instantiation of a digital services platform (DSP) within a primary health care (PHC) context with the objective of developing nascent design theory (Gregor & Hevner, 2013) to address a class of coordinative and collaborative problems experienced at the public, supraorganisational level in the PHC sector. Design principles are abstracted through the DSR methodology and presented as the primary research artefact. DSPs present a technology for users to interact and both create and appropriate individual and collective service value. They serve to facilitate digital interaction and service value co-creation among multiple users in a digital network. Conceptually, DSPs are thus more than the technical artefact, where the technology is simply a digital locus for the interaction of actors, rules, settings and resources that combine to create service value (Pena & Breidbach, 2021). In this study, the generation of DSP solution design knowledge (Gregor & Hevner, 2013), both artefact-centred and non-artefact-centred, will serve to advance and improve public, supraorganisational digital connectivity, coordination and collaboration in the context of known challenges and in response to sector calls for improved collective impact at this level. The research was authorised by Swinburne University of Technology and conducted in the Eastern Melbourne PHC district within a supraorganisational coordinative structure referred to as a primary care partnership (PCP).

Digital platform design plays a distinct and critical role in managing platform user interaction and relationships, especially in the public sector, where effective design must seek optimal configuration of the platform to incentivise users to engage and interact in the absence of any monetary incentives. This study's design objectives of incentivising, managing and coordinating user interaction on a proposed DSP, attempts to deliver a viable and sustainable platform and associated ecosystem that will generate PHC coordinative and collaborative service value for its users and the sector. An iterative, participatory DSR process method proposes to generate nascent design theory in the form of design principles to this effect. However, at this level, and in such highly complex supraorganisational environments, there tend to be a great many components to such DSPs and their emergent ecosystems, both social and technical, that connect, re-connect and interact in complex ways beyond the control of the designers. This complex interaction can result in unexpected turns in the evolution of platforms and their ecosystems, commonly referred to as emergence (Bhaskar, 2008), where emergence is seen

as the generation of new structures, entities or concepts. This research employs the Sein et al. (2011) concept of guided emergence to conceptualise and manage a revision process for developed solution design knowledge that leads to a revised set of design principles. The research was conducted within a PCP, a collaborative, supraorganisational network of PHC funders and providers, operating in the greater Melbourne area.

This introductory chapter starts by presenting a glossary of terms relevant to the research and its processes. The research study is a large DSR project carried out in a complex public environment. A glossary of terms brings forward a quick understanding of how the research uses key terms that range across multiple domains and literatures. From here, the chapter explores background research information on the PHC environment and existing known challenges to connection, collaboration and coordination at a supraorganisational level are described. This background information serves to highlight the motivation for research design that advances digital coordination and collaboration at this level in the PHC sector. Thereafter, the research problem and associated research questions are presented, followed by the research justification. The DSR paradigm and associated DSR method are briefly outlined. Finally, a chapter summary details the remaining chapters of the thesis and their relationships.

1.1. Key Terms Used in this Research

Public sector cooperation

Generally speaking, three different types of practitioner interaction can be determined in the public sector: cooperation, coordination and collaboration, based on the nature of the relationship and the requirement to pool or exchange resources. Cooperation requires the least interaction at the sector level, not requiring actors to pool resources or formally define a relationship (Mintzberg, 1993).

Public sector coordination

Coordination, as evidenced in coordination theory (Malone & Crowston, 1990), conceptualises the synchronisation of different activities and distributed resources and how the relationships between those activities and resources are managed. Coordination creates linkages between existing structures (McNamara, 2012) and dependencies between structures. This enables different actors to work together to produce outcomes. The rapid growth of digital technologies generally supports digitally mediated coordination in the public sector.

Public sector collaboration

Collaboration is an approach to coordinating organisational, interorganisational and/or supraorganisational activities in which actors coordinate and share information, resources, activities, and capabilities (experience/expertise) to realise shared goals (Axelsson & Axelsson, 2006). Collaboration creates new, joint structures to solve problems (McNamara, 2012) and the pooling of resources. It is the most demanding type of interaction. This information systems (IS) research explores how digital structures can facilitate and enhance coordination and collaboration via digital ecosystems in the public sector.

Digital ecosystems

Digital ecosystems are defined as "interacting organisations that are digitally connected and enabled by modularity and are not managed by a hierarchal authority" (Jacobides, 2019). This research would regard digital ecosystems as such, but where value is created and appropriated as an outcome of user interaction. The sustainability of digital platforms is invariably associated with their ecosystems.

Collaborative service value

Collaborative service value is the value generated by service delivery networks creating service value through collaborative activities such as resource sharing (information resources, service activities, capabilities and experience) to enhance overall service delivery in support of service goals and strategies. The beneficiaries of public service delivery are citizens.

(Digital) Connectivity

Historically, digital connectivity has moved through a number of stages starting from where the information resources of the personal computer and the World Wide Web effectively globalised connectivity and information (McLuhan & Powers, 1989). This was followed by the socialisation of digital connectivity, where social media platforms enabled collective sharing and social exchange (social media becomes important for organisational communication), (Leonardi, 2013). The advent of the smartphone personalised digital connectivity. The most recent stage reflects the datafication of digital connectivity, where the ability to collate and interrogate massive amounts of data is built on the preceding stages. Digital connectivity serves to create new capabilities and new ways of organising (Kolb, Dery, Huysman, & Metiu,

2020). This research seeks to leverage these capabilities to facilitate greater coordination and collaboration in a public supraorganisational context.

DSR artefacts

Gill & Hevner (2013) define DSR artefacts as the "tangible products of the design process that have moved from the problem space into the real world" (p. 5). In this thesis the set of design principles is the primary research artefact, in other words the principal deliverable of this DSR research project. Design propositions and an instantiation to this purpose are developed but, while recognised as DSR artefacts (products of the design process evidenced in the real world) that constitute and contribute to solution design knowledge, they are not the primary research artefact of the research.

DSR method

Design science research (DSR) (Baskerville, Pries-Heje, & Venable, 2009; Kuechler & Vaishnavi, 2008), is a research paradigm that develops both design knowledge and design structures and processes (Denyer et al. 2008), that seek to solve business and organisational problems. The application of DSR is informed by a number of DSR process methods, such as the PADR process used in this thesis (Bilandzic & Venable, 2011). This is the primary methodology employed in this thesis and is explained in detail in Chapter 3.

Exploratory research

Exploratory research is designed to "discover and describe unexplained phenomena and the contexts within which they manifest themselves" (Stebbins, 2001). The phenomena of interest in this thesis are the outcomes the designed artefact is meant to improve – digital coordination and collaboration at a supraorganisational level in the PHC sector within public health – challenges that in the user environment vary across time, context(s) and conditions (Briggs & Schwabe, 2011). These phenomena, bridging the social and the technical, are relatively unexplained in this context, at this level and are incorporated into the design objectives and evaluation processes of the thesis. Case studies are a useful research instrument within which to conduct such sociotechnical exploratory research.

Emergence

DSPs can be seen as a complex set of digital components, actors, resources, rules and settings (Pena & Breidbach, 2021) where the interactions of these elements give rise to the continuous emergence of phenomena (Holland, 2014). The implications of such complexity for design, especially concerning human agency, generate design risks in that the design process and extant research may not provide for all contingencies and outcomes.

Case study

The purpose of a case study is to produce a, "subjective understanding of phenomena" (Benbasat, Goldstein, & Mead, 1987). Researchers may use the methodology to develop a greater understanding of the phenomena from immersion in the context of that phenomena (Benbasat et al., 1987). The case study presents a framework to structure observation, to collect data and conduct analysis. Case studies explore the phenomenon in its natural context and makes use of qualitative tools and techniques for data collection and analysis (Yin, 2014) where, "the investigator has little control over events, and when the focus is on a contemporary phenomenon within some real-life context" (Yin, 2014, p. 1). The case study is an accepted form of research in DSR. The rationale for using case study research in this thesis is detailed in Chapter 4.

CIMO-Logic (Context/Intervention/Mechanism/Outcome)

CIMO-Logic is a framework based on the logic of prescription "If you want to achieve outcome *O* in context *C,* then use intervention *I*" (Bunge, 1967). This logic was extended by Pawson and Tilley (1997), who included the question of the generative mechanism (M) of the intervention: that is, which mechanisms produce that outcome in that context? Denyer et al. (2008) propose this framework for the development of design propositions, which are, by definition, prescriptive knowledge. This logic of prescription is followed in this research given it presents with a structured logic to define and accumulate design knowledge.

Kernel Theory

The term kernel theory in this thesis is used in a manner consistent with Gregor & Hevner (2013) as a "reference theory to mean theory that arises in disciplines outside of IS," used in DSR as descriptive theory to inform and explain artefact construction (Gregor & Jones, 2007).

The term is used interchangeably with justificatory knowledge which has that broader meaning, identified by Gregor and Hevner, above.

Platform governance

Bryson et al., (2006) define the governance of collectives as a "set of coordinating and monitoring activities that enhance the realisation of collective goals." Digital platform governance activities are comprised of both social (trust and behavioural norms (Ostrom, 1990)) and structural (Provan & Kenis, 2008) elements, and serve to frame governance activities for platforms structures such as self-governing digital structures and digital network administration and management (Bryson, Crosby, & Seo, 2020). Platform governance structures can be impacted by trust levels and goal alignment among groups.

Sociotechnical system(s)

In this research DSP technologies are regarded as sociotechnical systems (and thus an IS artefact (Prat et al., 2015)) in that they are embedded in a specific environment which impacts on the use and performance of that technology (Sarker, Chatterjee, Xiao, & Elbanna, 2019). Such technologies are reliant on user engagement and interaction for their performance. The IS discipline uses the term "to bolster the recognition that the technology under design will be implemented and used in a social context that will, to some degree, shape whether and how it is adopted" (Leonardi, 2011, p. 38). This research holds, consistent with Orlikowski and Iacono, (2001), that such social context will also shape that technology, in that process referred to as emergence.

Supraorganisational

In this thesis the term supraorganisational is preferred over interorganisational to reflect a broader interaction between individuals, networks, organisations etc. that takes place under a sector umbrella, where actors from different organisations and public health sectors come together to share information, resources, activities and organisational capabilities in the pursuit of public health sector goals. In this context there is no single overriding hierarchical structure and as a result participation and interaction at this level is often transient (Daymond & Rooney, 2018). Critically, a public health supraorganisational structure reflects a sharing of collective responsibility for complex 'public' problems not solvable by individual organisations or individual organisational networks (McNamara, 2012).

Usefulness

Within the DSR paradigm, usefulness refers to the degree to which users are satisfied that use of the digital design enables them to realise their use objectives. Within the IS domain, it means the extent to which an application assists a user to realise value in its application in the immediate term (Díez & McIntosh, 2009). This evaluative term is often used in conjunction with the term 'fitness,' used to describe how well the DSR solution evolves over time to address the problems it is designed to solve (Gill & Hevner, 2013).

1.2. Research Background and Context

This section explores the environment or the context of the problem space. A thorough and critical understanding of the research context (Hevner et al., 2004) within which the artefact is to be positioned, is required given that both the usefulness and fitness of the artefact, i.e. that the artefact enables actors to realise their objectives in use and that the artefact can be adapted to continue to offer value to users (Gill & Hevner, 2013), are impacted by that environment (March & Smith, 1995). Australian PHC has increasingly embraced greater coordination and collaboration, in an effort to enhance and improve collective impact where such collective action is seen as an effective way to address the complex social and health problems of the sector and improve PHC outcomes. Digital collaboration and coordination is consistently proposed as an opportunity and an enabler for the sector to achieve its collective impact objectives. The increasing advancement and ubiquitous use of digital coordinative and collaborative technologies presupposes that digital collaboration at the PHC supraorganisational level should be a relatively routine application of existing technologies. But this is far from the current reality. The complex, fragmented nature of the Australian PHC supraorganisational sector means it struggles to interact effectively to achieve collective impact. The sector faces coordination challenges across its multiple jurisdictions: it straddles multiple areas of government policy and has to balance numerous competing demands across all its stakeholders. While the sector actively seeks to leverage potential in enhancing digital service delivery, many constraints and challenges impact digital coordination and collaboration attempts. This study's examination of existing research reveals very little in the form of extant digital solution design knowledge that addresses this problem area. What design solutions do exist are primarily proprietary tools, geographically limited and bound for use and invariably

orientated around singular PHC projects. There is thus a requirement for digital solution design knowledge that would address this sector level lacuna. Given these known limitations of contextual understanding and knowledge on the application of collaborative digital technologies, the following section will position the research relative to the problem context (Baskerville et al., 2018).

1.2.1. The primary health care (PHC) problem environment.

The purpose of PHC is to protect and improve the health and therefore the quality of life of all people within a defined geographical catchment area. PHC is characterised by a varied organisational character that includes not only organisations from the public health sector but also organisations from other sectors of society, both public and private. Australia's PHC system is a multifaceted and complex ecosystem of public and private providers supported by research and training organisations, voluntary and community organisations and consumer and advocacy groups whose overall purpose is to promote, restore and/or maintain public health (Shigayeva & Coker, 2015). Governance of this sector is shared between the Australian Government and state and territory governments who act as funders, policy developers, regulators and service deliverers (Health & Welfare, 2016). This web of interconnected political, social and institutional factors forms a difficult environment within which to address major public health challenges, such as the increasing incidence of chronic conditions. A complicated and overlapping matrix of responsibility between health jurisdictions also serves to blur coordination and collaboration opportunities (Henderson et al., 2019).

Greater coordination and collaboration within and between PHC actors is recognised as a prerequisite to both better implement public health policy and address chronic public health priorities (such as diabetes, obesity and domestic violence etc.) that tend to define the sector (Oakley, Salam, & Iyer, 2013). Sometimes referred to as wicked public problems, they are perceived as intractable, complex, unpredictable and having no single defined source or solution (Clarke & Stewart, 2003). These intractable problems tend to cut across existing policy and service areas. To address these challenges, PHC attempts to connect and coordinate people and organisations from many different disciplines and backgrounds to develop and coordinate innovative and cost-effective public health interventions and solutions to these complex problems and policy objectives in order to generate more effective and efficient PHC

service delivery to the beneficiaries. This complexity of the PHC ecosystem requires PHC practitioners and organisations to work together to achieve value-added health outcomes that would not be feasible without coordination (Varda, Shoup, & Miller, 2012). Currently, within the PHC sector, the requirement is that this process of coordination and collaboration start with the research and mapping of the existing PHC service delivery landscape, specifically research of who is doing what, where, to what purpose, with what resources and with which population group. The identification and acquisition of such information will advance best practice, identify service gaps and duplications and allow PHC actors to integrate experience and expertise into their PHC service planning and delivery—leading to the implementation of more successful public health programs and policies and hence, the more efficient use of resources. These collaboration initiatives are often described in terms of public or community health partnerships and health alliances (Axelsson & Axelsson, 2006). Thus, a sector-wide response to public health challenges is to attempt to engage in some form of collaborative or coordinative approach, where actors work across jurisdictional, service and geographical boundaries, linking and combining knowledge and resources in order to generate collective action. Further, and especially in the Australian public health context, it is also often a funding requirement for PHC organisations to work in partnership (Bryson, Patton, & Bowman, 2011).

However the current process of collating this information is burdensome, and the fragmented and siloed nature of the Australian PHC sector complicates public health program visibility and information sharing across the whole of the PHC landscape. Experience and expertise are not easily located, as knowledge is often situated and siloed locally. Identifying and developing the networks and relationships required to encourage and manage information sharing is difficult in this siloed landscape. Much of the current knowledge-mapping process relies on limited personal networks and laborious manual searches that invariably provide partial or incomplete mapping, resulting in inefficiencies in service delivery and costly duplications of PHC programs. Current Australian PHC service planning and decision making therefore tends to be characterised by a lack of systemised planning and review and a lack of access to diverse information sources; decision making tends to be triggered by crises and short-term organisational interests tend to drive intervention decisions (Brownson, Fielding, & Maylahn, 2009). Within this problematic context, the collective objectives of interdisciplinary and supraorganisational collaboration are becoming increasingly important as evolving social and

economic conditions, ageing demographics and chronic diseases converge to focus attention on the delivery of PHC services (Brownson et al., 2009). A primary key to addressing these shortcomings is the capability to connect, share and coordinate resources and collaborate around PHC interventions and actions. Collaboration and coordination that brings all relevant stakeholders and their resources to bear across this complex ecosystem offers a more integrated and holistic response to the intractable problems of the sector.

1.2.1.2. The PHC actor landscape.

To provide further context to the research problem and possible solution opportunities it is important to see how actors involved in PHC processes interact. There is an extensive range of PHC organisations and actors, all with different objectives and institutional logics, that hinders the ability to collectively address shared problems which, in turn, tends to compromise strategic activities such as resource allocation planning, resource integration and the scaling of service solutions. This research study focuses on collaboration opportunities at the provider level in PHC, since it is at this level that service provision occurs, and it is at this level where the PHC service need for collaboration for service delivery is paramount. See Figure 1 below.

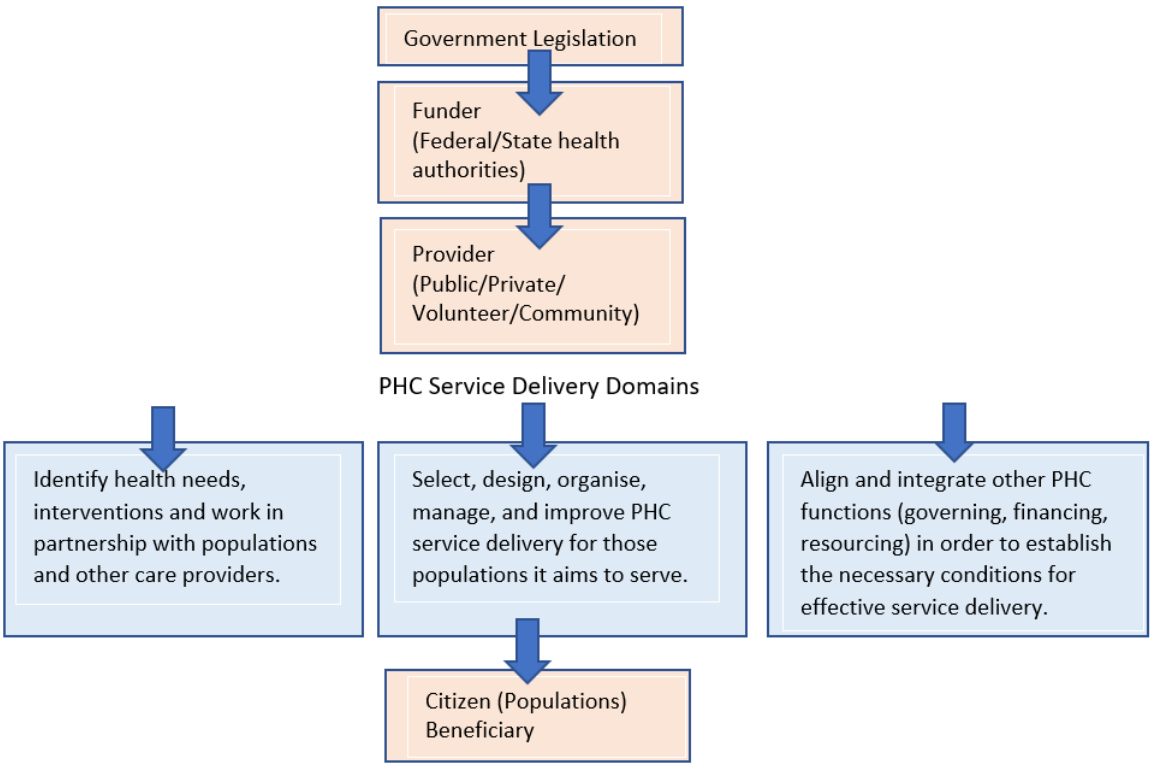

Figure 1: Domains of PHC Delivery (Adapted from WHO Regional Office Europe, 2016)

The diversity of providers and complexity of PHC integration needs across the above three domains encompassing service delivery is indicative of the diverse collaborative challenges for actors in the sector. This research focus of the study therefore leads to a very broad target group of potential actor/collaborators. In Australia, these actors may be practising professionals, organisation(s) and/or networks comprised of community health services, the departments of health and human services, regional health associations, local health authorities and general practice representatives. In an effort to simplify this complexity this research makes a distinction between firstly, funders (local, state or federal government actors) who both provide PHC services and fund other organisations to deliver services for them; and secondly, service providers, a wide diversity of organisations and actors across the public/private/community divide who deliver a range of PHC services. Across this distinction, needs and conceptualisations of PHC service value may be seen to differ depending on whether their involvement in the delivery of PHC service delivery is inside or outside of government, whether such involvement has a for-profit of not-for-profit focus and the particular PHC issue(s) addressed by the actor(s), further compounding coordination and collaboration challenges.

1.3. Research Motivation

The attempt to bring these different PHC service delivery networks, individuals and organisations with different roles and tasks from different PHC areas, together in collaboration presents with key integration challenges. The challenges that arise from such differentiation primarily include gaps or inconsistencies in the provision of services, the lack of access to diverse information, expertise and experience and rising service delivery costs (Glendinning, 2003). PHC has also often been criticised for its poor capacity to connect and coordinate diverse independent actors and structures in the PHC ecosystem (medical health, community and volunteer and institutional bodies), in facilitating joint problem solving and in improving access to broader experience and expertise in relation to PHC initiatives and discourses. At the same time digitisation is enabling new ways for practitioners to coordinate and collaborate in the service sectors. Digital innovation in collaborative and cloud technologies present

opportunities to create and incentivise collective PHC service delivery beyond the organisational role (Barrett, Oborn, & Orlikowski, 2016) and even the inter-organisational. PHC institutional and sector actors (groups, organisations, individuals) who seek to connect, coordinate, and share knowledge across sector and organisational boundaries are increasingly looking to digital technologies to achieve more effective and efficient service delivery. Ease of access and reduced communication costs have given rise to optimism that digital technologies can help alleviate coordination problems and promote greater coordinated action within the complex socio-institutional service ecosystem we call health care. Developing coordinative networks, sharing information, scaling solutions and identifying gaps are key collaborative PHC service value propositions for digital innovation. Digital service platforms (DSPs) offer an additional approach to facilitate this collaborative environment and offer opportunities to connect and share knowledge on a much wider scale than previously. This opportunity to digitally connect and coordinate provides the motivation to develop digital design knowledge that facilitates greater connectivity, coordination and collaboration across the PHC sector and that addresses the challenges of supraorganisational coordination and collaboration in the PHC sector. Extant research (see Chapter 2, Research Background) provides little in the way of a solution to this supraorganisational challenge.

To this end, the design, development and evaluation of an instantiation by means of the DSR methodology is proposed to develop solution design knowledge that address this class of coordinative and collaborative problems. The proposed solution is an open, peer-to-peer DSP, informed by participative input, extant social media platform affordances and service-dominant logic (S-D Logic). The objective is to give actors in the PHC sector greater capabilities to connect, coordinate and collaborate around PHC service delivery at the supraorganisational level. The research was designed, developed and undertaken in collaboration with PHC practitioners, a PHC supraorganisational coordinating body and academics. The next section summarises and defines the research problem and presents the two research questions developed to address it.

1.4. Research Problem, Objectives and Questions

The PHC sector or, more accurately, the supraorganisational PHC sector, faces collaboration challenges on two levels: firstly, the sector is characterised by complex, siloed processes,

geographical constraints and organisational structures that effectively hinder the ability to collaborate and collectively address shared problems. Secondly, technologies addressing collaboration are themselves fragmented, resulting in an absence of any coordinating or overarching technology that could enable effective collaboration and coordination at this level. Further there is very little normative design theory that would assist in the development of DSPs and their associated ecosystems and also facilitate collaboration across the whole of the PHC service ecosystem (Göbel & Cronholm, 2016). This lack is reflected in the literature and in practice. Given the context of the research and the motivation of the research, the following two research objectives are adopted:

1. To develop nascent design theory in the form of design principles that, when contextually operationalised, enhance coordination and collaboration in the PHC sector at a supraorganisational level.
2. To generate and demonstrate solution design knowledge that reflects a greater understanding of how a DSP can be optimally configured (designed) and used to generate collaborative service value for end users in a service delivery ecosystem in the supraorganisational public health space.

The research problem can therefore be summarised as follows:

> Digital and physical sector-wide coordination and collaboration in the supraorganisational PHC sector is constrained, which negatively impacts on PHC service delivery thereby compromising sector collective impact objectives.

In order to address this problem a thorough and critical understanding of the challenges and constraints of collaboration at this level is required. Focusing on the potential of digital coordination and collaboration the design, development and evaluation of a DSP framed by a case study is proposed as a means to address the research problem. This leads to the first research question:

1. *How can DSPs in the PHC sector be designed and configured to advance and improve the coordinative and collaborative objectives of PHC service delivery at a supra-organisational level?*

This question generates applicable knowledge and is artefact-centred. In this, the research expands knowledge on the design and configuration of IS artefacts, facilitating digital

coordination and collaboration at a supraorganisational level in the public sphere. One DSR cycle, incorporating iterative design and sociotechnical evaluation processes, is completed. By utilising participatory and investigative processes defined by the sociotechnical affordance lens (What can this technology do/not do for me in this context?), the research attempts to address both the social and technological aspects of PHC service coordination and collaboration at the supraorganisational level. The focus generated by this research question seeks to produce solution design knowledge that develops nascent design theory. This nascent design theory (communicated in the form of design principles) is informed by participatory design processes, social media platform affordance research and S-D Logic (Vargo & Lusch, 2004, 2008, 2016). The connective, coordinative and collaborative values of extant social media platform affordances are examined for their relevance to this research. The coordinative and collaborative value of the DSP can only be realised with an associated service ecosystem (Vargo & Lusch, 2016). The S-D Logic model presents with an alternative view of exchange and value creation to that of the goods dominant logic (G-D Logic) model (Vargo & Lusch, 2004). Here service—defined as the deployment of knowledge and expertise for the benefit of another—is seen as the basis of all social and economic exchange (Vargo & Lusch, 2004). It was concluded that S-D Logic, integrated with participatory planning and design processes, provided support for the development of the design, primarily in the form of design propositions from which an instantiation is built. Justification of this choice is explored in Chapter 2, and its implications for this research in Chapter 5.

The second research question addresses requirements for a more critical understanding of the problem domain. Innovative information and communication technology (ICT) designs that implement new practice have previously been seen to incur problems in implementation (Nelson, 2007) primarily where the usefulness and fitness of the artefact is dependent on social and environmental variables not associated with the technical design and configuration of the artefact. This sociotechnical issue was regularly reviewed during the research process, particularly within the naturalistic evaluation (Gregor & Jones, 2007) of the instantiation. Given that any PHC service value offered by the DSP is predicated on the interaction of many and diverse PHC actors and structures, this interaction between the social and the technical across technologies, actors, i.e., what the actors could possibly do with the technology in that context is a critical determinant of the success of the DSP (Baxter & Sommerville, 2011; Mumford,

2006). An improved critical understanding of the problem and its context realised from knowledge gained in the evaluation leads to further insights and understanding about how design can optimally facilitate collaboration at this level. This research therefore looks firstly to the generation of artefact-centred solution design knowledge that reflects a greater understanding of how a DSP can be configured to generate collaborative incentives for end users in a service ecosystem. Secondly, given that collaborative PHC service value is developed primarily through collective coordination and interaction among actors, the research looks at how the functioning of the instantiation, in this context, impacts on the establishment and development of an associated service ecosystem that serves to facilitate and enhance collaborative interaction and thus PHC service value at this supraorganisational level. This leads to the second research question:

2. *How can ecosystem orchestration and affordance theory further our understanding of the sociotechnical opportunities, challenges and constraints in generating collective action possibilities for users in an emergent DSP PHC ecosystem?*

The second research question therefore explores the how and why of ecosystem emergence and evolution in this context, using affordance theory to generate artefact solution design knowledge (Drechsler & Hevner, 2018) that builds a greater understanding of the challenges and constraints of emergent platform-based ecosystem development in the public space. In order to facilitate and realise greater coordination and collaboration, the DSP and its associated ecosystem will have to present with collective action possibilities. This will require a deeper understanding of not only how user and technology interact but also how user and user interact within the constraints and opportunities of the designed digital ecosystem, where intent to engage is primarily based not on individual objectives, but on collective objectives. While the IS affordance literature discusses the determinants of digital collective action at an organisational level (organisational affordances), discussion at a supraorganisational level is somewhat limited, as shown in Chapter 2, Research Background. To explore the establishment and development of the emergent DSP, its associated ecosystem and the collective action objectives, this study will turn to ecological psychology and a recent exploration of collective affordances (Weichold & Thonhauser, 2020), based on collective intent and the concept of embodied social identity. This conceptualisation of (professional) social identity and collective intent will serve to provide a richer explanatory framework and thus generate a deeper and

more critical understanding of the impact of DSP design on ecosystem establishment and collective use processes at this level, in this context. It allows the research to explain how individuals and collectives may engage with collaborative IS artefacts at this level and provides important knowledge regarding ecosystem emergence that is critical to the generation of collaborative service value in the PHC sector.

The research questions are designed to generate two distinct forms of knowledge, as articulated by Drechsler and Hevner (2018), and reflect a process of knowledge development where the solution generated from the first question led to the formulation of the second question. The first question generates artefact-centred design knowledge, which reflects the problem space, context diagnosis, requirements and the solution, inclusive of the artefact and its immediate usefulness that is specific and bounded to the design of that solution entity. This develops the solution artefact and demonstrates usefulness. Secondly, the research produces further actionable solution design knowledge (Drechsler & Hevner, 2018) reflecting design knowledge that is independent of the artefact as design entity (non-artefact-centred design knowledge), uncovered during the PADR artefact evaluation, and consisting of solution design theorising (Weick, 1989) that improves our overall understanding of the problem context and thus the solution space. This results from evaluating the effect of the artefact's interaction with the social and environmental context: in other words, the establishment and emergence of a collaborative ecosystem. Such design theorising is of value since this knowledge increases our understanding of how people and collectives interact with the platform in this context and will assist with the further development of collaborative digital technologies for this sector.

1.5. Research Problem Summary Statement

From the preceding discussion it is obvious that there is both limited empirical research on designing and configuring emerging DSPs (build) in a public service context and a lack of research on the integrated establishment and development (use) of associated digital service ecosystems (Ofe, 2018), that could inform the conceptualisation, design and collective use of DSPs in this context. This is significant on two levels: first, at a supraorganisational level where emergent service ecosystems tend to be characterised by loose and informal networks, limited proprietary control over service resources, and straddled with diverse knowledge and collaborative requirements and objectives; and second at a public level, where little is known

about processes of collective governance and scaling (generating network effects) in emergent DSP service ecosystems at this level. DSP design theory in this context is therefore required to move towards broader social engagement (Spagnoletti, Resca, & Lee, 2015), away from the current technocentric and market-orientated approach. The design will need to consider how DSPs and their emergent ecosystems may be associated with collective and service-orientated interaction and collaboration at this level (Majchrzak, Markus, & Wareham, 2016). Such design knowledge will strengthen the evolutionary sustainability and scalability of collaborative platform ecosystems in this sector, thereby facilitating the generation of collaborative service value. This research contributes to the literature for establishing and developing a DSP and its associated ecosystem at a supraorganisational public level and provides key solution design knowledge to manage such objectives.

1.6. Justification of the Research

From the above exploration of the environment (context) and problem space this section will provide the justification for the research and the expected contributions at both a research and practical level. The public health sector faces substantial challenges in establishing and maintaining coordinative and collaborative networks to share information and knowledge. These challenges often compromise collective objectives. Establishing and sustaining digital coordination and interaction at a supraorganisational level represents a class of coordinative and collaborative problems particular to the supraorganisational space in the public health arena. The research background section demonstrates the limitations of any extant solution design knowledge, at both academic and practice levels, to address this class of problem. Consequently, there is a need to study DSPs and their potential contribution to practice in this environment.

This study contributes to this problem space, to both the design knowledge base and to practice, through the design and development of an instantiation that generates a deeper understanding of how a DSP may be configured and developed to enable greater PHC coordination and collaboration. There is no solution design knowledge present in either the literature or professional practice that addresses this specific problem space. The study makes explicit the key constraints and challenges in establishing and developing such technologies to realise collaborative value. The proposed research design addresses the call for academic

research to deliver a practical answer to a real world problem. It also provides the rigour–relevance balance (Straub & Ang, 2011) required to create solution design knowledge to improve collaborative DSPs in the public health arena.

1.7. Expected Contributions to Research

There is limited research in the IS literature that looks specifically at solution design knowledge focusing on the collective use of public collaborative technologies within associated and emergent ecosystems (de Reuver et al., 2018; Ostrom, Parasuraman, Bowen, Patrício, & Voss, 2015). This is important at a supraorganisational level given there are limited incentives (such as organisational roles and/or financial), to motivate collective engagement with such collaborative technologies. The DSR literature remains unclear as to how the architecture of DSPs and their particular configuration of DSP features may enhance public service connectivity, coordination and collaboration at this level, given that these qualities must be delivered in the context of an associated service ecosystem. Much of the extant IS research focuses on the technological artefact, ignoring the fact that DSPs are more than the sum of their technical parts. DSPs cannot be determined in isolation from their associated ecosystems since it is this whole, the DSP and its associated ecosystem, that delivers the solution to the problem space. To address this perceived research gap, the present study has a particular focus on how design and architectural configurational choice shapes and is shaped by ecosystem emergence.

1.8. Expected Contributions to Practice

The rising ubiquitousness of digitalisation and the ease of connectivity and collaboration generated from social media technologies has led to a strong desire within the public sector to reap collaborative digital benefits. This bears relevance given that the public sector delivering a public good is more dependent on information sharing and collaboration than is the for-profit sector. However, there is limited evidence of sector-wide collaborative digital tools in these environments, which suggests that innovations in digital collaboration technologies have not fully made the transition to practice in these contexts. Equally, there is less evidence of any developed understanding of the challenges and constraints in the use of such sector-wide collaborative tools. Within the participatory design-build-evaluate DSR process, the expected

contribution to practice here is to provide a greater understanding of these challenges and constraints and thus provide practical solutions to certain identified problems. The design, use and evaluation of an instantiation to generate design principles is expected to advance our solution design knowledge base and enable practitioners to address collaborative requirements more readily at this level. From a practical perspective, established design principles and further design theorising provide knowledge that helps to reduce the trial and error process needed to generate PHC collaboration and interaction when using DSPs at this level.

1.9. DSR Method and Process

This section provides a brief overview of the chosen DSR method. The choice of DSR process is also important as the method must align with the research context and research objectives in order to optimise the outcomes of the research. A more detailed description is presented in Chapter 3, Research Methodology. The current research is operationalised through DSR methodology by means of a participative action design research (PADR) DSR process method. This is bounded within a longitudinal case study implemented over five PADR phases, as illustrated in Table 1. The research process was initiated with a discussion on PHC sector coordination and collaboration problems and the potential of suitable information and communication technologies to facilitate this coordination and collaboration at a supraorganisational level. This is then followed by a review and contextualisation of the literature and research on the PHC sector, PHC collaboration challenges, DSR, DSPs, affordance theory and S-D Logic, followed by the development of a framework for the study. The case study site was identified and relevant data collection methods for the purposes of participatory design formulated. Exploratory problem identification data was collected over five focus group interviews. Analysis of this data was informed by the participatory design process and the literature to generate digital collaborative value propositions in the sector that then informed the digital design propositions. The build and configuration of an instantiation was based on the design propositions. The design was enhanced and refined, and then validated iteratively, over an extended period (eight months) of participatory instantiation use within a PHC supraorganisational working system, referred to as a primary care partnership (PCP). Following this, 16 in-depth, semi structured interviews, framed by affordance theory, took place with

participants to summatively assess the usefulness and fitness of the artefact over the evaluation period. The design principles were then abstracted and developed. While design usefulness, considered from a means–end perspective (Kuechler & Vaishnavi, 2008; Peffers, Tuunanen, Rothenberger, & Chatterjee, 2007) was established (the instantiation and its configuration could realise the design propositions in a real world, real time, working configuration in that the design and configuration of the artefact could support collaboration at that level), the design fitness in terms of the viability of the DSP's ecosystem was not fully established. Design fitness (Gill & Hevner, 2013) refers to the artefact's ability to evolve over time, whereas usefulness is focused on the immediate realisation of the instantiation's objectives. Fitness determines the artefact's ability to adapt and respond to challenges as it evolves. While platforms are, by definition, malleable artefacts, evaluating for fitness, as well as usefulness is required in complex sociotechnical environments especially when dealing with the emergence of immature platforms and their associated ecosystems.

Reflections and learnings from this evaluation phase were fed into a participatory analysis prompted by the PADR DSR process method. This generated artefact-independent solution design knowledge, described in Chapter 7, from which a revised set of design principles was abstracted. The details of these methodological processes are further documented in Chapter 3.

The following table outlines the DSR schema for the study.

Table 1: Thesis DSR Design

DSR Process method: Participatory Action Design Research (PADR)		
Phases 1 & 2 Problem defining and objective-setting. Artefact dependent solution design knowledge		Research instruments
PADR process: Diagnosing and problem formulation	Project problem space: identification of the research problem and related factors. Factors impacting on design of an artefact that realise the creation and co-creation of PHC service value at a supraorganisational level. The problem is more complex than suggested by its technical or informational aspects. It also involves the industry and organisational complexity of PHC structures and any possible action opportunities for PHC actors to interact across geographical constraints with limited information visibility and network access.	Participatory: focus group interviews: Identify factors that impact on greater coordination and interaction at a supraorganisational level. Identify and operationalise constructs that will help in the identification of requirements. Research background study: identification of existing descriptive theory that can

PADR process: Action planning	**Requirement criteria and objectives of a solution:** the functional features of the DSP are identified through the integration of kernel theory regarding service provision and social media affordances and participatory feedback in the form of the focus groups. These functional features are derived from the participatively developed design propositions, communicated by means of the CIMO-Logic.	inform the design solution: Kernel Theory (S-D Logic). Identification of social media affordances. **Requirements analysis:** Participatory: focus group interviews. Factors impacting on design of an artefact that realises the creation and co-creation of PHC collaborative service value at a supraorganisational level.
Phase 3. Design and Development. Artefact dependent solution design knowledge		
PADR process: Action taking	**Physical solution entity:** the design propositions inform the construction of an instantiation. The instantiation is constructed as part of the research project and various service providers collaborate to produce the instantiation. The instantiation is called SALUS, after the Roman god of welfare. The instantiation is available to partners via a website (www.salus.org). The instantiation allows for the entering and searching for data in different ways. Users can connect, access and share information and expertise by exploring various options. Users may explore different datasets in different ways.	**Participatory construction of the instantiation:** Collective interaction impacts need to be participatively examined across the design and evaluation phases of the DSR/PADR process. This is of especial relevance when looking to develop research outputs in complex social settings (Lee & Baskerville, 2012). Evidences the link between justificatory knowledge/kernel theory and technical design.
Phase 4. Evaluation. Artefact dependent solution design knowledge		
PADR process: Evaluation	**Usefulness:** the evaluation of the artefact is conducted by means of an 8-month validation process capped by 16 semi-structured, in-depth interviews conducted with users. The semi structured interviews were informed by the affordance framework. The first set of design principles are abstracted as a result.	**Evaluation via affordance theory:** Semi structured interviews.
Phase 5. Artefact-independent solution design knowledge.		
PADR process: Participatory reflection and learning	**Fitness:** Further to the identified affordances that serve to validate usefulness, participatory reflection considered the evolution of the DSP's emergent ecosystem based on identified constraints and opportunities. Opportunities, challenges and constraints were identified that provided insights into the effects use of the DSP had and further solution design knowledge (non-artefact-centred) is generated. Professional social identity and collective affordances and	**Interpretation of findings/results:** Semi structured interviews. Participant/researcher analysis.

	their interconnectedness are identified. This presents a framework for a deeper understanding of the collective dynamic underpinning the emergent ecosystem. A revised set of design principles are communicated.	

1.10. Research Delimitations

The research was limited in terms of its geographic and temporal restrictions. The design artefact was developed from a single case study site over a four-year period. However, the case study site included a supraorganisational PHC network that represented multiple PHC actors, both at the funding and governance level and at a service provider level. The research period allowed only one iteration of the design cycle, although this design cycle incorporated several iterations in the build and an 8-month participative, evaluation process followed by a secondary reflection. This provided a reasonable scope to attain the immediate research objectives. Table 2 illustrates the scope of this research. While the research makes no claim of significance beyond the scope of delimitation evidenced in Table 2, the research artefact provides solution design knowledge to assist with digital coordination and collaboration at a public, supraorganisational level which may be applicable in other contexts. The unit of analysis is collective digital coordination and collaboration at a supraorganisational level in the public domain.

Table 2: Research Scope Delimitations

Scope of research	Delimitation
Design and development	
Domain	Public digital coordination and collaboration.
Challenges and problem	The lack of sector-wide collaboration and lack of sector-specific digital tools that could serve to facilitate supraorganisational coordination and collaboration in this public space.
Reference theory	S-D Logic, affordance theory.
Digital collaboration reference	Social media platform design and social media affordances.
Evaluation	
Industry	PHC within a public health context.
Case study supraorganisational site	Primary care partnership (PCP).
Case study actors	Government and funders (state/local govt)/primary health care service providers.

Location	Melbourne, Australia.
Evaluation	Sociotechnical focus, formative and summative, primarily naturalistic. Fitness (has a broader applicability) and usefulness (the artefact works as intended), is explored via affordance theory, an appropriate sociotechnical evaluation tool (see Chapter 6).

1.11. Outline of the Thesis Chapters

This thesis research is structured as follows:

In **Chapter 1** the background and motivation for the research is provided. The research problem and the research questions are presented as are the justifications for the research. DSR and the DSR process method are presented. Key definitions are also provided. The thesis structure (relationship between chapters) is also presented.

In **Chapter 2,** the research background identifies and articulates the key constructs used in the study. The chapter explores extant research in the literature and identifies the knowledge gap to further justify the research problem. The kernel theory of S-D Logic is identified and used to help develop design theory. Social media affordances and their relevance to the design problem are evaluated. The affordance lens which is used as a formative and summative evaluation tool is examined.

Chapter 3 introduces DSR and explores the DSR discourse giving rise to and justifying the research method. The sociotechnical focus and the causal requirement to understand the structures and mechanisms that generate outcomes grounds the research in the philosophical domain of Critical Realism (CR). DSR theorising, the generation of solution design knowledge and the research phases as identified in the PADR design science literature (Venable, Pries-Heje, & Baskerville, 2017), are presented. A case study site is identified to contextually develop the research artefact.

Chapter 4 presents the case study and case study analysis, which serves to frame the DSR project. Case studies are indicated for studies where research and theory are emerging (Benbasat et al., 1987). The chapter presents the case study description and the participatively-derived design propositions and functional requirements for the proposed instantiation. This represents the first part of the specification of a set of requirements identified to realise the

digital value propositions of practitioners for a collaborative DSP. The second part of the requirements are developed from S-D Logic, reflecting service value as the basis of exchange (Vargo & Lusch, 2004). These S-D Logic-derived requirements are integrated with literature-derived social media affordances that form the design's incentive mechanisms that will develop the associated ecosystem. These requirements are further developed in Chapter 5, where they are integrated and abstracted (with the participatory-derived requirements) to define the design propositions. The instantiation's functions are then described.

Chapter 5 elaborates on the artefact design and instantiation build processes. Design propositions are developed based on the exploratory research and supported by justificatory knowledge from the literature and professional experience and expertise. Architectural configuration choices and features are described and justified, and the instantiation system design is presented.

Chapter 6 presents the evaluation phase of the study, where the operationalisation of the instantiation is evaluated. This is a significant function in DSR (Hevner & Chatterjee, 2010). These evaluation outcomes are codified in the form of an initial set of design principles. This serves to answer research question one.

Chapter 7 discusses the evaluation outcomes in terms of PADR phase five, reflection and learning, specifically in terms of how the research achieved the research objectives and considerations arising from these evaluation findings. The research discusses the instantiation's fitness through the analytical lens of affordance theory and in terms of Ofe's (2018) three main orchestration challenges for emergent DP ecosystem evolution: creating and capturing value; attracting users and generating network effects; and governance and coordination). An explanatory framework explaining the evaluation outcomes is offered. This participatory reflection and learning adds to the solution design knowledge base. This additional knowledge prompts a review of the design principles leading to the development of a revised set.

Chapter 8 summarises the study's findings by presenting the conclusions for the research questions. Finally, limitations of the research and directions for future research are discussed.

1.12 Outline

Figure 2 below illustrates an outline of the thesis and a diagrammatic representation of the relationship between the chapters.

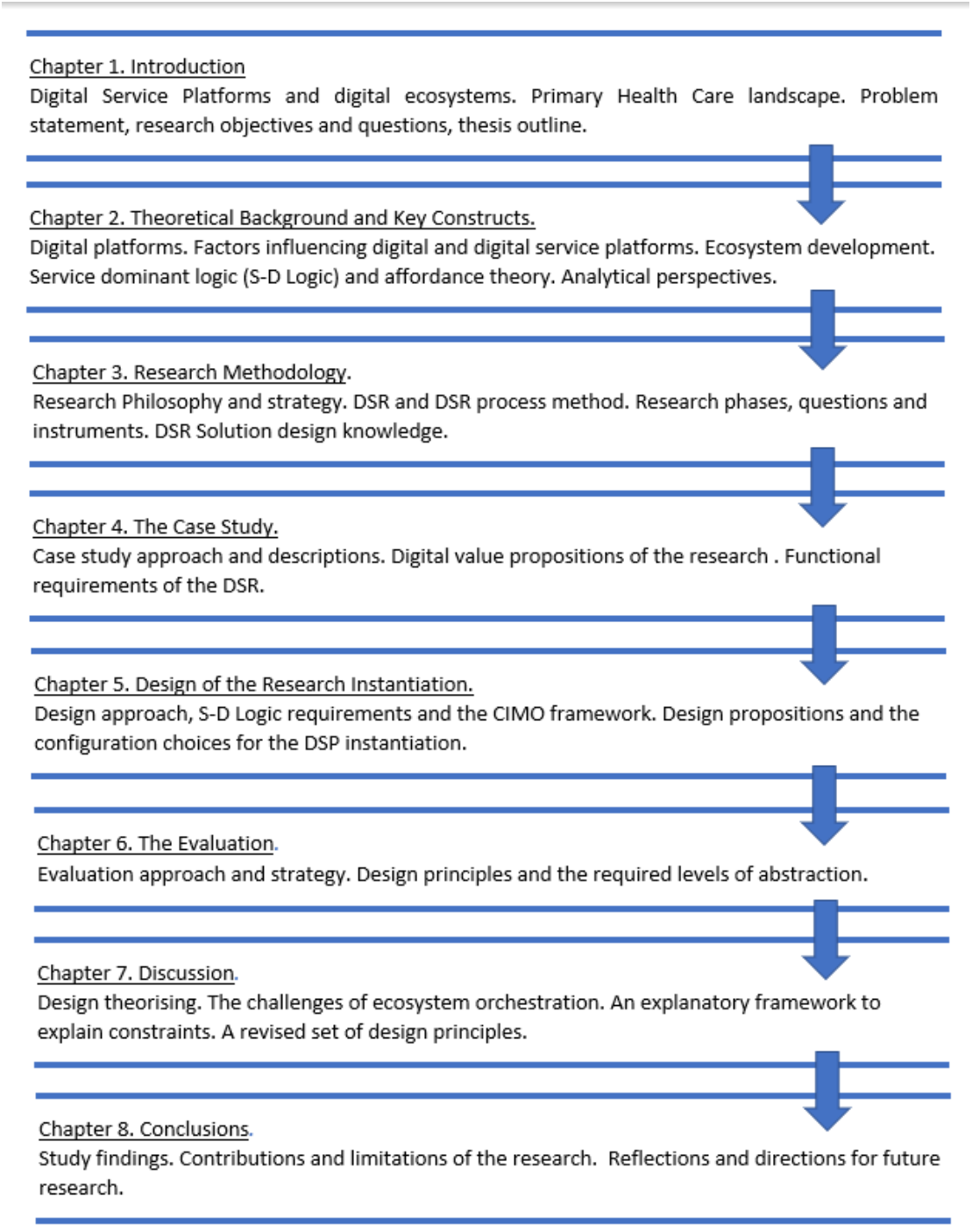

Figure 2: Outline of the Thesis

1.13. Chapter Summary

Chapter 1 presents a rationale for the overall framework for the thesis. DSPs represent new, digital, collaborative opportunities for sector-wide service integration and delivery in the public domain. The research seeks to address the problem of how to design for and understand digital collaboration and thus collaborative service value creation in the PHC sector at a supraorganisational level. This introductory chapter articulates the research problem, the context and the significance of the research for a greater overall understanding of the research environment, leading to the presentation of the research questions. The introductory chapter posits an initial justification of the research approach and method and suggests where the study might offer a contribution. A breakdown of subsequent chapters of the thesis and their relationships is given.

Chapter 2: Research Background

2.1. Approach and Structure of the Chapter

This study identifies and communicates solution design knowledge (Drechsler & Hevner, 2018) for DSPs that seeks to address a class of supraorganisational coordination and collaboration problems (Markus, Majchrzak, & Gasser, 2002), across the PHC landscape. Chapter 1 identified and elaborated on the research problem and context. This chapter (Chapter 2) presents an extended discussion of the problem context. The key constructs surrounding the challenges and opportunities of the problem are firstly examined, followed by an identification of the research gap. This is then followed by identifying and presenting the research opportunities. Finally, relevant theory which will serve to inform the research opportunities are examined. As such, this chapter has three broad goals: firstly, to provide a background on the primary factors and constructs that impact on the generation of coordinative and collaborative service value in the PHC sector at a supraorganisational level; secondly, to identify the research gap and the research opportunities. Finally, this discussion will identify existing theoretical and analytical constructs from both the academic literature and industry practice that will serve to inform the research opportunities.

More specifically, Chapter 2 is divided into five sections. This first section, 2.1 provides an overview for the chapter. Section 2.2 provides a background on the primary factors and constructs that are seen to impact on the digital generation of coordinative and collaborative value in the PHC sector at this level. Section 2.3 reviews the literature on the technologies that offer potential solutions in realising coordinative and collaborative value in the supraorganisational PHC space (digital platforms (DPs) and DSPs, as this is the practice and research domain of the study). Digital ecosystems are explored as the establishment and development of such ecosystems is critical to the collective interaction required to give rise to greater coordination and collaboration in this context. The delivery of PHC coordinative and collaborative value via digital means requires a careful consideration of how the design and subsequent use of the technology (DSP) will lead to the establishment and development of an associated ecosystem. Section 2.4 elaborates on the research gap generated by this review, prompting the consolidation of research opportunities. Section 2.5 turns to the theoretical background that will underpin the exploitation of the research opportunities; specifically, the

kernel theory that serves to inform design, S-D Logic, social media affordances and affordance theory, which are examined. Here the theory of S-D Logic is presented and its contribution to the development of the primary research artefact is stated: that is, the design principles. The integration of SD-Logic, where service is seen as the dominant form of exchange, with the affordances framework, offers a sociotechnical perspective and also gives a deeper and richer insight in the design and development of the artefact. The objective of digitally generating coordinative and collaborative value at a supraorganisational level (in the form of information sharing, service delivery coordination and the integration of resources) points the study towards extant research on technology affordances in both social media research and communication theory (where social media platforms digitally connect and integrate resources for users). This combined research review will serve to inform our empirical research on requirements, design and evaluation. Finally, section 2.6 gives a summary of the theoretical and analytical perspectives addressed in the chapter.

2.2. Key Constructs of the Research

As an introduction to the chapter, Figure 3 below presents a schema of the key theoretical and analytical constructs used in this study. The study examines how digital tools may be designed to enhance coordination and collaboration in a public arena at a supra organisational level. Thus the DSR methodology and the manner in which it may contribute to knowledge is considered. A participatory build and evaluate program is followed with a focus on the creation of knowledge from these DSR processes since a greater understanding of how these collaborative digital tools may improve coordination and collaboration in this problem space is the focus of this thesis. It is here where researchers may both pragmatically assist practitioners generate greater PHC public service value (in the form of artefact centred solution design knowledge) and contribute to a greater body of knowledge on the subject (in the form of non-artefact centred solution design knowledge). S-D logic and affordance theory is discussed, both in the form of justificatory knowledge and as a tool for analysis. Finally, ecosystem development is discussed, given that a viable and sustainable ecosystem must emerge in order to realise the goals of greater PHC coordination and collaboration at this supra organisational level.

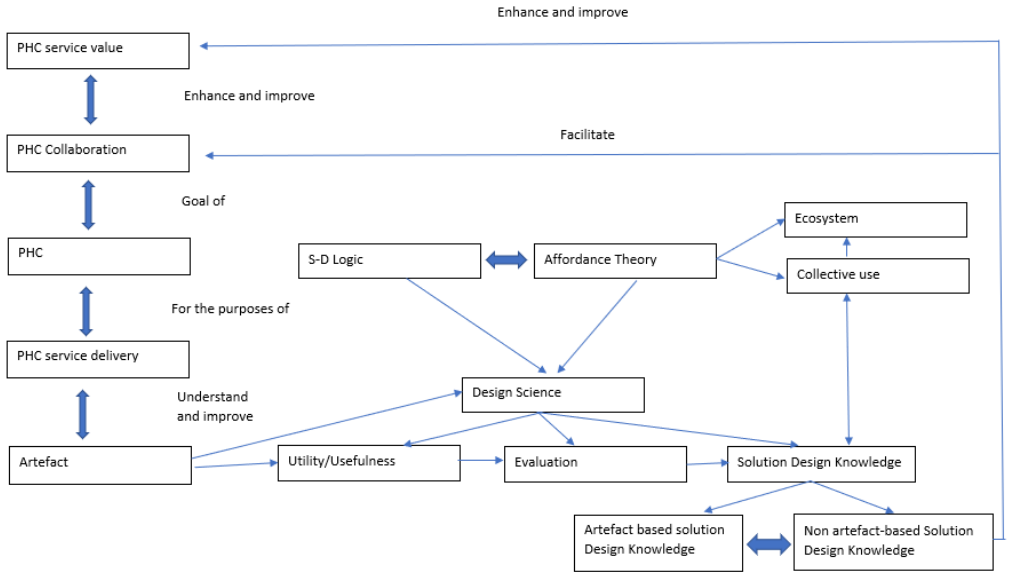

Figure 3: Schema of Key Constructs and their Relationships

2.1.1. PHC (Public) service value and its realisation.

This research background review seeks to develop an understanding of current knowledge and understanding around the digital facilitation of greater connectivity, coordination and collaboration in the public domain. Following on from the introduction to the PHC context in Chapter 1, this section starts with a discussion of the concept of public (service) value. The concept of public value was originally introduced by Moore in his seminal work, "Creating Public Value: Strategic Management in Government," (Moore, 1995). This work identified the role of public managers and elaborated on public value as a balance of efficiency and effectiveness that sought improvements in public values such as engagement, participation and trust. Moore conceived the creation of public value as being a function of value received versus resources expended to produce the service and the costs of consumption (Moore, 1995). According to this public value theory, value is created when public service actors deliver beneficial and efficient service to citizens, the end beneficiaries of the service.

There is a difference between private and public sector value creation (Wilkin, Campbell, & Moore, 2013). The private sector tends to measure and manage value delivered based on cost efficiency, focusing on individual customer preferences. The public sector is required to consider the overall service needs of entire populations or groups. It is characterised by complex, continually shifting ecosystems that involve multiple different stakeholders and

organisations (Pang, Lee, & DeLone, 2014), and has actor expectations that can vary according to need or rapidly changing environments. Public sector organisations are subject to political influence (Wang & Noe, 2010); practice logics vary widely, and there can be a marked difference in organisational goals (Wilkin et al., 2013). Authority is more fragmented. There are substantial differences among public sector organisations based on ownership, funding and control and given this, there is a huge variation in information needs. Further, users of public services are not simply end users they are also citizens who have a values-based interest in the broad direction and outcomes of public services. PHC service value is realised as public value when effective and efficient PHC services are delivered, problems are solved, patients are satisfied and trust in PHC delivery is increased. (Kearns, 2004). PHC service delivery reflects a process of managing and integrating (sometimes competing) values and concepts of the PHC good. Meynhardt, (2009, p. 212) sees public values being established in "evaluations about how basic needs of the individuals, groups and the society as a whole are influenced in relationships involving the public." This evaluation takes place in the public sphere, that "web of values, places, organisations, rules, knowledge, and other cultural resources held in common by people through their everyday commitments and behaviours, and held in trust by government and public institutions" (Benington, 2011), a place that is emergent and continually contested. The public interest, or public good is associated with this public sphere. Creating value has evolved from the traditional hierarchal bureaucratic approach of process and efficiency to one where value is more perceived in a whole-of-government, approach, where value of life, program effectiveness, participation and quality of service are targeted as desirable outcomes of public value (Bryson, Crosby, & Bloomberg, 2014; Luna-Reyes, Picazo-Vela, Luna, & Gil-Garcia, 2016; Stoker, 2006). This means that whereas the private sector seeks collaboration and coordination to create economic value, the public sector uses collaboration and coordination to create social, economic and political value—in other words to deliver a public good from a whole-of-government approach. This manifests itself when public services are seen to address identified public problems.

Given that the public sector is more interconnected and interdependent, greater coordination and collaboration is required to effect public value (O'Flynn, 2007; Stoker, 2006). Public sector officials need to garner resources for a range of objectives and usually need to manage through networks (Stoker, 2006). A common objective here is creating public value by means of

collaboration through networks. Thus public services are increasingly inclined towards a more networked and collaborative approach. This means greater cross-sector collaboration and engagement to address problems and achieve mutually agreed objectives (McGuire, 2006). Referred to as a whole-of-government approach, it is focused on integration and coordination (primarily information integration) to address the fragmented and continually shifting PHC landscape (de Bri & Bannister, 2010) referred to in Chapter 1. The delivery of public services requires public sector actors and organisations to coordinate and collaborate across both vertical and horizontal service delivery (Christensen & Lægreid, 2007). Digitisation, and DPs in particular, offer potential value for achieving greater coordination and collaboration at a cross-sector level. In the public management literature this has been referred to as governmental interorganisational information integration (Gil-Garcia, Pardo, & Burke, 2010), which is defined as a sociotechnical phenomenon with integrated networks, data and infrastructure designed to share information. Collaboration in this literature field has a prominent role for technology.

2.1.2. PHC digitisation, collaboration and the generation of PHC service value.

Perceptions of the role of technological innovations and diffusion in the generation of public value have evolved. Originally seen as a tool to improve organisational process and deliver managerial objectives (Kraemer & King, 2003) regarding efficient resource management (digitalisation of services), technology is now seen as a disruptive force transforming the management of public values and practices in the public sector. The ability to use ICTs to assist with service delivery has become increasingly vital to public health sector professional practice. Digitised products greatly enhance synchronous and asynchronous communication and interaction, which serves to open up and increase opportunities for service integration.

In designing and implementing these technologies, it is critical to understand the service value that DPs can potentially deliver. Service value here stems from realising the affordances of the technology, the capability to facilitate association, information sharing and coordination. With PHC sector actors (organisations, networks and professionals) commonly spread across diverse geographical and organisational locations, online digital technologies can make it easier to connect and collaborate with peers around common challenges and opportunities and to build networks and collaborations that can improve service delivery. Online-enabled connectivity enables greater transparency, a more efficient dissemination of information and an expansion

of end users (Bobsin, Petrini, & Pozzebon, 2018; Fryer & Granger, 2008; Vaccaro & Madsen, 2009). ICTs can generate different kinds of collaborative service value for different actors engaging across organisational, network and sector public service activity. These different forms of service value, generated through coordination and collaboration, can be seen as related to sectoral and organisational goals and specific actor's goals, depending on the technology and the social and organisational context the technology is situated in (Barrett et al., 2016). In the communication literature Barrett et al. (2016), in their study on the creation of value in online communities, identify several forms of value propositions for different stakeholders engaged within an online community DP, namely, financial, service, ethical, epistemic, reputational and platform. These value propositions bear relevance to the potential service value collaboration within a DSP in the PHC sector can bring to bear.

For this study, set in the public sector, financial value holds little relevance; there is no monetary incentive to encourage engagement and interaction. Service value here (Vargo & Lusch, 2004) refers to the benefits from applying or integrating external resources or competencies in service delivery. Ethical value (in terms of the common interest or good) does bear relevance in the form of freely sharing expertise and experience with those who can benefit from that expertise. Epistemic value refers to that value generated and realised when external expertise and experience confirms or supports the validity of one's decisions or activities (Mazanderani, O'Neill, & Powell, 2013). Reputational value bears relevance to the increased legitimacy and confidence that arises from collaboration with greater expertise and experience. Platform value refers to the ongoing generation and expansion of these different kinds of value as the digital capabilities and the collaboration opportunities increase as a result of the growth or scaling of the technical system (Ceccagnoli, Forman, Huang, & Wu, 2012).

2.2. The Digital Means

In this section the review turns to the technological background of the research. The development of the internet and integrated social media has allowed for the provision of public services online, greater digital interaction and interoperability within the public sphere and more transparency. Critically, this has created the opportunity for interaction with a greater range of societal actors (Dawes & Helbig, 2010; Pollitt & Bouckaert, 2011). Digital innovations such as participatory digital platforms, crowdsourcing technologies, sensors, big and open data

and smart devices have led to continuous digital interaction and new, digital cooperative spaces that are actively transforming practice in public service, advancing the expansion of actor-to-actor networks beyond geographical and organisational boundaries. Within the public sector, IS can enable distributed actors to more readily exchange and integrate resources in broader, multi-actor networks. In the current siloed and fragmented ecosystem of PHC, such a digital capability will allow actors to connect and integrate resources, where the use of these resources can improve competence and problem solving, leading to the creation and co-creation of PHC service value (better addressing specific public health problems). Digital technologies may allow economic and social actors in the PHC sphere to more readily create this value (exchange and integrate information-centric resources to address problems) in multi-actor settings and across organisational boundaries (Breidbach & Maglio, 2016).

2.2.1. Digital platforms (DPs).

Digital platforms, utilising collaborative web-based technologies, offer innovative and beneficial new ways for organisations and individuals to search and combine external knowledge in an effort to create useful approaches and solutions to PHC problems. In this sense they enable individuals and organisations to use external knowledge to address problems they cannot address completely internally (Jeppesen & Lakhani, 2010). This is done in a shared space beyond the organisation's boundaries. PHC actors may leverage digital technologies to improve the way they connect, communicate and share resources with other stakeholders across the PHC ecosystem (Jacobides, Cennamo, & Gawer, 2018). Within this process of digitalisation DPs, and their ecosystems have emerged as key enablers for organisations and networks to generate service value from greater connectivity, collaboration and distributed knowledge (Sedera, Lokuge, Grover, Sarker, & Sarker, 2016), in that they allow for users to coordinate and cooperate with their external environment for ideas and engagement (Hossain & Lassen, 2017). This ability to store, make and interact with data across systems, devices and networks has become easier. Digital platforms allow for many-to-many interactions, moving from the limitations of co-located, dyadic service encounters to networked service ecosystems. Public value is created when this information and knowledge is integrated into the decision-making process that underpins effective and efficient public service delivery, i.e., the addressing of PHC organisational problems.

DPs are variously conceptualised and defined in the literature (Costa, Soares, & de Sousa, 2019; de Reuver, Sørensen, & Basole, 2018; Sun, Gregor, & Keating, 2015). Commonalities of definition revolve loosely around DPs serving as intermediaries. Broadly speaking, DPs are either considered from the technical aspect (Ghazawneh & Henfridsson, 2015; Tiwana, Konsynski, & Bush, 2010) or from a sociotechnical point of view (Tilson, Lyytinen, & Sørensen, 2010). Within IS, De Reuver et al. (2018) identified two broad conceptualisations of digital platforms, seeing them as either purely technical artefacts, "the extensible codebase of a software-based system that provides core functionality shared by the modules that interoperate with it and the interface through which they operate" (Tiwana et al., 2010) or, as sociotechnical ecosystems that comprise both the technical elements of hardware and software (technology, associated organisational processes and stakeholder management) and the standards within which the digital platform operates (Tilson et al., 2010; Tilson, Sørensen, & Lyytinen, 2013). The research agenda for digital platforms in IS, as promoted by de Reuver (2018), notes the burgeoning body of research on digital platform concepts and dynamics from outside the IS discipline. Digital platforms contribute to digital transformation across industries in no small manner and have attracted extensive research interest from outside the IS discipline (Spagnoletti et al., 2015). The result is an expanding body of research on digital platform concepts and dynamics from outside the IS discipline.

This research adopts the Spagnoletti et al. (2015) definition of a DP in this context as a complex, emergent, network of technology, processes, individuals, networks and organisations that seek to collectively address shared problems (Spagnoletti & Resca, 2012; Tiwana, 2013). DPs enable users to collaborate and interact with one another virtually, in the pursuit of common goals (Barrett et al., 2016; Faraj, Jarvenpaa, & Majchrzak, 2011; Spagnoletti et al., 2015; Tiwana, 2013). Fundamentally, a DP is a digital architecture that is designed to orchestrate interaction(s) between users taking advantage of an existing digital infrastructure. Data is collected, managed and presented by means of interfaces in a manner that seeks to steer user connectivity and interaction. A DP can therefore be described as an endeavour that enables the generation of value to participants through user interaction (Belleflamme & Peitz, 2018; Lusch & Nambisan, 2015; Tilson et al., 2010) facilitated by the supporting digital infrastructure. Networks and multi-actor assemblages that leverage DPs have the capacity to create value through the coordination of exchanges (Jones, Hesterly, & Borgatti, 1997), enhancing

individual and collective performance through knowledge integration and sharing and the development of the capacity for learning, thereby advancing effective problem solving. Digital platforms that facilitate service value creation networks, referred to as DSPs, present new opportunities for service by making it possible to connect and share knowledge on a much wider scale. (Dinant, Floch, Vilarinho, & Oliveira, 2017). With greater user connectivity and interaction, DSPs support interorganisational communication, create and manage knowledge and support online communities by facilitating information sharing, coordination and collaboration (Carneiro, Soares, Patrício, Azevedo, & Pinho de Sousa, 2013; Costa, Soares, & de Sousa, 2016; de Reuver et al., 2018; Spagnoletti et al., 2015).

DSPs in the public sector are primarily a variant of DPs, where complementary goods and services are perceived to offer more value co-jointly, than separately, and where the DSP can serve as a vehicle for the orchestration of service value creation and co-creation in a given public service ecosystem. When public actors integrate shared knowledge into their own context, so as to deliver an improved public service, then public value is created. Digital service platforms (DSPs) are therefore a variant of DPs that allow users to interact in a manner that develops and promotes service relationships and interaction (Dhanaraj & Parkhe, 2006; Teece, 2007).

2.2.2. Digital service platforms (DSPs).

A public DSP is a digital address where individual and interdependent resource offerings integrate to deliver public value in the form of more efficient service delivery. DSPs are designed specifically to facilitate the creation of value in service ecosystems. They are technologies that focus on end users as creators of service value (Lusch & Nambisan, 2015), and that utilise various service components and interactivity to mediate, orchestrate and encourage users to generate and capture innovative and coordinative-based service value (Barrett, Davidson, Prabhu, & Vargo, 2015). Collaborative coordinated interaction among DSP users may create service value in that it can generate greater overall efficiencies (lowers the learning and knowledge acquisition curve), leading to more effective problem-solving and more integrated public service delivery. In supporting greater sector visibility, connectivity and interactivity in complex public ecosystems, a DSP can connect needs with resources as it connects users across time and space. In this context, the role of a DSP can be seen to have a

network-centric, information-centric and value-centric focus as opposed to being a tangible good or product (Gawer & Cusumano, 2014; Nambisan & Sawhney, 2011). A DSP is specific to a given service ecosystem, designed to allow service exchanges within that service ecosystem, where service is defined as, "the application of specialised competences (knowledge and skills) through deeds, processes, and performances for the benefit of another entity or the entity itself" (Vargo & Lusch, 2008, p. 26) . DSPs can facilitate the exchange and integration of services by multiple actors beyond their given organisational, spatial and temporal boundaries (Breidbach & Maglio, 2016; Lusch & Nambisan, 2015). This greater reach of service exchange within a service ecosystem (improving and extending relationships and resource sharing), leverages service innovation (Cronholm & Göbel, 2016). DSPs can provide for greater collective action, which is core to collaboration (Gulati, Puranam, & Tushman, 2012; Nurdin, Stockdale, & Scheepers, 2014). DSPs have also enabled the broadening out of collective action value generation from an organisational focus to a larger ecosystem of complementors and beneficiaries (Hein, Schreieck, et al., 2019) across sectors. Digital collaboration capabilities such as those presented by DSPs offer sectors such as the PHC sector new collaborative service value propositions in terms of expanding user networks and generating greater connectivity across the larger ecosystem.

But creating digital PHC service value is neither easy or simple; it depends on the design and development of a DSP ecosystem that can orchestrate collective action across a wide, complex ecosystem of known and unknown stakeholders who all have varying objectives. The generation of collaborative service value is dependent on the creation of a viable platform ecosystem where users engage and interact to share experience and expertise. This platform ecosystem will be managed or orchestrated through recursive interaction between actors and their goals, existing structures, available technology and required tasks (Bostrom & Heinen, 1977), and thus across the sector as a whole (Dremel, Herterich, Wulf, & Vom Brocke, 2020).

2.2.3. Digital ecosystems.

The concept of an ecosystem (Tansley, 1935) has been adopted and applied in a number of settings, including in business and innovation (Adner & Kapoor, 2010; Moore, 1993), where interaction and competition is shaped by the business landscape within which actors operate. A business ecosystem is thus the broad context within which actors cooperate, innovate and

compete for resources distributed and regulated within that context (Moore, 1993). Actors are dependent on each other and the whole to interact sustainably. Ecosystems can be evaluated from the market perspective where they are seen as multifaceted markets mediated by the technology and where value is generated from the sheer number of actors participating in the ecosystem (e.g., Uber). Or they can be seen from an organisational perspective (Teece, 2007) as loosely connected networks of suppliers, distributers, clients, all operating within an ecosystem of constituting institutions, that is, the environment external to the organisation. In this context, the creation of value requires an interdependence that needs to be aligned as efficiently as possible.

In any IS, the technology perspective centralises the digital tool in the creation of value in ecosystems and foregrounds the power of technology (Ghazawneh & Henfridsson, 2015). Ecosystems in IS are generally linked to platforms, seen as new forms of organising for the creation of value (Gawer & Cusumano, 2014; Henfridsson, Nandhakumar, Scarbrough, & Panourgias, 2018; Tiwana, 2015). Here digital platforms connect and organise a community of interacting actors (actor-to-actor networks) and shared resources within a given context for the purposes of generating value for all. To achieve this, actors need to be able to collaborate with relative ease and there needs to be a shared understanding of resources and how they can be integrated to generate value (Lusch & Nambisan, 2015). The architecture of the digital platform is therefore specifically configured to facilitate interaction and coordination of actors.

2.2.4. Platform-based service ecosystems.

A digital platform ecosystem is the collection of users and stakeholders that forms around the platform technology with a shared view of the value creation that the platform ecosystem is designed to generate (de Reuver et al., 2018; Spagnoletti et al., 2015). Across industries, users and stakeholders can exhibit diverse needs, goals and perceptions of value. DSPs may be designed or configured to orchestrate new, or shape existing service ecosystems for the purposes of mediating the realisation of users' goals and objectives. Service platforms or digital service ecosystems, are conceived as networks and communities of actors, interacting through digital means, that serve to facilitate (service) exchange and who create and capture service value (Lütjen, Schultz, Tietze, & Urmetzer, 2019) as a result of that exchange. The ecosystem is represented by this integrated and entwined relationship between technology, actors,

context and value. The architectural configuration of the platform must present actors with the possibility of realising collaborative service value propositions to attract and enable users to interact and exchange resources (Jacobides et al., 2018), thereby capturing value across these diverse needs and goals.

DPs and DSPs can expand horizontally, in that they offer resources across organisations (Nambisan, Lyytinen, Majchrzak, & Song, 2017; Yoo, Boland Jr, Lyytinen, & Majchrzak, 2012), bridging traditional organisational boundaries and either forming new ecosystems or shaping existing ones. Platform ecosystems in public service-orientated sectors are relatively novel in the IS literature; in the PHC sector such a system would reference the funders, service providers and end users who coordinate to create, deliver and use PHC services, and in doing so, add value (Huang, Fan, & Tan, 2014; Papazoglou & Van Den Heuvel, 2006). In this context, the ongoing exchange of services and integration of resources between different actors (Benedict, 2018) is facilitated by a technical structure, the DP or DSP, which must be conducive to a decentralised and self-organised ecosystem (Guggenberger, Möller, Haarhaus, Gür, & Otto, 2020). DSPs in the public sector manage complementary services that offer more value co-jointly, than separately, where the DSP serves as a vehicle for the orchestration of this value co-creation (Jones et al., 1997). Where actors integrate shared knowledge into their own context, so as to better deliver a public service, then public service value is co-created in the form of a public good (Barrett et al., 2016). A common denominator of DSPs in service industries is that they enable a many-sided service facility that seeks to take advantage of network capabilities (Smedlund, Lindblom, & Mitronen, 2018) as they orchestrate (Teece, 2007) relationships, activities and value exchanges among that community of actors or end users. DSPs are dependent on these actors to realise the DSP's value proposition (Teece, 2018), generating interdependencies between platform and actors and actors and actors. Value-generating ecosystems consist of three structural elements (Adner, 2017; Kapoor, 2018), architectures, actors and activities. Actors are complementors who engage in activities, such as the provision and exchange of services, in order to contribute to a platform's value proposition. Actors interact with each other, through the medium of the platform, in activities that generate value. The architecture is the technical infrastructure that facilitates the exchange (activities) between actors (Hein, Schreieck, et al., 2019).

The term orchestration refers to a purposeful process designed to both create and extract value from a network (Dhanaraj & Parkhe, 2006). Orchestration processes are those processes and activities facilitated by the DSP's architecture and governance configurations designed to achieve DSP user goals and objectives. As such, the sociotechnical lens of affordance theory is a suitable lens to explore orchestration processes. Multiple actors, engaging in activities pursuant to their diverse goals, fuel digital generativity (affordances), along with the degree of architectural openness of the DSP (Nambisan, Wright, & Feldman, 2019). An open platform architecture associated with a large, independent and diverse number of users will prompt further opportunities for cooperation and coordination, thus fuelling ongoing generativity (affordances) in a DSP ecosystem.

Orchestration activities are invariably grouped around three ecosystem challenges, that of the generation and capture of value, attracting users (network effects) and control and coordination (Hein, Soto Setzke, Hermes, & Weking, 2019; Ofe, 2018). In the matter of attracting users, DSPs may be designed and configured to orchestrate specific network relationships (Smedlund, Lindblom, & Mitronen, 2018) that attract and enable users to generate and capture value through interactions that exchange services. Attracting more and diverse users is key to triggering network effects (Evans & Schmalensee, 2010). The value proposition of the platform is critically associated with the numbers of actors engaged with the platform, since the size of the user base impacts network effects (Tiwana, 2015). Network effects may reflect a two-sided or cross-sided effect or a one-sided or same-sided effect (Katz & Shapiro, 1985). A cross-sided network effect is achieved when all sides generate value from an increase in the user base. For example, the more drivers in the Uber ecosystem, the greater the coverage, the greater the economies and opportunities for ride seekers, which generates more ride seekers which in turn generates greater value for the company. Same-side network effects occur when an increase in users on one side of the platform encourages further users to enrol (Katz & Shapiro, 1985). Capturing and realising value is the primary goal of digital ecosystem orchestration. Actors will create and realise value by leveraging the architecture to offer and capture value (Adner & Kapoor, 2010). The appropriate configuration of the architecture is critical to the realisation of value in that ecosystem—it provides the means and the rules by which actors coordinate and exchange resources (Jacobides, Knudsen, & Augier, 2006). Governance of a platform ecosystem may involve both explicit rules (Tiwana, 2013)

governing enrolment, performance and even restrictions on interaction and content (Ghazawneh & Henfridsson, 2013), and informal governance mechanisms such as aligning goals and generating shared worldviews or common frames of understanding. Coordination within an ecosystem is facilitated by the architecture of the platform and how well it facilitates interaction and allows integration of resources (Tiwana, 2015).

The above review has explored key constructs that impact on the challenges and opportunities of the problem context. The next section addresses the research gap in the academic literature that justifies the research problem.

2.3. Development of the Research Gap

The research problem has already been identified in Chapter 1. The following sections discuss the key lacunas and challenges in current research that have suggested the current research opportunity and suggests how the study might address those challenges.

2.3.1. The technocentric focus.

How technologies and their ecosystems can be designed, configured and governed to facilitate supraorganisational collaboration has been neglected on a number of levels in IS research. Firstly, despite the evident applicability of DSPs to the PHC sector and its service delivery requirements, there is limited knowledge in the extant literature as how to design, configure and evaluate DSP technologies to generate and sustain interaction and coordination in complex sociotechnical ecosystems (de Reuver et al., 2018) at a supraorganisational, public level. Traditional IS design theory tends to be technocentric and does not adequately consider the longer-term, broader interactive processes that take place in such cross-sector, online collaborative ecosystems (Huysman & Wulf, 2006; Mingers, 2004; Walls, Widermeyer, & El Sawy, 2004). In DSR evaluation processes the evaluation of an artefact's technical aspects tends to dominate, with limited evaluation of associated organisational impact. This is especially relevant where the fitness of technical artefacts is determined in terms of social interaction, such as where user interaction in platform ecosystems is required. It also applies where governance or management factors play a dominant role in platform viability, as in the case of emergent, immature platforms which have yet to develop a viable user base. Overall, there has been limited consideration of the human, social and organisational challenges and

opportunities that may advance our understanding of the dynamics of effective DSP design and development in this sector. At a supraorganisational level in the PHC sector, fragmented governance and operational structures and diverse individual, organisational and sector collaborative requirements complicate the effective use and viability of collaborative digital technologies to support service delivery objectives. In such a fragmented field, the utility and fitness of any collaborative DSP will always be impacted by human agency, interactivity and organisational relationships.

As such, any potential platform design seeking to generate collaboration in PHC needs to be studied in terms of such interaction within the broader social, organisational and institutional ecosystem it is to inhabit. The DSP has to be designed, developed, and embedded in a context that is shaped by people (De Leoz & Petter, 2018; Orlikowski & Iacono, 2001). Any such design is required to facilitate not only the interaction between technology and users but must also account for interaction between involved actors within that technology. Any design theory output must acknowledge the sociotechnical design challenges implicit in the PRC supraorganisational, public context (Carlsson, Henningsson, Hrastinski, & Keller, 2011).

A key contribution of this study is the use of affordance theory (Leonardi, 2013; Pozzi, Pigni, & Vitari, 2014; Strong et al., 2014; Volkoff & Strong, 2017) to explore a particular sociotechnical ecosystem. The affordance lens is more fully examined later in this chapter but it allows researchers to integrate technical, interorganisational, social and contextual perspectives in building a DSP design and, because of its greater explanatory power, it holds the promise of illuminating unexplored DSP platform ecosystem processes. Affordances are defined as action possibilities arising out of the relationships between technology, users, and the environment (Pozzi et al., 2014). This relational nature of the affordance lens makes it a suitable lens to explore the relationship between the technology and the user and also to understand how emerging relationships and interdependencies between users and between users and context impacts on DSP design and ecosystem development. By asking the questions “What possibilities does this technology offer in this context?” and, “What can you do with this technology in this context?”, use of affordance theory enables the study to identify and evaluate the collaborative service value propositions afforded to users in the PHC sector (Anderson & Robey, 2017; Leonardi & Treem, 2012). Affordance theory may generate specific design knowledge around the challenges and constraints of both DSP design and the resulting

ability to establish an emergent ecosystem. By addressing and integrating these perspectives this research will enable better configuration of DSPs, to ultimately develop and establish an ecosystem tailored to the service objectives of the sector.

2.3.2. The commercial focus.

Secondly, it is notable that compared to commercial research on DPs, research on how DSPs can support the establishment and development of a DSP within the public sector remains sparse (Provan, Fish, & Sydow, 2007). Prior DP research has focused primarily on platform technologies in the commercial sector, where value capture is underpinned by monetary considerations and where ownership of the platform is heavily skewed towards power centralisation. Further, a great deal of extent research evaluates DPs within developed and mature ecosystems (Eaton, Elaluf-Calderwood, Sorensen, & Yoo, 2015; Gawer & Cusumano, 2014; Ghazawneh & Henfridsson, 2015), where the platform provider exercises considerable control over the nature of platform interactions (Jacobides et al., 2018). There is less research that looks at developing DP configurations in decentralised models, where there is limited control over platform interactions, as at the supraorganisational level. As discussed earlier in this chapter, existing design theory does not address how public collaborative value differs from commercial value for the purposes of DSPs. Little is known about the design potential of DSPs in enhancing or constraining collaborative public service value at a supraorganisational level (Osborne, Radnor, & Strokosch, 2016). We lack a proper understanding of how digitally enabled PHC collaborative value, in terms of resource integration and knowledge-sharing, may be realised and consequently, how design of a DSP could capture this value. Consequently, the PHC field has been relatively ignored in terms of IS design and configuration. There is currently a lack of the necessary linkages between that design stage and the establishment (orchestration) of the associated ecosystem(s) necessary to generate service value.

Consequently, to conduct some exploratory research, this study adopts a participatory co-design approach that seeks to link end users with designers and developers to create a situation where practice needs dictate the design and development of the platform and its associated ecosystem. In this manner the study is able to evaluate the nature of PHC practice needs and how they govern platform design, configuration and ecosystem development. The

study will also assess how the platform might impact PHC practice. In this way, DSP design can accommodate and benefit from the perspective of the end user.

2.3.3. The Goods Dominate Logic (G-D Logic) focus.

Thirdly, existing (primarily commercial) DP design theory is primarily based on G-D Logic (Vargo & Lusch, 2004, 2008). However, in a service ecosystem, such as the public PHC sector, it would be more logical to develop design theory based on service value-co-creation, using a service-dominant logic (S-D Logic) perspective (Vargo & Lusch, 2004, 2008) rather than G-D Logic, which is primarily concerned with the production of goods and defines value creation as the exchange of goods. The key premise of S-D Logic is that service exchange is what underpins all value creation (Williams, 2012). Service is seen as specialised knowledge and competencies being applied for the benefit of others (Vargo & Lusch, 2008). S-D Logic is a framework (and kernel theory for design) more suitable to better understand and analyse ways in which economic and social actors recognise and create value in the exchange of services. S-D Logic will allow us to more effectively elevate PHC value creation to suit the expanded network of individuals, organisations and networks that characterise the PHC sector. The creation of design knowledge informed by S-D Logic will enable the study to more optimally configure DSPs and orchestrate (establish and develop) ecosystems to further PHC collaborative value in supraorganisational contexts. This study contributes with a design for the configuration of DSP and its architectural features that will serve to advance service delivery coordination and collaboration at this level.

2.3.4. The individual use focus.

Finally, interaction among DSP users may enhance collaborative service value in that digital interaction itself may generate greater collaborative problem-solving and more integrated PHC service delivery. Much of current research examines DSP design and ecosystem orchestration in terms of the individual user's relationship with the technology (Vaast, Safadi, Lapointe, & Negoita, 2017). Such studies see digital engagement and interaction from the perspective of individuals and their motivation to engage and interact with the technology to realise their personal or organisational goals. Indeed, the application of affordance theory within IS primarily explores the action possibilities arising from the relationship between technology and the individual. But this necessarily limits our understanding of how to optimally design for the

collective use and application of collaborative technologies. The realisation of collaborative value is dependent on users not only interacting with the technology but also with each other. This is relevant at a supraorganisational level where guidance that would advance our understanding around the engagement and use of collaborative technologies at this level is lacking. Here, design is required to account for supraorganisational collective action objectives that are not based on individual or formal organisational roles and goals, but rather aim for a loose, collectively generated set of objectives targeting sector-wide collaboration.

2.3.5. Digital research opportunities for PHC public service coordination and collaboration.

This identification of the research gap in the preceding sections suggests that an existing research focus on the commercial aspect of for-profit DPs (one that predominantly examines the individual relationship between user and technology at the expense of collective relationships) limits our understanding of how to socio-technically design for public domain DPs and their emergent ecosystems. Addressing the following research aims will target this gap.

1. The design and development of a public, service-orientated DSP to facilitate greater coordination and collaboration in the supraorganisational sector.

2. To develop a greater and more critical understanding of the constraints and challenges relevant to the emergence and evolution of a digital platform ecosystem in such a public, supra- organisational space.

The following sections will explore theory relevant to the above research opportunities.

2.4. Theoretical Perspectives that Underpin the Research Opportunities

2.4.1. Overview

Conceptualisations of public value, having moved from a resource-based, unidirectional efficiency approach to a multilevel, multi-actor service integration orientation, require analytical frameworks that explore public exchanges from a service ecosystem perspective. Service-Dominant logic (S-D Logic) is a reference theory we can use to better understand and analyse ways in which public political and social actors recognise and create value in terms of

this new orientation to the public value - the exchange of services (value-in-use). Within S-D Logic, service is conceptualised as the process wherein expertise and experience (specialised competencies) are applied and made available to others in order that they might benefit from that expertise and experience. S-D Logic allows to us to more fully elevate public value creation to the greater ecosystem of individuals, organisations and networks that characterises the PHC sector.

Affordance theory, which asks what the technology can do or not do in terms of actors' objectives (and in doing so helps identify the action possibilities of that technology in the context it is to be used), allows us to construct a more comprehensive, relational structure of collaborative possibilities, advancing the pragmatic applicability of design principles for a collaborative DSP in the PHC sector. Integrating these two theoretical lenses generates greater analytical power as we examine PHC collaborative value creation for this sector and therefore provides a more suitable theoretical framework for the development of design requirements and principles.

2.4.2. S-D Logic as kernel theory.

This research proposes S-D Logic as a primary kernel theory or justificatory knowledge to assist and inform the generation of descriptive and prescriptive DSP solution design knowledge for a supraorganisational, networked PHC environment. S-D Logic is used in this thesis to analyse and theorise coordinative and collaborative PHC service value in the public sphere. S-D Logic, as opposed to goods dominant logic (G-D Logic) (Vargo & Lusch, 2004, 2008, 2016, 2017), holds that all providers are service providers and that service sits as the basis for all forms of exchange (Edvardsson, Tronvoll, & Gruber, 2011). In this way, S-D Logic reorientates our concept of the economic exchange system. This reorientation moves from a value-in-exchange where delivered goods and services are seen as the source of value for the beneficiary (Yu, Wen, Jin, & Zhang, 2019) and where producers and consumers have distinct, linear roles, to a process where value is created in the use, effectively, the exchange of services. G-D Logic would see the delivery of public services in this context as a product (operan*d* resource) and seek to define the generation of value within the context of value-in-exchange (Lusch, Vargo, & O'brien, 2007). On the other hand, operan*t* resources (experience, expertise, knowledge, skill) leverage operand resources to create value-in-use and are seen as the primary source of

value creation in S-D Logic (Vargo & Lusch, 2008). Limiting the perception of value to the exchange of a tangible product nullifies any exploration of value that is generated through service. The effect of this is to limit the ability to identify possibilities for further value generation through service exchange. Use of S-D Logic, on the other hand, allows us to explore and support opportunities for further value creation. It creates a framework that allows us to more effectively analyse the dynamic, interactive, service-based ecosystem that is the PHC sector.

S-D Logic, as it has evolved (Vargo & Lusch, 2016), sees value creation as a more dynamic and holistic endeavour of resource integration and service exchange among actors, comprised of a much more comprehensive "configuration of actors" than the more limited, dyadic firm and customer roles premised by G-D Logic. S-D Logic is based in service management theory but looks at value creation from a systems perspective and attempts to explain value creation in all contexts and at all structural levels, from a societal level to an organisational level (Grönroos & Gummerus, 2015). This systems perspective is derived from Ecological System Theory (EST), where a system is deemed to work when complementary and coherent interdependence exists among its parts. The system perspective enables research to describe service holistically. Value is co-created through the integration and coordination of resources (information, knowledge, technology etc.), which reflect the interactions and exchanges between the users, beneficiaries and organisations (referred to as actors) (Paunonen, 2019). Individual actors will not have access to all resources and, as a result, are required to share resources in order that value might be created for themselves and others. Organisations exist to coordinate and integrate actors and resources. Actors provide value propositions and invite other actors to take part (Lusch & Vargo, 2014). The combination and recombination of resources creates a coherent and coordinated whole designed to meet the service user/beneficiary needs. This service user/beneficiary is one of the most important resource integrators, being the primary integrator who accepts the value proposition, and representing the point where value is co-created, defined and realised.

The creation of value in S-D Logic is therefore a function of the integration of resources between actors in a network during use and, in S-D Logic, value is determined on the basis of value-in-use rather than value-in-exchange (Edvardsson et al., 2011). These service processes are seen as interactive and collaborative, and involve multiple service actors or entities (Vargo

& Lusch, 2004, 2008) as follows: first, there are service actors, who create and offer service value propositions by offering and applying experience and expertise for the benefit of others; second, there are consumers of that service value, who realise these service value propositions through consumption (Vargo & Lusch, 2004) or through experience of the interaction itself (Grönroos, 2011). Of course, these actors form part of an ecosystem and are interchangeably both service providers and beneficiaries, dependent on context and need. Put differently, "service is exchanged for service" among all actors within an ecosystem and, when viewed through the lens of service-dominant (SD) logic (Vargo & Lusch, 2004), service represents the foundation of all social and public exchange in the service ecosystem. This represents a movement away from the focus on delivery outputs (products and services) towards a more dynamic and broader systems orientation on the created-in-use processes (Vargo & Lusch, 2008) that generate value in public and social exchange.

S-D Logic and a value-in-use ecosystem perspective on public sector value creation presents a productive starting point from which to inform the design of PHC DSPs. To address the constraints and challenges of individual, intra-organisational and inter-organisation interactions in the PHC sector and to design technologies that facilitate more effective integration of service resources in the sector requires conceptualising PHC value creation as a collective process among multiple actors, specific to a given context. This integration and application of resources occurs on multiple levels across the PHC service ecosystem, affecting individuals, interest and advocacy groups, government organisations, non-government organisations and so on. Further, this contextually determined coordination and integration of service resources is framed by institutional arrangements defined by PHC service objectives and challenges. There are important PHC design considerations in this broader view of public service value creation, where this value creation process takes place collectively among networks of actors. Evaluation will require a systems approach, because PHC actors cannot deliver value individually; they can only offer value propositions and reciprocally coordinate and integrate resources within a service ecosystem defined by a framework of institutional arrangements (Grönroos & Ravald, 2011). Creation of this value lies in the collective coordination of resources and the value proposition is thus a collective offering of resources and mutually beneficial interaction.

2.4.2.1. Theoretical foundations and foundational premises of S-D Logic.

S-D Logic is primarily conceptualised by four metatheoretical foundations (MFs) and 11 theoretical foundational premises (FPs) (Lusch & Nambisan, 2015a; Vargo & Lusch, 2004, 2008, 2016) linked to the metatheoretical foundations. The foundational premises of S-D Logic are formulated from the metatheoretical foundations of S-D Logic (Vargo & Lusch, 2004, 2008). The first MF reinforces how value co-creation occurs in actor-to-actor networks across ecosystems, reflecting collaborative and collective value co-creation processes within a service ecosystem. The second MF reflects how information can become decoupled from its immediate context and digitised, making it easier to share with others—a process known as resource liquefaction. The third MF underscores how resource mobilisation can maximise and combine (densify) contextually relevant resources for a particular situation. Finally, the fourth MF shows how all actors act to integrate resources (mutual value creation) on a systems-wide basis in order to create value (Blaschke, Haki, Aier, & Winter, 2019). Table three presents the MFs and their linked foundational premises.

Table 3: Meta-theoretical Foundations and Foundational Premises of S-D Logic. (Vargo & Lusch 2016)

Metatheoretical Foundation (Lusch & Nambisan, 2015)	Foundational Premise 2016 (Vargo & Lusch, 2004, 2008, 2016)
MF1: S-D Logic reflects on a multi-actor, network-centric generalisation. (multi-actor networks)	FP1 Service is the fundamental basis of exchange.
MF2: S-D Logic draws on decoupling of information from its physical form or device. (Resource liquefaction)	FP2 Indirect exchange masks the fundamental basis of exchange.
MF3: S-D Logic draws on an effective and efficient mobilisation of contextually relevant knowledge. (Resource density)	FP3 Goods are distribution mechanisms for service provision.
MF4: S-D Logic draws on the view that all social and economic actors are resource integrators. (Resource integration)	FP4 Operant resources are the fundamental source of strategic benefit.
	FP5 All economies are service economies.
	FP6 Value is co-created by multiple actors, always including the beneficiary.
	FP7 Actors cannot deliver value but can participate in the creation and offering of value propositions.

	FP8 A service-centred view is inherently beneficiary orientated and relational.
	FP9 All social and economic actors are resource integrators.
	FP10 Value is always uniquely and phenomenologically determined by the beneficiary.
	FP11 Value co-creation is coordinated through actor-generated institutions and institutional arrangements.

The foundational premises are derived from the metatheoretical foundations and effectively capture and make explicit the principle of S-D Logic. In the marketing literature the foundational premises have been elaborated into nine derivative propositions that inform commercial practitioners (descriptive knowledge) as to the applicability of S-D Logic in practice Lusch, Vargo & O'Brien, 2007). These derivative propositions are determined in the seminal S-D Logic literature to inform practice about competing through service thinking. There is no such equivalent for the public sector and a different practice perspective is required to effectively address public sector practice.

2.4.2.2. S-D Logic and the public health sector.

To address public health problems, many resources need to be integrated, on various structural levels, in order to create a functioning whole (effective and coherent public service delivery) that effectively integrates and mobilises the optimum information, knowledge and other resources in order to solve those problem (Lusch & Vargo, 2014). Optimising this resource density in specific contexts requires an effective interaction between resources and actors. Within the supraorganisational public health sector there have been very few attempts to explicitly develop digital structures that would generate these sources of value. Indeed, this limitation, coupled with a mainstream analytical focus on G-D Logic, may contribute to the paucity of research and the general lack of sector-wide collaborative technologies in the public sector.

The application of S-D Logic to public policy and the public sector has resulted in the concept of the public service-dominant logic (PSDL) which is argued can improve service delivery in the

public sector (Grönroos, 2019; Osborne et al., 2016; Skålén & Edvardsson, 2016). However, while PSDL initially generated linkages with S-D Logic by recognising a service perspective on value creation, this value creation was seen as the production of a service in concert with a user of that service, departing from S-D Logic. PSDL reflects a dyadic (between organisation and end user), unidirectional process focusing on the service organisation's production and delivery processes (Osborne, Radnor, & Nasi, 2013). PSDL's primary departure point with S-D Logic lies with an emphasis on delivering public value to the end user, an external stakeholder representing a co-producer of value (Osborne et al., 2016; Ostrom, Parasuraman, Bowen, Patrício, & Voss, 2015). In this PSDL would see public services as something produced and consumed, where that service delivery results in the delivery of value to the citizenry (Osborne et al., 2016).Value, here, is seen to be produced and consumed as a function of this dyadic relationship. This runs counter to S-D Logic, where value is seen to be co-created in use, across multi-actor networks and within a specific context (Edvardsson et al., 2011). The term value co-creation has been applied across a number of areas (Grönroos, 2008; Gummesson, 2006; Prahalad & Ramaswamy, 2004; Ramaswamy, 2011; Runar Edvardsson & Kristjan Oskarsson, 2011) in the public sphere. This occurs through a shared institutional context and is generated through an exchange of knowledge, experience and expertise of all actors involved in that service delivery process. It is created through a network effect and delivers value to all actors, not merely the user, in the form of access to greater knowledge and information, co-learning, increased connectivity and thus a more effective, integrated service solution. By creating relationships in networks, and sharing operant resources (information and knowledge) in an service-for-service exchange (Chandler & Vargo, 2011), actors are able to better develop public service offerings, and in doing so effect change at a service ecosystem level.

Table 4 illustrates Chandler & Vargo's (2011) useful consolidation of how S-D Logic can be applied to a public sector service ecosystem. Here it is adapted to bring the implications of S-D Logic in a public sector context to the fore.

Table 4: Implications for the Application of S-D Logic to a Public Sector Service Ecosystem. (Adapted from Chandler & Vargo, 2011)

S-D Logic Foundational Premise	Public Sector Implications
FP1 Service is the fundamental basis of exchange.	• In public service ecosystems the user should always be able to co-create value in various forms and specific contexts.

	• End users in public service ecosystems are not passive actors but are resource integrators and thus cocreators of value.
FP2 Indirect exchange masks the fundamental basis of exchange.	• Public service ecosystems need to consider how value co-creation activities take place and evolve between collectively organised actors.
FP3 Goods are distribution mechanisms for service provision.	• All exchanges in the public sector are service exchanges.
FP4 Operant resources are the fundamental source of strategic benefit.	• A fundamental aim of public service ecosystems should be to support value co-creation activities to address public problems. • Public service ecosystems should include the identification and support of emergent solutions driven by different actors.
FP5 All economies are service economies.	• Likewise for the public sector
FP6 Value is co-created by multiple actors, always including the beneficiary.	• Public service ecosystems provide an important basis for coordinating resources within a sector composed of multiple actors with different interests. • Public service ecosystems need to consider value co-creation activities that occur independently or beyond dyadic exchanges with the service-providing organisation. • Public service ecosystems need to evaluate the effect of government interventions on collective actions involving various actors with different interests. • Instead of directing individual organisations to deliver solutions, public service ecosystems should enable relevant actors to address public problems collaboratively.
FP7 Actors cannot deliver value but can participate in the creation and offering of value propositions	• Public service ecosystems requires an understanding of why and how actors coordinate themselves around specific value co-creation activities.
FP8 A service-centred view is inherently beneficiary orientated and relational.	• Public service ecosystems are required to understand the users' value creation process in order to establish a suitable configuration of resources for users to integrate and operate on.
FP9 All social and economic actors are resource integrators.	• Public service actors are both providers and consumers of services.
FP10 Value is always uniquely and phenomenologically determined by the beneficiary.	• Public service actors generate value through value-in-use.

FP11 Value co-creation is coordinated through actor-generated institutions and institutional arrangements.	• Public service ecosystems need to consider how users create value based on the provision of a given resource configuration. • Policy makers need to evaluate the effect of governance (government interventions) on collective actions involving various actors with different interests.

These implications for applying S-D Logic in a public sector setting, along with the exploratory research, will inform the study's abstraction and communication of the design propositions and principles for greater coordination and collaboration.

2.4.2.3. Summary S-D Logic.

The primary objective of this study is solution design knowledge in the form of design propositions and design principles for DSPs that enhance collaboration and coordination in a PHC service ecosystem. A public service ecosystem sees value being co-created when resources are integrated and used on a service-for-service basis. A public service ecosystem based on these premises can provide an appropriate resource configuration to support public actors in coordinating and integrating resources to address problems (Trischler & Charles, 2019). This broad focus on service exchange that is generated through networks and governed through institutional arrangements allows for a more complex, multi-actor reflection of value co-creation that is relevant to PHC service and the generation of DSP design knowledge. S-D Logic is therefore an appropriate theoretical lens to inform the study's solution design knowledge for a collaborative service-focused digital platform that seeks public value co-creation in an emergent, networked PHC service ecosystem. Given S-D Logic's framework of how value can be co-created in broad, multi-actor networks, this thesis will therefore adopt S-D Logic as kernel theory to inform the development of the research's solution design knowledge (Vargo & Lusch, 2004, 2008, 2016).

Efficient public health service delivery is about maximising the integration and coordination of resources in the most appropriate configuration for a given context, in order that actors may integrate and operationalise those resources to address specific PHC problems and provide solutions that increase the wellbeing of PHC beneficiaries. In a siloed, fragmented ecosystem, technologies offer us options in that regard. To leverage this opportunity, we need to be able to assess what any proposed technology can offer in its proposed context of use. Given the

affordance lens's distinctive conceptualisation of exactly this (Hutchby, 2001; Leonardi, 2013), the research will employ affordance theory as complementary justificatory knowledge to guide the development of solution design knowledge.

2.4.3. The technology affordance lens.

This study proposes the affordance lens as an analytical and evaluative tool to explore and evaluate the relationships between users, collaborative technologies and the public sector and any research artefacts produced during this research. According to Leonardi (2013a) an affordance is a "relational structure" that exists between the technology, a user and their goals and the context within which those goals are to be realised. In other words, a technology affordance presents a user with a range of possible actions in that given context. These affordances that present with possible action as a result of the interaction between users, the technology and their situated use are effectively the value propositions perceived by the user, interacting with the technology in that context in an attempt to realise their goals. The affordance framework can be appropriately used to identify propositions of value arising from the use of technology in a situated context. This would assist the development of solution design knowledge sympathetic to the value objectives of situated users of the technology and which is based on a broader understanding of use and engagement with the technology. In the public health sector, a collaborative DSP can offer various value propositions for users to co-create public health (service) value. It may enable a greater sharing of information, can increase options for connecting and networking, promote greater visibility over sector activities, heighten access to experience and expertise and encourage greater coordination and collaboration. This potential ability to integrate and coordinate operant resources offers potential to the sector. But useful designing for this potential means understanding how and why actors seek to coordinate themselves and resources around specific value co-creation activities within that institutional context. The use of the affordance lens in this research will enable a more comprehensive and complete identification of sources of digital collaborative value in the public health sector and develop a more holistic picture of potential value propositions generated by interactions of technology and user. This will serve to more comprehensively inform the proposed design principles.

2.4.3.1. Affordance theory.

The concept of affordances, consistent with Hutchby (2001) and Leonardi (2013a), makes explicit the relationship between the capabilities of the technology and the way actors use those capabilities. This research draws on IS-based affordance theory (Bygstad, Munkvold, & Volkoff, 2016; Strong et al., 2014; Volkoff & Strong, 2013; Zammuto, Griffith, Majchrzak, Dougherty, & Faraj, 2007), to enhance the analytical and evaluative processes for studying value creation in the design and development of a DSP in the PHC sector. The creation of value can be analysed from the point where humans (agents) interact with the technology (DSP) and where perceived affordances (potential value) are generated as a function of the relationship between the material and the social (Volkoff & Strong, 2013a). Affordances are seen as relational (Hutchby, 2001), as being a function of neither user nor technology, but of their interaction within a given context. Actors' goals shape and define what they perceive as affordances of the technology (Leonardi, 2011; Markus & Silver, 2008). Thus, some users will perceive affordances for action in a given context, whereas others will not. People with different goals will perceive different affordances from the same technology. Importantly, affordances exist whether or not they are actually realised. An actualised affordance is a concrete outcome that results from a goal-directed actor taking advantage of the possibility for action (perceived affordance) to realise that outcome. Affordances can both enable and constrain action possibilities, whereby the perception and actualisation of certain affordances may negate the possibility of perceiving or achieving other outcomes. Equally, an actor may not perceive an affordance, given the actualisation of an affordance is dependent not only on an actor's goals but also his/her capabilities in realising that goal (Bygstad et al., 2016). There can be multiple affordances that are interrelated and that impact on each other (Strong et al., 2014). The described context also includes the conditions that may either enable or constrain the perception and/or realisation (actualisation) of affordances that emerge from the relationship between the technology and users. Affordances may not be actualised all at once, the actualisation of affordances can unfold over time and affordances can be seen to build upon one another. The realisation of an affordance may subsequently generate the perception of further action possibilities, only perceived when other affordances, or bundles of affordances (Volkoff & Strong, 2013), are realised. The actualisation of affordances is commonly associated with individual goal-orientated actors, but these affordances are also

impacted by organisational and supraorganisational goals and arrangements (Festila & Müller, 2017; Strong et al., 2014). Focusing on how these broader contextual socio-institutional forces interact with the technology and individual and organisational goals allows us to better understand the dynamic and emergent processes that give rise to the realisation of the technology's affordances in the context of this research. The actualisation of affordances is therefore seen as dependent on the sociotechnical context (Hedstrom & Swedberg, 1998). Volkoff and Strong (2013) see goal-directed affordances as generative mechanisms that lead to organisational change. In the public sector, such generative mechanisms can also result in social change which, when perceived and actualised as positive and in the beneficiaries interest, constitutes public health value.

This examination shows how affordance theory might benefit the research, in that it presents a means of integrating the technical and the social in the research, from the development of the value propositions for design, to the use and evaluation of the artefacts. The following section looks at key affordance research pertinent to the present research.

2.4.3.2. Affordances of social media.

There is limited IS research that deals with the supraorganisational collaborative value propositions of DSPs, but digital communication theory and social media affordance research present with relevent insights into such potential. There are several fundamental concepts of social media that are equally applicable to DSPs in the public sector as well, such as advances in internet technologies (Web 2.0) which allow for a more intuitive and comprehensive sharing of information in a collaborative manner. Much of this focuses on the sharing of information, information richness, interactivity and the ability to control the flow of information (Levy & Gvili, 2015) on social media platforms. There is value in exploring this theory and integrating it with this study's empirical research into collaborative value propositions in the use of digital technologies within the PHC supraorganisational sector. Social media have been defined as "a group of Internet-based applications that build on the ideological and technological foundations of Web 2.0, and that allow the creation and exchange of user generated content" (Kaplan & Haenlein, 2010, p.61). Social media platforms are therefore primarily service platforms that encourage collaboration and the integration of information resources. While this study accepts that perceived affordances are constituted in relationships between actors,

technology and the specific context (Bygstad et al., 2016), it will argue that there is sufficient similarity between social media platforms and collaborative DSPs to warrant an examination of the affordances of social media platforms. An understanding of which affordances social media commonly present with can productively inform this study, since the objectives of the technologies are somewhat similar—the sharing of information and other service content between users. Leonardi and Barley (2010) and Leonardi (2011) have argued that the affordances of a social media technology are often the same or similar across different contexts because the material features of the technology constrains the perceptions of what is and is not possible. The following social media and communication theory affordances have relevance to this research. Firstly, Treem and Leonardi's (2013) research into social media affordances identified the following four affordances as germane to social media: visibility, persistence, editability/selectability and association. Secondly, and for the purposes of this study, a further affordance gleaned from communication theory is added, that of interactivity (Song & Zinkhan, 2008), seen where users willingly exchange resources with others. Perceptions of willing exchange will lead to greater information exchange in the future. Exploring these affordances of social media can offer to advance design that would serve to sustain and encourage user resource seeking and exchange behaviours in the DSP at this PHC supraorganisational level. The affordances of social media platforms identified in the literature that influence social media platform use are summarised in Table 5 and further discussed in the following sections.

Table 5: Social Media Platform Affordances Identified in the Literature

Affordances perceived in social media communications theory	Literature
Visibility	(Cross, Borgatti, & Parker, 2003) (Bregman & Haythornthwaite, 2003) (Boyd, 2010) (Grudin, 2006)
Persistence, Reviewability, Recordability	(Hancock, Toma, & Ellison, 2007) (Whittaker, 2003) (Erickson & Kellogg, 2000) (Mejova, De Schepper, Bergman, & Lu, 2011)
Association, Connectivity, Social Ties	(DiMaggio, Hargittai, Neuman, & Robinson, 2001) (Ellison, Steinfield, & Lampe, 2007) (DiMicco, Geyer, Millen, Dugan, & Brownholtz, 2009) (DiMicco et al., 2008)
Selectivity, Editability.	(Oostervink, Agterberg, & Huysman, 2016) (Shen, Cheung, & Lee, 2013)

Interactivity, Information sharing.	(Song & Zinkhan, 2008)

2.4.3.2.1. Visibility.

Treem and Leonardi's (2013) review identified the social media affordance of visibility, whereby the technology enables users to view information about others in an easily accessible manner. Making information about others' knowledge, interests, activities and networks visible is a prerequisite for exchanging information and integrating resources. If actors do not have this information, do not know it exists or perceive it as too costly to access, they will not look for it (Brown & Duguid, 2001). The ease of finding and connecting with other public health actors also depends on the visibility and availability of that information (Dawes, 2010), including the contextual information, where any such lack would make it difficult to interpret and make use of the data. Equally, creating and enhancing this potential (affordance) for visibility is a precursor to exchanging information, developing networks and coordinating activities. This attribute of social media, of providing increased communal visibility across work activities and personal profiles (which allows viewers to assess expertise, skills and knowledge) is found to stimulate greater communication and engagement with the social media tool (Wattal, Racherla, & Mandviwalla, 2009).

A lack of sector-wide visibility in the supraorganisational PHC sector (knowledge as to who is doing what, where and with what resources) hampers the development of resource exchange seeking to collaboratively address public health issues. This limits the potential for efficiently maximising resource sharing and thus public health value. Using digital means to increase the visibility of actors and activities beyond that of co-location may potentially counter this limitation.

2.4.3.2.2. Persistence.

The ability to store information and make it available to users has been defined by researchers as reviewability (Clark & Brennan, 1991) or recordability (Hancock et al., 2007). Information does not expire; a record is maintained. Past activities, even past actors can be viewed and accessed over time and provide a connection that affords the potential for actors to collaborate over time. This ability to generate a "long view" in integrating resources can provide a distinct advantage in generating value. It allows, in effect, the ability to create a

limitless, historically indexed knowledge repository (Poole & Grudin, 2010). Creating the situation where content can be reused will provide added value thereby increasing the potential for engagement.

In the supraorganisational PHC sector, this identified affordance may enable the recording and retention of identity, activities, experience and expertise over time, consistent with reviewability and recordability affordances. One of the major constraints in the public health sector is that there is no available sector-wide record of activities and knowledge. When actors initiate planning for new interventions there is no means by which they can access the record (sector-wide) to assist with planning. A capability to base one's planning and activities on given experience, where relevant, would generate public value.

2.4.3.2.3. Association.

Social media affords actors and users the ability to connect to other people, connect people to content and content to content (Treem & Leonardi, 2013). Numerous social media studies have shown that the digital generation of associations with other people (social ties) and content is an affordance that increases social capital (DiMaggio et al., 2001) and helps to make associations more visible and to build greater community, important in promoting engagement and trust in interactivity. Social media users can use the tool to make contact and establish associations with people they did not know and about whom they knew very little. Making an association between people and content provides an extra dimension in allowing for a more efficient use of content according to the user's interests (Millen, Feinberg, & Kerr, 2006). Content to content ties helps the user to access relevant content. A further advantage of the association affordance is the capability to consolidate existing associations or make new ones (DiMicco et al., 2008)

What information is currently available in the supraorganisational PHC sector is not really used in any meaningful way. It is limited to small geographical areas of local import. A lack of interaction combined with no means of sharing information limits coordination and efficiency. The affordance of being able to connect to both other actors and content through increased association, thereby potentially gaining access to actors and information anytime and anywhere, will assist a user to generate greater value in the delivery of public services.

2.4.3.2.4. Selectivity.

The affordance of selectivity denotes the possibility of users selecting information that is relevant to them. This is enabled in social media by means of customisation and localisation, i.e., user preferences and activities (Oostervink et al., 2016). The outcome is the ability to target content more efficiently. Editability refers to the ability to review, edit and update information already posted (Rice, 1987). Editability therefore allows for more purposeful information and the ability to improve information quality. This capability to target and edit content increases the perception of the value of the social media and greater coordination and collaboration (Danis & Singer, 2008).

The supraorganisational PHC sector has no common repository for actors to target content update and edit existing data. Over and above this, there is no agreed definition of context, no common language within which data can be targeted or edited to maintain accuracy. The result is that information sharing is compromised, with the potential for misinterpretation due to a lack of reliable information. A DSP built with a common language and categorisation system would allow actors in the sector to target and edit data and information.

2.4.3.2.5. Interactivity.

The social media affordance of interactivity is manifested in the ability of the user to actively participate and engage in the social media platform. They can select personal preferences, target specific information and post information (Van Noort, Voorveld, & Van Reijmersdal, 2012). The key issue is that the social media platform enables users to control their interaction with the tool. It lets them decide who they will receive information from, post information to and what information they will be exposed to.

The ability to tailor one's engagement and use of a DSP to your specific needs and context increases the benefit obtained from the DSP. These interactive features increase the potential of a positive relationship between interactivity and higher DSP engagement. The higher the engagement the higher the potential visibility that can be achieved by means of the DP. PHC actors can interact and cooperate with a greater range of other PHC actors, communicate broader, useful knowledge and coordinate activities that will contribute to the generation of PHC collaborative value.

The integration of these affordances in the generation of design knowledge will assist in providing a broader view of the value propositions of a DSP and in so doing contribute to the creation of design propositions that will help to ensure the viability of the proposed DSP. Social media and communication theory appear consistent in defining these five affordances of social media technology: visibility, persistence, association, selectivity/editability and interactivity. Given this, and the similarity between social media technologies and the proposed public health DP, this study will integrate these into the DSR requirements analysis processes described in Chapter 5.

Importantly, Leonardi (2013b) suggested distinctions between the concepts of individual, shared and collective affordances. This is of relevance given the success of the proposed DSP is dependent on a shared exchange of services. Users need to interact to achieve the required PHC service value. For Leonardi (2013b) an individual affordance might only benefit the person who enacts it, where others might perceive no such affordance. Such an individual affordance will be specific to that person only, helping to realise that person's objectives only. A shared affordance is then an individual affordance perceived by all. All users within that context will use the technology in a similar fashion, but to realise their own individual goals. A collective affordance is seen as an affordance that is realised collectively, by users in that context and would reflect a "greater than the sum of its parts" achievement (Leonardi, 2013b). Organisational goals are seen as the primary form of collective affordances, where individuals interact with technologies and the organisational context to achieve organisational goals. This multilevel perspective on affordances provides the potential for a greater depth of analysis on potential DSP affordances in the PHC supraorganisational sector, where there is currently a lack of research on the perception and realisation of such collective affordances at this level.

2.4.3.3. Organisational and collective affordances.

Affordances result in concrete action (Volkoff & Strong, 2017) when they are actualised by actors. Until that point in time they remain possibilities for action. User awareness of these possibilities tends to be heavily impacted by the context—where the goals of an individual user and organisational practices and culture (Zheng & Yu, 2016) combine with the technology to generate potential value. This applies equally to groups pursuing organisational goals or the achievement of a collective outcome (Pozzi et al., 2014; Strong et al., 2014). DSP configurations

can afford organisational and collective level possibilities for action as per organisational and group goals (Markus & Silver, 2008; Zammuto et al., 2007), where individuals coordinate to realise organisational or, increasingly, sectoral objectives. This is especially relevant in the public health context where cooperation and coordination are required to operate at interorganisational, and supraorganisational levels.

Affordance theory has been productively used in IS literature to examine the relationship between technologies and individual or organisational action possibilities (Strong et al., 2014). The IS literature has examined various forms of affordances in various contexts, primarily at the individual and organisational level (Volkoff & Strong, 2017). Organisational-level affordance research has examined how multiple users may use a technology in an aggregate manner that serves to actualise organisational-level goals (Volkoff & Strong, 2017). In his examination of organisational network change, Leonardi (2013b) distinguished between individual affordances, collective affordances and shared affordances. The configuration of a technology, or what can be referred to as its feature set (Markus & Silver, 2008) can generate multiple affordances across these categorisations. Individual users may be aware of different affordances arising from the same feature, independently, and seek to actualise these different affordances in pursuit of their individual goals (Leonardi, 2013bb). The benefit received would be specific to these individual goals. Individual affordances (Leonardi, 2013b) are thus the result of individuals seeking to realise their goals independently of others. Affordances can also be seen to be nested or bundled (Volkoff & Strong, 2013), for example, where users become aware of new action affordances resulting from the combined effect of a bundle of individual affordances. This nesting characteristic of affordances creates an interdependence between affordances crucial to the realising of organisational or sectoral goals (Leonardi, 2013b). Leonardi (2013b) saw shared affordances as those where individuals actualise the same affordance, the outcomes of which (Spohrer et al., 2007) serve to generate group action possibilities or the achievement of group goals. The inference inherent in the shared affordance construct is that individuals combine and coordinate the actualisation of individual affordances to achieve group goals. A collective affordance is seen as an action possibility, collectively created by independent action that, in aggregate, allows for a collective or group to achieve a group goal that an individual would not otherwise be able to achieve (Leonardi, 2014). Collective affordances for Leonardi (2013b) arise where the outcomes of individuals

actualising different individual affordances align to create a collective action possibility as an outcome.

Strong et al. (2014) have theorised the actualisation of organisational affordances as collective constructs emerging from many individual level actualisation journeys. Strong et al. (2014) analysis of affordance actualisation processes found three measures of actualisation where the aggregation of individual affordance actualisation leads to an awareness of organisational affordances and the possibility of achieving organisational goals, namely, consistency, extent and alignment of individual actualisation processes. Consistency refers to how individual actualisations of affordances combine to either present with an organisational-level action possibility or to achieve an organisational goal. The action in actualising individual affordances may not be the same, however. Here extent (of the actualisation processes), refers to the degree or level of affordance actualisation across individual actualisations. Multiple users may be required to actualise affordances to a certain degree before an organisational-level action possibility or organisational level goal can be achieved. Alignment of actualisation is indicative of how the individual actualisation outcomes align with organisational-level goals. In other words, how directly the individual actualisation outcomes contribute to organisational-level goals (Strong et al., 2014). Thus, the IS affordance view predominantly sees actualising organisational or group-level affordances as either coordinated individual level action or the aggregate of individual action. Individual action may combine (or be coordinated) to realise group or organisational goals, or the aggregate outcome may result in the realisation of group or organisational goals (Leonardi, 2013; Strong et al., 2014). Here, individuals are seen as component parts of a system but acting on their individual intentions. This perhaps assumes an overly individualistic approach, where outcomes are seen as the sum of individual actions. These approaches are helpful conceptual tools to examine technology use at the individual and organisational level where the motivation for use is primarily based on individual needs and goals but are limited in contexts where motivation is based on collective needs and intent at a supraorganisational level. Weichold & Thonhauser, (2020), ecological psychologists, define collective affordances as a collective level construct that references collective rather than individual intent. A group of individuals, identifying with similar collective intent, such as professional practice and having the means to interact, can develop as a collective and generate collective objectives giving rise to collective affordances (Weichold & Thonhauser,

2020). Such a conceptualisation is more helpful when examining motivations for platform engagement at a level beyond the organisational. The context for this study's research interest lies where the motivation for technology use is to realise collective intent, rather than individual, and where there are few formal organisational or individual roles to control or govern platform engagement at a supraorganisational level. This conceptualisation of collective affordances and its integration into this research is more fully examined in Chapter seven, sections 7.5.2. and 7.5.3.

2.4.3.4. Summarising affordance theory.

Affordance theory is therefore a valuable theoretical lens to assist in exploring the collaborative design potential of DSPs in the PHC sector. The obvious advantage of thinking about how the technology—the material features—interacts with the goals and perspectives of users is that it enables the study to avoid focusing solely on either the technological or social aspects of the equation. Using affordance theory enables the study to more accurately identify where PHC collaborative value can be designed for in the sociotechnical design process. The affordance lens also potentially has greater capacity to explain DSP use processes in this context. This relational nature of the affordance lens is a suitable lens to explore not only the relationship between the technology and the user but also how emerging relationships between users and between users and context govern the way the technology can or cannot be used collectively. Affordance theory enables the study to identify the collective action possibilities that serve to generate PHC collaborative value (as a result of the interactivity between actors and their goals, the DSP and the context (Anderson & Robey, 2017; Leonardi & Treem, 2012). Further, it allows us to explore user awareness of these action possibilities in the PHC supraorganisational context, and to judge user willingness and ability to realise those action possibilities.

2.5. Chapter 2 Summary

Research on PHC supraorganisational public service value and how DSP design could support such collaboration at this level remains limited (Provan et al., 2007). Little is known about the potential of DSPs in creating or constraining collaborative public value at a supraorganisational level in this important sector (Osborne et al., 2016). Existing work on public value and the

realisation of PHC value, in particular, indicates the importance of context and the requirement to consider local conditions in terms of PHC value realisation. However, the analytical concepts of S-D Logic and affordance theory have not yet been effectively harnessed and applied in the context of collaborative DSP design in the supraorganisational public sector. Spagnoletti et al. (2015) confirm there is a limited understanding on how to effectively design value-in-use DSPs that will support heterogeneous many-to-many online communities. As a consequence, effective design theory of public DSPs at this level remains largely unknown.

How can we design for a digital platform that will facilitate the generation of collaborative value in a PHC ecosystem at a supraorganisational level? Here we need to investigate how diverse public service organisations and actors, who do not have complete access to resources and information, and who face a constantly shifting landscape, can feasibly exchange and integrate these resources collectively via digital means, with other PHC actors, to create better collaborative service value propositions. Such design parameters are complex, needing to incorporate technological elements, such as data and hardware, with emergent ecosystems characterised by highly volatile sociotechnical organisational configurations. New ways of sharing and integrating resources can result in tension and risk, threatening actor engagement with the DSP and the ecosystem it generates. The viability and usefulness of any such solution design knowledge must therefore be based on a comprehensive understanding of PHC sector characteristics and dynamics and be grounded in participatory governance and incentive design mechanisms that foster user confidence in the technological artefact and encourage engagement. This research background generates and integrates specific knowledge that will both inform the design of a DSP for that purpose and provide solution design knowledge on the integral aspect of the establishment of an emergent digital ecosystem, critical to the realisation of collaborative value. Based on this knowledge, the following chapters describe research activities designed to design, build and evaluate an instantiation for the purposes of generating DSP design knowledge and solutions. The new knowledge generated will address the two research questions postulated in Chapter 1.

Chapter 3: Research Methodology

3.1. Structure of the Chapter

The objective of this chapter is to present and explain the research design (see Figure 4). The chapter starts by referring to the philosophy underpinning the research. This philosophy will inform the research design, research strategy, method choice, data collection techniques and analytical processes so that the research design forms a coherent whole that effectively addresses the research questions. The chapter then presents and explains the DSR research approach and DSR process method, based on the knowledge acquired in the research background section and which is used to achieve the research objectives. The phases of the research are then outlined and related to the research questions. The chapter then links the research approach to the development of design theory and solution design knowledge, identifying the proposed design solution contributions and linking these to the research phases and instruments, as summarised below in Figure 4.

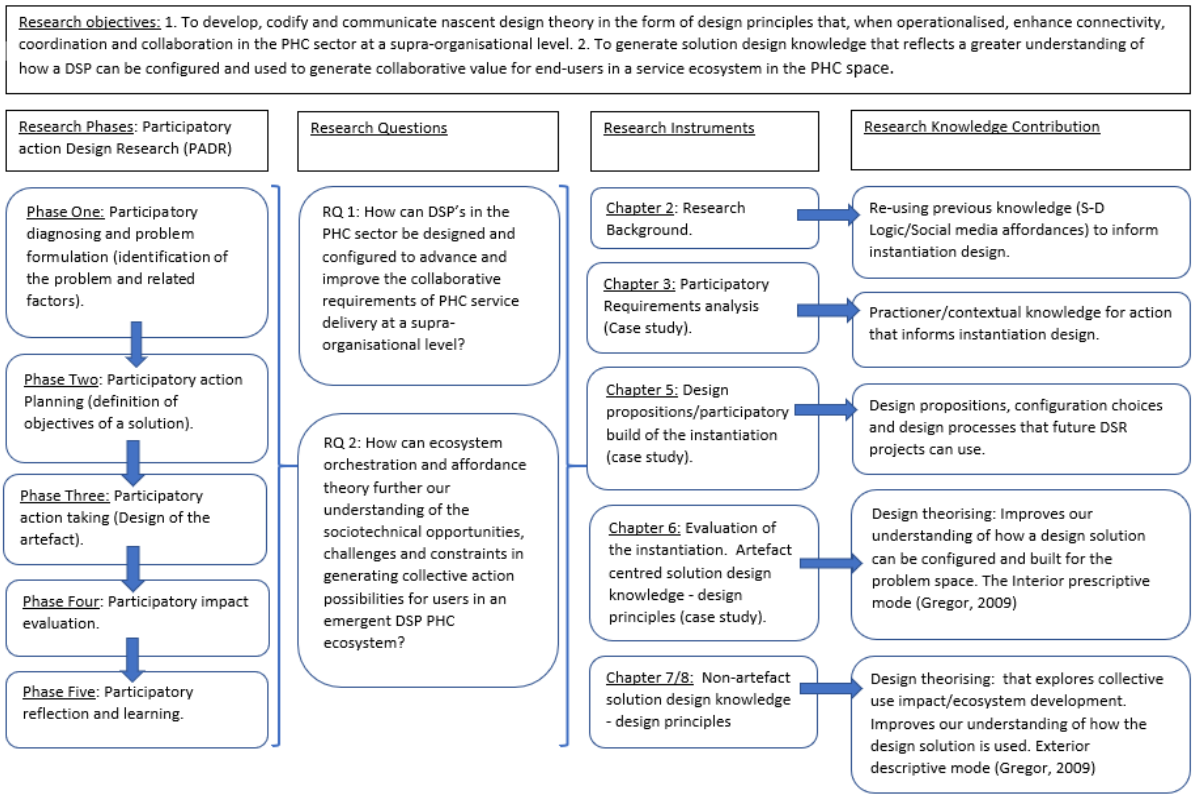

Figure 4: Research Design

3.2. Research Philosophy

A research philosophy refers to a generated system of beliefs and assumptions about how knowledge may be created and justified (Wynn Jr & Williams, 2012). Research paradigms may differ based on their varying philosophical foundations and conceptions of reality (Lincoln & Guba, 1986). Filstead (1979, p. 109) sees a research paradigm as a set of "interrelated assumptions about the social world which provide a philosophical and conceptual framework for the organised study of that world." The term paradigm therefore refers to a philosophical way of thinking (Kuhn, 1962). The most dominant work within IS on research paradigms is that of Orlikowski and Baroudi (1991). Here three research paradigms used in IS are presented: positivist, interpretative and critical. The positivist paradigm reflects a worldview of research based on the scientific method of investigation, reflecting a reality independent of our perceptions and holds that law-like generalisations can be made across contexts. Alternatively, the interpretivist paradigm argues that reality(ies) are multiple and socially constructed. The critical or transformative paradigm holds that knowledge is situated both socially and historically and focuses on uncovering agency (Orlikowski & Baroudi, 1991). Further work by Chen and Hirschheim (2004) and Becker and Niehaves (2007) find the positivist paradigm to be the most dominant in IS research, followed by the interpretivist. DSR is not included in this debate, although it is the subject of separate discussions as an alternative research paradigm based on the pragmatic paradigm. The question to be posed first is whether DSR can be viewed as a separate research paradigm or whether it can be combined with other research paradigms (Weber, 2010). In this review of the literature on the subject, Weber (2010) found DSR not a fully accepted independent research paradigm but extolled the potential of a DSR approach to "combine the advantages of different paradigms." Niehaves (2007), in commenting on this issue, advocated for a pluralistic philosophical approach for DSR, and to avoid positioning DSR as a further research paradigm. It is noticeable that in the majority of DSR studies and DSR process approaches the explicit consideration of research paradigms is invariably absent. This thesis views DSR as complementary to existing research paradigms because its primary focus is on the generation of relevant, practical knowledge that directly impacts on the environment it is embedded in, that is, design utility and efficacy.

Further, the research is exploratory in nature, requiring a critical approach that seeks to understand causality: why and how actors engage with the technology; why and how actors

engage with each other through the technology. In order to do this, researchers must understand the context, and the nature of actors' agency within that context, in order to effect optimal design. This requires a sociotechnical approach and therefore this research will embrace critical realism (CR) as a foundational philosophical approach, a complementary philosophical foundation that serves to more constructively align design strategy and methods to the research objectives and environment in question. It is assumed that a different design problem in a different context might require a different foundational research philosophy, implicating alternative design and method approaches to effect a solution.

The aim of this research is to investigate how PHC actors can digitally improve their coordination and collaboration at a supraorganisational level. Despite the prioritisation of collaboration and significant improvements in connective and collaborative technologies, the sector still lacks capacity in actor connectivity, coordination and collaboration at this level. This study argues that an appropriately configured DSP could go some way in addressing this lacuna by providing for greater digital collaborative capacity at this level. Accordingly, this research is seeking to develop a technical solution to a complex social problem. In order to generate collaborative value, the platform must facilitate an associated ecosystem, wherein actors collectively interact through the DSP to achieve their collaborative goals. Of particular interest to this research is how this ecosystem might be established and developed (causal mechanisms thereof), since it is this ecosystem development that will impact most prominently on the realisation of collaborative value for the users or, put more simply, the usefulness and fitness of the DSP. Developing causal explanations as to how and why actors interact with each other and with the technology can generate insights on the use of collaborative technologies in that specific context, and therefore how such technologies could be better designed and implemented. The largely exploratory nature of the research seeks to generate a greater understanding of the underlying structures and generative mechanisms (Bygstad et al., 2016) that impact on collaboration and that give rise to the observable events that we see—how and why people collectively interact (or not) with the technology (DSP) and with each other.

Critical realism (Bhaskar, 2009, 2010, 2013, 2014) presents a world view that enables the researcher to focus on how the material (the DSP) and the social become entangled (Leonardi, 2013), a view that supports the research's objectives of understanding how technology can facilitate and enable sector collaboration. IS has seen lengthy discussions on the concept of

sociometeriality (Leonardi, 2013; Leonardi & Rodríguez-Lluesma, 2012; Mutch, 2013; Orlikowski, 2007; Scott & Orlikowski, 2010), and its association with the sociotechnical concept (Mumford, 2006; Trist & Bamforth, 1951). The sociometerial approach sees the social and material as inextricably enmeshed while the sociotechnical sees a purpose in separating the two concepts for analytical purposes. While a full discussion of this debate (and other perspectives impacting on the debate such as actor-network theory ANT (Latour, 1987, 2005) and practice theory (Bordieu, 1977)) is beyond the scope of this thesis, critical realism aligns most closely with the sociotechnical perspective in that it incorporates the materiality of the technology with the key dynamics of the organisational and social context. The sociotechnical perspective sees technology as an embedded constituent element of complex social processes. A sociotechnical perspective will value the joint optimisation of the social and technical (Mumford, 2006; Trist & Bamford, 1951), while maintaining the analytical distinction between the social and the material (Leonardi, 2012). Joint optimisation of the social and the technical has, as its objectives, effectiveness and efficiency (Avgerou & Madon, 2004). This aligns with both the utility and fitness objectives of DSR (Hevner, March, Park, & Ram, 2004; Peffers et al., 2007) and also the realisation of PHC service value, which preferences efficiency and effectiveness (Kearns, 2004). The ability to separate the technical from the social enables this research to generate greater explanatory power of what is observable through distinguishing the material properties of the technology and its use in specific contexts. For those interested, Leonardi (2012) presents a useful overview of this debate.

3.2.1. Critical realism.

Critical realism holds that reality is at once, structured, differentiated and continually changing (Bhaskar & Hartwig, 2016). Critical realism holds that our world is real (exists independently of our perceptions and beliefs), but that our understanding of this world is socially constructed (Taylor, 2018). Critical realism is a transcendental, realist, naturalist and critical philosophy of science that has three domains in its world view: the real, the actual and the empirical (Bukowska, 2021). A real world does exist outside of human understanding, consisting of natural and social objects and structures and their underlying causal mechanisms—entities that exist independently in the real world, and that have the power to influence behaviours and events (Bhaskar & Hartwig, 2016). These generative natural and social structures have an objective reality independent of human thought and social construction, “causal structures

that generate observable events" (Henfridsson & Bygstad, 2013). An example of a causal structure in this research would be the DSP, situated within the internet infrastructure, consisting of people and technology in the PHC environment. This infrastructure seeks to distribute information effectively and efficiently, representing a value proposition to those seeking to achieve this. Such a causal structure will serve to attract users to interact to innovate service provision and generate PHC value, thereby attracting new users. For the purposes of this research, understanding this causal structure is paramount.

Within the actual world, specific events and behaviours occur, resulting from causal mechanisms that are activated in the real world, such as (in our example), the formation (interaction of people and technology) of new service delivery networks (ecosystem) within the PHC sector as enabled by the DSP. In this view, a number of generative mechanisms interact, creating a context-dependent, contingent causality (Smith, 2010). People interact with this real-world structure, the DSP, in order to achieve their goals. In doing so they shape and reshape both their goals and the structure, leading to outcomes which others will perceive and experience in terms of their own context. In this research and in order to optimise design the contingent causality underpinning this interaction needs to be understood. Archer's (1995) conceptualisation of morphogenesis perhaps best encapsulates this: existing structures generate but do not determine what takes place; this leads to social interaction which, in turn, leads to structural elaboration, which will either bring structural changes or the reproduction of that social structure. The final world in critical realism is the empirical, where events and behaviours generated in the actual domain may (or may not) be observed (Archer & Archer, 1995). This would constitute our perception and experience of these events. From a research perspective, this is the domain where a researcher may attempt to experience and measure what can be observed (Mingers, Mutch, & Willcocks, 2013). The generative structures and mechanisms of this real world cannot be directly experienced or measured (by research for example (Danermark, 2002)). Therefore any experience of the manifestations of the real world (events in the actual world) is conditioned and shaped by the context of that experience. It therefore cannot be objective and thus different experiences of an event will generate different accounts of that event (Dobson, 2001). The social world is a dynamic, open world and certain social conditions will enable or constrain the actualisation of causal mechanisms at a real level of reality (Bhaskar, 2009). Of particular importance for the purposes of this research

is critical realism's conceptualisation of causation as "powers" or "liabilities emergent from particular objects, relations and structures" (Sayer, 1999). Critical realism sees these mechanisms as potential capacities to act in certain ways (affordances)—capacities which may or may not be exercised dependent on contextual conditions. This is an important consideration when designing for ecosystem development and generation.

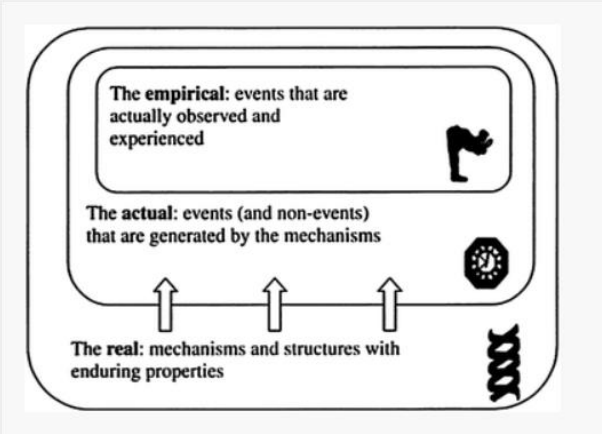

Figure 5: Stratified Ontology of Critical Realism (Mingers, 2004)

Critical realism is therefore regarded as an appropriate philosophical foundation to guide the ontological, epistemological and methodological assumptions and approaches that will articulate solution design knowledge for greater connectivity, coordination and collaboration in the PHC supraorganisational sector. Bhaskar's intent (Bhaskar, 2008) with critical realism was to present a more flexible, combinatory alternative to social scientific research methodology than the existing siloed paradigms of positivism, interpretivism and the transformational. This is done, in effect, with the combination of a positivist ontology (a real world exists) with an interpretative epistemology (knowledge is always subjective). This underpins a research understanding that the consequences of embedding a technology into a social context, "cannot be predicted with certainty" (Drechsler & Hevner, 2015). Vaishnavi and Kuechler' s (2004) epistemological observation that design science is knowing through making bears relevance here. This is applied in this research with the choice of critical realism (to more fully understand the how and why of artefact use for design purposes, how the social impacts on the materiel and vice versa) and the use of case study research to frame the participative DSR design and evaluation processes (which presents the opportunity to closely identify where users see the value in the technology and how they ultimately interact with the technology based on their context).

The basic theoretical construct used by critical realism is the entity or object that has the power to make things happen. These happenings or outcomes are referred to as events and are the observable phenomena or behaviours of people and systems that occur (or are reported on) within a specific context. Critical realism attempts to explain what generative mechanisms caused the events to occur. In the light of critical realism, the study will attempt to explain how and why the proposed structure, the DSP, will cause actors in the PHC sector, under specific conditions, to either engage in collaboration to a specific degree, or not. This causal explanation shows how entities and mechanisms may combine to cause things (outcomes) to happen.

Critical realism assumes emergence and thus connectedness. Examining the social impact on causal mechanisms requires understanding of the connections or relationships between people (individuals and groups) interacting in that context. This is seen in the relationships, PHC systems and governance, values, priorities and resources, which are the social and generative structures of the real world setting that impact on the use of the technology and ultimately, the performance of the technology.

Critical realism also holds that there are relationships between entities or objects (Sayer, 1992) such as the DSP in this research and actors in the PHC supraorganisational context. There is thus obviously a necessary causal relationship in the generation of events from these relationships. Digital, supraorganisational collaboration and coordination will not occur without this essential relationship between the DSP and actors. These relationships may give rise to a mutual shaping or definition of these entities, in that the DSP may change the way actors collaborate at this level. By the same token, actors seeking to collaborate through the DSP may shape and reshape the entity we refer to as the DSP and this will be an important aspect when the research evaluates the fitness of the artefact. Relations may also be contingent in that the entities, the DSP and actors, have some relationships that impact on each other. Critical realism requires that all observable events be explained in terms of these necessary and contingent relationships. This bears relevance to the study's exploration of how and why collaboration occurs (or does not occur) through the DSP and also tests the efficacy of the case study because such relationships enable the building of theory and thus support the generalisation of results (Easton, 2010; Sayer, 1999). Critical realism is applied in this research to more fully understand the how and why of artefact use for design purposes, how

the social impacts on the materiel and vice versa and the use of case study research to frame the participative DSR design and evaluation processes. The case study framework presents with the opportunity to closely identify where users see the value in the technology and how they ultimately interact with the technology based on their context.

To summarise: the underpinning research philosophy is critical realism. Critical realism is suitable for this research endeavour given it enables the research not only to explore a realist view of the world, but also to accept there will be different, subjective experiences or interpretations of this real world, these experiences in themselves contingent on the context of that experience. This serves to validate the use of the affordance lens. The performance of the DSR artefact in this research is heavily dependent on context, on the interests and perceptions of stakeholders, on overarching sector objectives and on local organisational mission and objectives. In critical realism, context is critical and is represented by the domain of the real. A critical realist design contribution engages with practice to generate greater understanding in that practice and to identify constraints and opportunities for positive change solutions (Ram, Wu, & Tagg, 2014).The effect of this would be to provide both a more comprehensive design contribution and a fuller explanatory framework for the phenomenon under investigation.

3.2.2. Methodological implications of critical realism.

Critical realism asks the researcher to explain the underlying mechanisms that generate events that can be experienced—in other words, to develop causal explanations of observable events. While accepting that the underlying mechanism may never be found, hypotheses for such mechanisms may be postulated (Collier, 1994), by the process of retroduction, which Sayer (1999) identifies as "a mode of inference in which events are explained by postulating (and identifying) mechanisms which are capable of producing them." This is a process where mechanisms are suggested and developed from existing data or evidenced through new data and either supported or revised iteratively from the analysis of that data (Easton, 2010). In this interpretation is the starting point, "we must at least know what agents think they are doing and why they are (in their opinion) doing it" (Bhaskar & Hartwig, 2016). Here the researcher works backwards from the experienced results of something to explain why it happened. Procedurally and iteratively, this process is as follows: firstly to generate a description of the

situation, drawing on actors' interpretations. This description is generated from both the empirical data (actors' understanding and reasons, possible relationships and connections) and concepts, arguments and extant research from the literature. Secondly, by analytically identifying the core components, their properties and relationships of the phenomenon of interest, followed by redescribing (retroduction) the identified components in terms of theories about relations and structures in order to suggest causal mechanisms that might be at play. Finally, to assess the explanatory power of these causal mechanisms in the context under examination. By this means (combining observation with theory) this research is able to "redescribe" the empirical observations and findings of the research in terms of theory and thus provide a richer explanatory framework to account for those empirical findings. Collective experiences of the technology can be connected to both the technical and social structures by means of the identified generative mechanisms that serve to enable and constrain collaborative action.

Critical realism also accepts that different forms of knowledge exist, thereby enabling a pluralist methodological approach (Wikgren, 2005). DSR, with its focus on relevance and practical utility, is combined with the case study method to form an interpretive methodology designed to generate rigour with its use of participatory data collection methods (informed by affordance theory). Dobson, (2001) views a critical realist epistemology as "ongoing developing process of explanation and enlightenment rather than the derivation of immutable scientific laws," an aspect of critical realism that sits well with DSR's iterative design process.

3.2.3. Summary: critical realism.

Critical realism's view of causality is focused on generating empirically supported causal explanations of answering the how and why questions as to the occurrence of events (Wynn Jr & Williams, 2012). Understanding how underlying causal mechanisms impact on outcomes in a specific context (Sayer, 1999) enables the researcher to explain complex social events. Critical realism enables the separation of structure and agency, wherein we can look at how human agency is both conditioned by structural possibilities and constraints and how social structures are impacted by human agency (Volkoff, Strong, & Elmes, 2007). On the basis of this understanding, the information infrastructure this research refers to as the contextually embedded DSP is a social structure produced by human agency, which at the same time

creates and provides conditions for human agency to act on (Volkoff et al., 2007). Human agency will make subjective sense of the opportunities and constraints of any possible action in terms of their own contextual (subjective) understanding of this social structure. Therefore, from a critical realist perspective, the collaborative opportunities offered by the information infrastructure, the DSP, are possibilities or constraints for realisation by human agency, which may result in greater service-orientated collaboration and further shape (scale) the information infrastructure. Understanding the causal mechanisms that give rise to this actualisation, or non-actualisation, holds important knowledge for effective design. Critical realism expects that if something is expected to occur and does not, that is of itself interesting and requires explanation. Understanding why something expected did not occur can provide very useful information in a design context. Critical realism enables the research to explore and integrate the subjective experience of participants with the objective reality of causal mechanisms such as social structures, i.e., the DSP in its context, and here the contribution and alignment of the affordance lens to critical realism and the research design speaks for itself. CR and the affordance lens allows us to take the empirical data generated from the research process and provide causal explanations of the social conditions and events that generate outcomes—in this instance more or less effective collaboration—and thus present with an effective evaluation strategy. Table 6 presents an overview of how critical realism underpins and guides the research design (DSR and DSR process method choice discussed in Section 3.3.).

Table 6: Research Design Framework

Research objectives	1. To develop nascent design theory in the form of design principles that, when operationalised, enhance connectivity, coordination and collaboration in the PHC sector at a supraorganisational level. 2. To generate design knowledge that reflects a greater understanding of how a DSP can be configured and used to generate collaborative value for end users in a service ecosystem in the public health space.
Research philosophy	Critical realism (CR).
Ontology	Critical realism holds that a world exists independent of our knowledge but that this world is not reducible to our knowledge of reality (Bhaskar, 2013).
Epistemology	Critical realism holds that our knowledge about the real world is socially produced, that we subjectively interpret and make sense of this reality dependent on context and social interaction (Bhaskar, 2013).
Research type	Exploratory/Explanatory.
Research title and topic	Develop and evaluate a DSP to facilitate greater coordination and collaboration in the PHC at a supraorganisational level.

Research problem	There is a lack of sector-wide connectivity, coordination and collaboration in the PHC sector at a supraorganisational level, which negatively impacts on PHC service delivery.
Research design	DSR PADR (human agency – subjective experience) Affordance theory (analysis - causal mechanisms that give rise to objective reality). Case study research (single)
Data collection	Participatory research Focus groups Semi structured interviews (affordance theory)
Unit/level of analysis	Digital collaborative opportunities and constraints applicable at the supraorganisational level
RQ1	How can DSPs in the PHC sector be designed and configured to advance and improve the collaborative requirements of PHC service delivery at a supraorganisational level?
RQ2	How can ecosystem orchestration and affordance theory further our understanding of the sociotechnical opportunities, challenges and constraints in generating collective action possibilities for users in an emergent DSP PHC ecosystem?

3.3. Research Design

The research background review in Chapter 2 indicates little work towards a solution enhancing collaboration at this supraorganisational level in the public health sector. Given advances in digital connectivity and increasing collaborative mandates by funders and governance bodies in the sector, there is a compelling need to fill this gap. To achieve this, this research proposes a digital solution and adopts a DSR approach given the purpose of this research is to provide a solution to an existing problem (Gregor & Hevner, 2013; Hevner & Chatterjee, 2010). This solution is to be presented in the form of an artefact (solution design knowledge) that seeks to facilitate and improve coordination and collaboration at a supraorganisational level in the public domain. The solution will incorporate not only guidance for the build of such artefacts but also knowledge that will serve to increase our understanding of the challenges and constraints that emerge in this dynamic, public, sociotechnical context, where users are expected to interact with each other to achieve their collaborative goals. And equally, it will reveal impacts on the expected behaviour of the artefact. This research approach is appropriate in IS, as such systems are concerned with both understanding and changing what is (Carlsson et al., 2011). The following sections discuss DSR as an appropriate research methodology to achieve the research goals.

3.3.1. Design science research (DSR).

Information Systems (IS) is an applied, problem-solving discipline and within IS, DSR is becoming an increasingly important research framework (Bichler et al., 2016; Gregor & Hevner, 2013; Venable, 2015). The IS literature commonly understands DSR as a research framework that enables the researcher to address and find solutions to practical problems (Dolata, Kilic, & Schwabe, 2015). Generally speaking, DSR can be seen as a series of activities that result in the construction of design knowledge to address organisational problems, achieve desired outcomes and generate knowledge in response to a problem or opportunity (Hevner & Chatterjee, 2010; Takeda, Veerkamp, & Yoshikawa, 1990). Dresch et al. (2014) hold that DSR combines two processes in a singular research project, that of designing solutions to real organisational problems and generating scientific knowledge. The design aspect distinguishes DSR from descriptive or explanatory research (Van Aken, 2006). Design essentially means to bring into being, and design science research involves the creation of an artefact that did not exist previously. If the design knowledge required for creating that artefact already exists, then that design is regarded as routine; if not, then that design knowledge is new and innovative (vom Brocke, Hevner, & Maedche, 2020). DSR is thus characterised by the creation of knowledge that can be used to develop new artefacts that attempt to resolve unsolved problem space (Baskerville, Pries-Heje, & Venable, 2009). March and Smith (2004) see DSR as an activity that created things to serve human purposes, or as Hevner and Chatterjee (2010, p. 1) described it, "to turn things into value that people use." Simon (1996) defined this science of the artificial as being a body of knowledge about man-made objects and phenomena that have been designed to meet human objectives. Simon (1996) perceived such design as the interaction between two environments: the outer environment being the set of external forces that impact on the design of the artefact, and the inner environment representing components of the artefact and their relationships. Design science reflects and guides artefact construction through this interaction between the two environments and constructs and evaluates these artefacts. It is concerned with how things ought to be—of producing artefacts to achieve objectives (Simon, 1996).

Design science is equally a pragmatic paradigm (Hevner, 2007; March & Smith, 1995) that will allow for different approaches in performing DSR (Björn Niehaves, 2007) in a search to develop reliable design knowledge. This research sees DSR as a distinct research methodology that can

pragmatically and appropriately serve to frame the design, development and evaluation of sociotechnical, embedded artefacts (McKay & Marshall, 2007; Björn Niehaves, 2007; Weber, 2009), for the purposes of research that serves to produce and communicate usable solution design knowledge (Gregor & Hevner, 2013). This research seeks to apply a new solution to a given problem in a complex and dynamic social environment, the solution of which can only be understood through the connections and interactions of actors involved. This creates an entanglement of the social and materiel (Leonardi, 2013) that impacts the design, build and evaluation processes of DSR in this research. A solely technical focus in the research design will not account for the dynamic and complex relationships that develop between actors seeking to use the technology to realise the collaborative goals of the sector. Pragmatically, this research design takes account of this entanglement of the social and the material by means of the foundational CR research philosophy and creates a research design consistent with this sociotechnical context and the research goals of the study.

The seminal work for any DSR research framework in IS is Hevner, March, Park and Ram's (2004) paper in *MIS Quarterly*. In this paper Hevner and colleagues elaborate on March and Smith's (1995) build and evaluate cycle and provide a DSR framework of develop and build, justify and evaluate. They also provide seven guidelines for conducting and communicating DSR research. These guidelines shape this research design:

1. Design as an artefact: An artefact is purposefully created and effectively described to address an identified problem in a specific context.
2. Problem relevance: the artefact is a technology-based solution that answers a real, unsolved problem. Behavioural science and design science here complement one another in that behavioural science generates explanatory and predictive theory (justificatory knowledge), generating a fuller understanding of the problem and context, while design science constructs (builds and evaluates) artefacts (technology-based solutions) that improve or solve the identified problem.
3. Design evaluation: the usability and fitness of a design must be rigorously demonstrated. Evaluation is crucial and must be affected by well-designed and justifiable evaluation methods.
4. Research contributions: DSR must provide clear contributions in the areas of artefact design and design knowledge across construction, evaluation and design theory. Hevner

et al., (2004), stipulated that research contributions in DSR must reflect one if not more of three contributions: namely, novelty (must generate a unique outcome), generality (solution must be generalisable across a larger problem space) and significance (in that the designed artefact must address a real problem).

5. Research rigour: rigorous methods must be demonstrated across construction and evaluation.
6. Design as a research process: iterative, heuristic design search strategies will produce good designs that solve real problems.
7. Communication of research design: design must be communicated in a manner that enables practitioners to realise the benefits of the design and for the researchers to build a knowledge base that allows for further extension and evaluation.

The following sections explore the relevance of the DSR paradigm for this research.

3.3.1.1. DSR and design theory.

The foremost objective of DSR is to design and develop an artefact(s) that makes a contribution to knowledge in the form of theory, where that theory's purpose is to guide artefact development (Walls et al., 1992). Within this general DSR outcome space, two IS studies have developed identifiable positions. The first, represented by Hevner et al. (2004), March and Smith (1995) and Nunamaker et al. (1991) , is characterised as the pragmatic design camp, and is focused on the physical doing of design research. The second, represented primarily by Gregor and Jones (2007), Walls et al. (2004) and Markus et al. (2002) is referred to as the design theory camp (Deng & Ji, 2018) and is focused on the generation of DSR solution knowledge at a higher level of abstraction. The two camps have traditionally placed differing emphasis on DSR outcomes, with the former placing more emphasis on applicable or prescriptive knowledge (immediate use) focusing on the research outcome such as artefacts-constructs, models, methods and instantiations. These are defined as follows (Hevner & March, 2003): a construct is a formulation serving to conceptualise and describe problems and their solutions. A model is a representation of a problem or solution where the relationship between constructs is depicted, an integrated set of propositions that describes the relationship between constructs. A method is a staged process that leads to the realisation of an objective. Effectively, this entails how a task or activity should be conducted, so, in essence,

a structured plan. An instantiation is the operationalisation of a design as an artefact within the context it addresses as a solution (Deng & Ji, 2018). For Hevner et al. in their 2004 paper, the primary focus of DSR is the IT artefact itself, "the result of design science research in IS is, by definition, a purposeful IT artefact…". DSR has traditionally defined the artefact in terms of Simon's (1996) concept of artificial things (De Leoz & Petter, 2018) as above, emphasising a narrow focus on the IT artefact in DSR. This camp defines theory as an outcome of the behavioural and natural sciences (Deng & Ji, 2018).

The design theory camp laid more emphasis on a broader understanding of design theory, beyond prescriptive knowledge. A number of authors in this camp have problematised the concept of theory in DSR, proposing a wider understanding of design theory that is both specific to the design entity and comprising of descriptive and explanatory theory that serves to increase our understanding of how people, organisations and societies behave in relation to the design entity. In this camp, Baskerville et al. (Baskerville, Pries-Heje, & Venable, 2009) have developed their conceptualisation of explanatory theory. Keuchler and Vaishnavi (2012) have also proposed their explanatory and predictive theory. The design theory camp looks at design theory as the primary objective of DSR, with both artefact and explanatory theory as valid theoretical outputs of DSR (Deng & Ji, 2018). Gregor (2006) has described a theory of IS structure, identifying causality, explanation, prediction and generalisation and, based on this, Gregor (2006) identified five types of complementary theory relevant to IS:

1) Theory for analysis
2) Theory for explanation
3) Theory for prediction
4) Theory for explanation and prediction
5) Theory for design and action

The fifth type of theory, theory for design and action, would prescribe how an artefact should be developed inclusive of the approach, methods and principles (Gregor, 2006). According to this camp there are two types of artefact, material and abstract. Thus, an instantiation would be a material artefact and a theory would be an abstract artefact (Gregor & Jones, 2007), both being common outputs of DSR.

The distance between the two DSR camps is really somewhat artificial and concerns varying perspectives on the scope of artefact and theory in DSR. Deng & Ji (2018) see this simply as

possibly a different emphasis on long- and short-term outputs. The pragmatic camp would prioritise the immediate usefulness of the artefact while the design theory camp would prioritise not merely the immediate usefulness of the artefact, but also the supporting theory that provides for a greater understanding of the phenomenon under review thus contributing to the knowledge base supporting the longer-term sustainability of the artefact. In 2013 Gregor and Hevner attempted to converge the two camps, recognising that design theory and design artefact are complementary and that both make important knowledge contributions. This convergence saw Gregor and Hevner (2013) define the following knowledge contributions from IS DSR, ranging from "more specific, limited and less mature knowledge," to "more abstract, complete, and mature knowledge":

> Level 1: Situated implementation of artefact, e.g. instantiation
>
> Level 2: Nascent design theory—knowledge as operational principles/architecture, consisting of constructs, methods, models, design principles and technological rules
>
> Level 3: Well-developed design theory about embedded phenomena, e.g. mid-range and grand theory.

Consistent with the above, and with the exploratory nature of the project, this research attempts to generate Level 2 nascent design theory, consisting of both material and abstract artefacts: firstly in the form of the developed instantiation (Vaishnavi & Kuechler, 2015), based on the identified design propositions (Denyer, Tranfield, & Van Aken, 2008; Offermann, Blom, Schönherr, & Bub, 2010), and secondly, in the form of abstracted design principles that create a deeper understanding of how the instantiation and the behaviour of actors associated with the instantiation address the problem space (Purao, 2002). This research is concerned with not only the artefact, but also the complex social context within which the artefact is to be embedded (Drechsler & Hevner, 2015) and the impact of this social context on the use of the artefact and therefore on any design knowledge generated as a result. Such an approach recognises that the artefact is embedded within contexts (De Leoz & Petter, 2018), which can be described as a complex set of emergent relationships between people, organisational and institutional landscapes (Orlikowski & Iacono, 2001). Importantly, McKay and Marshall (2005) define the purpose of DSR as to provide a more complete explanatory framework and therefore a better understanding of the impact and utility of artefacts in their real world context. This research therefore seeks solution design knowledge that supports our

understanding of the phenomena under consideration and adds to the solution knowledge base.

Consistent with the convergence of the two design theory camps in IS DSR, Drechsler and Hevner's (2018) paper classifies design knowledge into two distinct DSR knowledge outcomes, in an effort to enable DSR researchers to more explicitly define their research knowledge contributions. Within the DSR project solution, knowledge can be generated which Drechsler and Hevner (2018) refer to as solution design knowledge, comprising two aspects: knowledge specific to artefact design (artefact dependent solution design knowledge) and knowledge independent of artefact design (artefact-independent solution design knowledge). There is thus solution design knowledge specific to the design entity on the one hand, and on the other hand solution knowledge that contributes to the general solution knowledge base, that contributes to our overall understanding of problem, context and solution. Here DSR knowledge contributions are seen to encompass both descriptive and explanatory knowledge (adding to the overall human knowledge base) and the applicable or prescriptive knowledge bases (designed to address a given problem space). Solution design knowledge is thus a broader concept, than project design knowledge, or artefact-centred design knowledge, that encompasses more abstract knowledge about technology and its context independent from artefact-centred design knowledge (problem space and diagnosis, build and solution, evaluation). Solution design knowledge allows for a convergence with the broader definition of design theory as reflected in the design theory camp. The overall effect is to integrate IS DSR design knowledge approaches and is followed in this research.

DSR is also concerned with learning through design (Purao et al., 2008; Vaishnavi & Kuechler, 2004) and design failure may impart as much learning and knowledge as design success. Solution design knowledge on how and why a design succeeds or fails is an important contribution to the evolution of a design artefact. In this research there is an instantiation (a technical design), serving to generate design principles but which also has enabled new observations based on design failure that impacted on the iterative design and development of the artefact. Existing design knowledge is thereby supplemented (Woo, Saghafi, & Rosales, 2014). This research concerns itself with the interaction between the social and the technological and seeks to provide a greater understanding of the use of the technology *in-situ*, thus generating both artefact dependent solution design knowledge and artefact-

independent solution design knowledge to increase the knowledge base of the solution. In this research this was achieved through the incorporation of justificatory knowledge (reference theory inclusive of kernel theory) and case study evidence and is considered a theory for design and action (Gregor, 2006).

3.3.1.2. DSR and design theorising.

Solution design knowledge is the outcome of various modes of design theorising (Weick, 1995). Gregor (2007, 2013) identifies two general activities in design theorising: first, an interior mode to develop theory for design and action (culminating in prescriptive design knowledge) and second, exterior theorising, where the researcher engages in analysing, describing and predicting what happens when artefacts are implemented and used in the context for which they are designed. Drechsler and Hevner's (2018) work identifies six modes of design theorising covering this broadened conceptualisation of IS DSR solution design knowledge:

1. Theorising for understanding the problem, context and design of a solution entity
2. Theorising the application of the solution to improve our understanding of the problem, and to study how people, organisations and societies behave in relation to the solution entity
3. Theorising the design of a solution entity
4. Generalising and codifying solution design knowledge (principles, features, actions)
5. Re-using existing solution design knowledge
6. Contribute effective solution entities (most common mode of IS DSR design theorising).

This categorisation of design solution knowledge has the advantage of creating a more effective means of both designing build and evaluation activities and communicating the knowledge contribution of the DSR study. Using this categorisation this research design discusses all six modes of design theorising to generate both artefact-centred solution design knowledge generated from DSR build and evaluate activities and non-artefact-centred solution design knowledge generated from further analysis in the case study. Evaluation outcomes generated a requirement for further understanding, given the impact of the instantiation when implemented. Using all six forms of design theorising improves our understanding of how users perceive and behave with the technology in that context and contributes to the overall knowledge base of the problem and solution space. The solution design knowledge is codified

and communicated in the form of design principles, formulated as per the Gregor, Chandra Kruse, & Seidel (2020) schema for specifying design principles (see Chapter 6, Section 6.4).

3.3.1.2.1. DSR and the role of justificatory knowledge in design theorising.

As previously stated, DSR research is informed by the input of both theory and practice-based knowledge (Gregor & Jones, 2007). This is consistent with CR where (Bhaskar, 2008) condoned the use of existing theory as a starting point for empirical research. Here both kernel theory and practice-based knowledge are consolidated into justificatory knowledge that enables a deeper analysis. This helps support a more accurate explanation of the reality that informs the design process and research outcomes. The development of justificatory knowledge therefore occurs both as an input to the DSR process (kernel theory) and as an output in the form of solution design knowledge, inclusive of reference theory, that supports and explains how and why the artefact works as it does in that context. On the input side, Hevner et al. (2004) state that artefacts created through the design science process are reliant on an existing set of kernel theories and/or justificatory knowledge to create the explanatory framework as to why the artefact should work. Kernel theories assist in grounding the artefact in the context within which it is be operationalised. In complex social settings DSR goals are required to be specifically grounded in information about the social world of the technology's context (Gregor & Baskerville, 2012). Kernel and reference theories thus inform the design solutions. In this research, kernel theories, reference theory (extant explanatory theory) and the case study (practice) serve to inform research design and findings. The behavioural science-based literature that bears on digital PHC coordinative and collaborative processes (for example, affordance theory and S-D Logic) form the basis of this research's kernel theory. Kernel and reference theories thus inform design theorising around problem and solution design. Reference theory also assists with the explanatory framework that explains and scaffolds the research's understanding of the solution space. On the output side, justificatory knowledge (reference theory and case study evidence) can also provide the tools and support to generate solution design knowledge that enable a greater understanding of the problem, the context and the solution. Behavioural sciences are important in helping to provide the tools and support required for solving and understanding problems in complex social settings. Hevner et al. (2004) see these two paradigms of behavioural research (the social sciences) and design science as being complementary. Used in conjunction, they increase the design science

researchers problem-solving capacity and advance design theorising, not the least by increasing the efficacy and power of the explanatory framework of both problem and solution.

3.3.1.3. Design theorising and solution design knowledge contributions.

In this research, the primary research artefacts generated are the design principles, nascent design theory as defined in Gregor (2006) or, equally, design theorising that informs the design of a solution entity (Drechsler & Hevner, 2018). The design principles are abstractions based on the participatory design and evaluation of the instantiation and provide solution design knowledge on a more detailed level. These design principles are iteratively developed from firstly, the literature on digital platform collaboration and S-D Logic and secondly, from the literature on social media affordance theory, looking at digital collaboration and coordination arising from social media use, and finally from the participative design, build and evaluate process. In the following table the research defines and categorises the solution design knowledge contributions based on the applicable design theorising modes identified in Drechsler & Hevner, (2018). The research study makes a number of design theorising contributions across several of the identified theorising modes.

Table 7: Solution Design Knowledge Contributions. (Adapted from Drechsler & Hevner, 2018)

Design theorising mode	Contribution	Design theorising contribution of this research study
1. Design theorising that informs the understanding of a problem, its context or the design of a solution entity	Phase 1 • Defining and operationalising key constructs • Informs the generation of the design framework that generates solution entities	• S-D Logic to inform design propositions • Affordance theory to inform design framework
2. Design theorising that improves our understanding of the application of solution entities and their use	Phase 5 • Improves our understanding of problem and context • Improves our understanding of how the design solution is used (evaluation)	• Reflection and learning that explores collective use impact • Revisited design principles
3. Design theorising that informs the design of a solution entity	Phase 2 • Knowledge for action that informs artefact design • Knowledge for action that informs design processes	• Design propositions

4. Design theorising that codifies solution design knowledge to advance that knowledge base	Phases 3 & 4 • Features, principles and/or requirements and design processes that future DSR projects can use	• Design principles
5. Design theorising that incorporates previous codified solution design knowledge to inform the current design	Phase 1 • Re-using previous solution design knowledge	• Social media affordances

These combined solution design knowledges are consolidated in the primary artefact of the research as the design principles. This nascent design theory serves to capture and communicate prescriptive knowledge and understanding that would assist in the building and sustainable use of DSPs in the PHC sector. Such design principles would form the basis of any subsequent artefact design knowledge addressing this problem space.

3.3.3. Summary: DSR and theory.

Design science is thus the solution design knowledge (the constructs, the techniques, the methods and models and associated knowledge and theory (Drechsler & Hevner, 2018)), that achieves given sets of requirements or realises given needs (Vaishnavi & Kuechler, 2015) in order to effect change. Design science is complemented by behavioural science (activities and interactions among humans and the key aspect of Simon's outer environment) in the sense that it enables a fuller understanding of the context within which design science problems must be solved. Behavioural science, in the form of kernel and reference theories that seek to explain and predict human and organisational behaviour, complement DSR which seeks to create innovative artefacts that improve human and organisational capabilities.

In this research, the research starts with applying justificatory or extant knowledge, inputting an existing kernel of theories and experience-based knowledge (Gregor & Jones, 2007), to derive a solution to a particular problem (Hevner et al., 2004). The solution or output manifests itself in the form of an artefact design theory (Gregor & Hevner, 2013) applicable to a real world problem and is evaluated as to how well it solves the problem (Venable et al., 2017). DSR's solution design knowledge focus lies in how the design of artefacts contributes both to knowledge and the improvement of practice (Ågerfalk & Wiberg, 2018). So, while there is this

focus on the artefact in DSR it is also concerned with the production of design knowledge that contributes towards the solution of a general class of problems, and understanding the impact of that solution across organisational and social contexts (Venable et al., 2017). In exploratory research this might include justificatory knowledge and theory that would help explain inputs to, and outcomes of the DSR research. This research would seek to provide new solutions for a known problem (Gregor & Hevner, 2013) and to achieve that it uses DSR to realise two outcomes for the research project: firstly, by providing a solution to a given, real organisational problem, and secondly, by generating solution design knowledge (Dresch, Lacerda, & Antunes, 2015) that increases our understanding of the problem and solution space. Based on this understanding of DSR in terms of theorising and solution knowledge outcomes, the following section examines the DSR process model, chosen as most fitting for the research context and objectives.

3.4. DSR Process

In this research, the DSR process model is carefully chosen to align with the research problem, research context and the research objectives. Within DSR research methodology, there are a somewhat confusing diversity of process approaches for conducting DSR (Hevner & Chatterjee, 2010; Vaishnavi & Keuchler, 2007; Venable et al., 2017) . However, in order to conduct quality DSR research, it is expected that a given form of DSR process model will be used and that a clear justification will be given for the choice of that DSR process model. A research methodology can be considered as an interrelated and integrated group of concepts and variables that shows how we link research problems with particular research methods and techniques to conduct empirical research. As such, it is important to delineate how such research was conducted and to discuss how the research process so chosen represents an appropriate approach to the research problem, objectives and context. A research method will therefore frame and align the research process (Altinay & Paraskevas, 2008) and strategy.

DSR is concerned with relevance, rigour, design and impact (Baskerville, Baiyere, Gregor, Hevner, & Rossi, 2018). DSR focuses specifically on seeking solutions to real organisational problems by building and evaluating technology artefacts within the three main areas of relevance, rigour and design. Relevance speaks to the context of the design, rigour, the knowledge base used to build and evaluate. The design cycle process constitutes two basic

phases or activities: build and evaluate. In the build phase an artefact is constructed to address a specific problem. Evaluation determines how effectively the artefact provides a solution to that problem. There are a number of DSR process models developed to guide these methodological processes of development and evaluation. These process models present codified ways of doing and communicating DSR in a rigorous and relevant manner (Baskerville et al., 2018). DSR has had a common aim of developing a general DSR process model (Deng & Ji, 2018) that applies scientific processes to the task of designing solutions to problems. What follows is a brief overview of the main process models in IS DSR research. It can be observed that process models move from very IT centric process models with limited client involvement to process models that immerse the client in the design process (Venable et al., 2017).

DSR has had a common aim of developing a general DSR process model (Deng & Ji, 2018) that applies scientific processes to the task of designing solutions to problems. The first significant step in this process approach can be seen in the work of Nunamaker et al. (1991) who proposed the first systematic DSR process model, proposing a 5-stage model as below:

- Construct a conceptual framework
- Develop a systems architecture
- Analyse and design the system
- Build the system (prototype)
- Observe and evaluate the system

Although this focuses only on one type of artefact, or system, this work is widely viewed as the first attempt to integrate system development into the IS research process (Deng & Ji, 2018). Similar to this, Vaishnavi and Keuchler (2004, 2015) propose a 5-step process where the research outputs are clearly delineated:

- Awareness of problem–*proposal*
- Suggestion–*tentative design*
- Development–*artefact*
- Evaluation–*performance measurement*
- Conclusion-*results*

Several process methods were considered for the purposes of this research. Firstly, and perhaps the most widely referenced DSR process, is that of Peffers et al., (2007), DSR general process model, as depicted below:

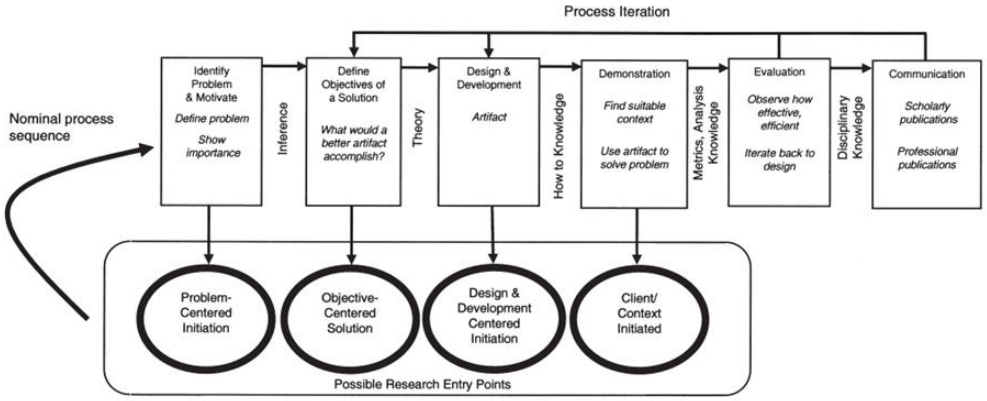

Figure 6: DSR General Process Model (Peffers et al. 2007)

The first step identifies the problem and provides the motivation for the research. Such problem must be a real business or organisational problem and the motivation should be the opportunity to develop new knowledge to address that problem. The second step of the model is to define the objectives of a solution: How can the problem be addressed? How would a better or innovative design improve the situation? The third step is the physical development of the proposed solution. The fourth and fifth steps are the utilisation of the physical artefact in the context of where it is to be used and an evaluation of how effective and efficient it is. The final step outlines the communication of outcomes, the codification of the knowledge generated and its distribution to the research and practice communities.

Another process model considered for this research is the action design research (ADR) model (Sein, Henfridsson, Purao, Rossi, & Lindgren, 2011) which specifically seeks to integrate the practice approach of action research (AR) and DSR into a 4-step model which combines the unique strengths of the two methods (Baskerville et al., 2018):

- Problem formulation
- Building, intervention and evaluation
- Reflection and learning
- Formalisation of learning

Finally (for the purposes of this review), the soft design science methodology is based on Checkland's soft systems methodology (Checkland, 1999; Checkland & Holwell, 1998; Checkland & Scholes, 1990). A practice-based, 8-step process, the model is notable for including three evaluation steps:

- Determine the specific problem
- Define the general requirements
- Abduce the general solution
- Ex-ante evaluation (general)
- Design specific solution
- Ex-ante evaluation (specific)
- Construct specific solution
- Ex-post evaluation

Lastly, Participatory Action Design Research (PADR) is the DSR process method finally chosen for the purposes of this thesis. The following section examines this DSR process method and the justification for its use in this research.

3.4.1. The process model: participatory action design research (PADR).

It is clear that the object of enquiry in this study, the DSP, must create and re-create social structures and relationships among actors (De Leoz & Petter, 2018). Solution design knowledge that will determine the usability and long-term effectiveness of the DSP must accommodate the sector's complex supraorganisational context. Information, in this context, as facilitated by the technology, exists within a specific sociocultural setting. It is therefore important to ensure that the design takes into consideration and is grounded in the practices it will be used in. Designing and evaluating the technology that will effectively identify, store, share and communicate this sector-specific information requires a targeted research method. This study's choice of DSR process takes, as a point of departure, that DSR goes beyond simply the utility or the usefulness of the artefact to consider solution design knowledge that will lead to an improvement in our understanding of the problem and its context and thus a more effective design solution (Vom Brocke, Winter, Hevner, & Maedche, 2020). Good designs should solve problems, inclusive of social problems. This study will therefore adopt the 5-stage PADR process model developed by Bilandzic and Venable (2011) which combines action research

(AR) and DSR to produce a process methodology developed specifically to address problem spaces faced by numerous and diverse groups and stakeholders in the public space (Bilandzic & Venable, 2011). It is therefore more suitable for the supraorganisational level that exists in in PHC. PADR seeks to provide for contexts where there is a requirement to understand and provide for a large variety of needs and requirements, and in an openly accessible technological environment. It is designed for contexts where the design of the technology is required to be informed and shaped by the social and cultural context (Bilandzic & Venable, 2011).

Figure 7, below, graphically depicts the PADR process methodology.

Figure 7: Participatory Action Design Research (Bilandzic & Venable, 2011)

3.4.1.2. Phases of PADR. Central to all DSR process methodologies is a framework of four primary activities: the identification and diagnosis of the problem space, the design of the technology, the evaluation of how well the designed solution addresses the problem space and the construction of theory to address the problem space (Venable, 2006). Consistent with this PADR proposes five phases (Bilandzic & Venable, 2011):

1. Diagnosing and problem formulation: approaches to this phase are required to recognise that the problem space is experienced differently by different stakeholders. To this extent a shared understanding of the problem needs to be developed and agreed on if the solution is to be sustainable. This is particularly relevant where the problem context is not well understood. There is thus a requirement for participative problem setting in the PADR methodology.

2. Action Planning: developing the design intervention that will address this problem space is consistent with traditional DSR processes but given the diversity of perceptions on collaborative value outcomes across the problem space, collaboration is required to develop inclusive design implications from the problem diagnosing phase. Greater participation in design planning should result in a better fit of a design that responds to diverse requirements and an increase in the potential sustainability of the solution.

3. Action taking: consistent with DSR processes this phase specifies the design and development of the instantiation or artefact and usability testing and evaluation. Again, the requirement of the PADR process is participative design by actively engaging users in the design process to ensure a better fit to the problem.

4. Impact evaluation: impact evaluation is conducted participatively and serves the purpose of evaluating impacts across all the various stakeholders. Use of the artefact in that sociotechnical context is evaluated in terms of how the design impacts the problem space (affordance theory).

5. Reflection and learning: here participants (researchers and practitioners) take time to reflect on what has been learned through the use of the instantiation. This knowledge benefits all parties and is carried forward into future development and use of the technology. Where original requirements have not been met or new considerations become apparent, the option is to iterate back to re-design or halt the project. This collaborative approach to learning and its outcomes is captured in both artefact dependent and artefact-independent solution design knowledge generated.

Participatory action design research is a suitable DSR process methodology for the problem the study has identified. The problem space is a complex, public and, at a supraorganisational level, seeks a technological solution to a socially constructed problem, requiring any such solution to be defined and shaped by that sociocultural context (Bilandzic & Venable, 2011).

3.4.1.3. Thesis PADR design.

The methodology of this research study encompasses the guidelines for DSR research as identified earlier in the chapter. Table 8 depicts the PADR research phases of the research, relates them to the research questions and identifies the research instruments (Piirainen,

Gonzalez, & Kolfschoten, 2010). These research phases are contained within the case study (Chapter 4) developed to explore the instantiation in its real-life context. It further depicts the secondary analysis or participative learning and design theorising phase occurring as an outcome of the DSR evaluation phase of the case study. Constraints that became evident in the operationalisation of the instantiation generated further enquiry which led to the generation of artefact-independent solution design knowledge based on further participatory analysis and the importation of knowledge from ecological psychology. This new knowledge bears relevance to the problem and context and will inform further iterations of the design.

Table 8: PADR Research Design and Phases

Research aim: the development of a nascent design theory for a DP that enhances collaboration in the PHC sector		
Research phases (PADR)	**Relevant research question**	**Research instruments**
PADR phase 1: Diagnosing and problem formulation **Research outcomes:** • understanding the problem domain/sociotechnical context • understanding actors and relationships	How can DSP's in the PHC sector be designed and configured to advance and improve the coordinative and collaborative objectives of PHC service delivery at a supraorganisational level?	• Research background review – digital service platforms/public health/ collaboration/collaborative value/service delivery • Focus groups/interviews/ethno-graphic study – problem/context
PADR Phase 2: Opportunity identification; participative planning **Research outcomes:** • requirements	How can DSP's in the PHC sector be designed and configured to advance and improve the coordinative and collaborative objectives of PHC service delivery at a supraorganisational level?	• Case study analysis: Focus groups/interviews-how can technology assist in the realisation of public health collaborative value across a many-to-many network? (Perceived affordances)
PADR Phase 3: Participative Design of the Instantiation, testing and implementation, Usability evaluation. **Research outcomes:** • design propositions • instantiation • usability testing	How can DSP's in the PHC sector be designed and configured to advance and improve the coordinative and collaborative objectives of PHC service delivery at a	Design principles • based on participatory input/Justificatory knowledge • identified by means of design propositions/CIMO-Logic • instantiation Build–design configuration.

	supraorganisational level?	• Utility: user testing for form and function usability-2x user sessions
PADR Phase 4: Ethnographic study; participative sociotechnical evaluation. **Research outcomes:** • participative evaluation via affordance theory • artefact-centred solution design knowledge: design principles	How can DSP's in the PHC sector be designed and configured to advance and improve the coordinative and collaborative objectives of PHC service delivery at a supraorganisational level??	• usability evaluation: Does the instantiation achieve the value propositions of the participations in the context it was designed for? • semistructured interviews: (affordance theory: What can this technology do for you?)
PADR Phase 5: Participative client learning, design theorising. **Research outcomes:** • Non-artefact-centred solution design knowledge: Professional social identity and collective affordances. • **Revisited Design Principles**	How can ecosystem orchestration and affordance theory further our understanding of the sociotechnical opportunities, challenges and constraints in generating collective action possibilities for users in an emergent DSP PHC ecosystem?	• iterative fitness evaluation cycle over 8 months–ecosystem development • semistructured interviews (affordance theory-what can this technology do for you?). • Participative reflection-interaction between identified affordances and collective action (complex and emergent) collaborative value (service delivery) realisation

The following section seats the research study into the PADR phases.

3.4.1.3.1. PADR research phase one (participative diagnosing and problem formulation).

In this first phase of the study, research is driven by the need to define the research problem and context. An initial introduction to the research problem and context was given in the introductory chapter and this is developed in chapter two. The research background review enabled an overview of the existing knowledge base and the identification of key constructs materiel to the research (Webster & Watson, 2002). This introduces solution design knowledge in the form of constructs, concepts and their relationships. This research background review (as integrated with the exploratory focus group interviews) informed the development of a

research framework that served to identify the requirements for the instantiation. The PADR approach produces knowledge that can be used in action (Cornwall & Jewkes, 1995). The integration of input knowledge from the research background and knowledge from the participatory problem identification and solution planning process creates a structured approach to the identification of requirements for the build of the instantiation.

3.4.1.3.2. PADR research phase 2 (participative planning).

This second phase of the study effectively defines the objectives of a solution. These objectives of a solution are defined as requirements for the DSP that advances coordination and collaboration at the required level. Participative exploratory research and the outcomes of phase 1 identify what functionality is required from any design solution by the potential users (Dym & Little, 1999). Bounding this research project within a case study is useful given case studies are used to explore the phenomena and dynamics of an issue within a single setting (Eisenhardt, 1989), where theory and research are at an emergent stage (Benbasat et al., 1987). The relevance of the case study framework is further discussed in Chapter 4. The objectives of a solution are usually found in the form of (primarily) functional requirements (FRs) which will define how the platform is to be used. While there is general agreement on the definition and processes of FR there is no such agreement on determining non-functional requirements (NFRs) (Kurtanović & Maalej, 2017). NFRs are essentially quality attributes such as performance, reliability and availability of (in this instance) a platform (EzzatiKarami & Madhavji, 2021). When the study was initiated, it was found to be among the first to look at DSPs in the public context at a supraorganisational level. With regard to NFRs it was not clear how these could be included in the DSR process, nor could the participatory planning process shed much detail on these requirements given the participants' lack of familiarity with the technical components of the platform. It is recognised that NFRs could constrain the functionality of the solution design knowledge, that is, the functionality of the design knowledge (Shankar, Morkos, Yadav, & Summers, 2020). Further, NFRs appear to be typically the last of the requirements to be considered, due to their dependence on other requirements (Shankar et al., 2020). For this reason the case study framework contains what amounts to a cursory examination and identification of NFRs taken from what could be extracted from the analysis and the research background phases. NFR analysis is extended from the evaluation

phase and seen to be included in non-artefact solution design knowledge developed in Chapter 7 from the evaluation phases. This is consistent with the iterative processes of the DSR.

3.4.1.3.3. PADR research phase 3 (participative design).

This third phase consists of the participatory instantiation design based on design propositions. Design propositions are derived from the required functionalities of a DSP that would serve to enhance collaboration and coordination at a supraorganisational level in the given context. The design requirements are identified by means of the exploratory case study which is relevant when the relationship between context and the issue under investigation are not immediately evident (Yin, 2009). Focus groups explored the value propositions of digitally enhanced coordination and collaboration. The identified design propositions are abstractions developed by means of the context-intervention-mechanism-outcome (CIMO) mechanism (see Chapter 5). The CIMO mechanism is used to argue how and why a specific design proposition might work by identifying and linking the causal processes, forces and interactions (mechanisms) that are triggered by an intervention (the digital platform and its configuration) and should result in the realisation of the intended outcomes in that context.

The design process reflected a number of iterative cycles with participants whereby the architectural configuration choices of the instantiation were developed from the design propositions. As a final step in this design phase the research develops and describes the instantiation. Here the research explores the selection of functions and the resulting architecture and configuration choices of the instantiation. This process occurs iteratively with feedback and development introducing modifications on an ongoing basis and is detailed in Chapter 5. The instantiation was created by a small systems development team gathered to iteratively develop the artefact in conjunction with study participants over a three-month period based on the identified design propositions. Immediately post the development of the instantiation, two user usability testing sessions were held with participants.

3.4.1.3.4. PADR research phase 4 (participative evaluation).

In this phase the instantiation artefact was implemented and evaluated participatively over a period of eight months. Evaluation is core to DSR (Hevner & Chatterjee, 2010) and can be considered as the systematic evaluation of both the artefacts usefulness and its fitness (Gill & Hevner, 2013). The instantiation is evaluated with qualitative evidence to determine its

usefulness and fitness. Evaluation processes utilised a wide range of PCP participants to ensure the evidence covers a range of *in-situ* participant experiences. Evaluation processes were based on affordance theory, semistructured interviews using open-ended questions, such as What can this technology do for you in this situation? What can this technology not do for you in this situation? in over 16 in-depth interviews, an analytical method deemed to be consistent with the participatory processes of PADR. Participants used the DSP to see how well they, through the instantiation, could realise their coordination and collaboration objectives. The first objective of this phase was to establish that use of the instantiation met the design propositions originally stipulated. The second objective was to determine if the participant users found the DSP useful in their daily collaborative tasks, over time, in other words that they were able to realise coordinative and collaborative value in the ongoing use of the instantiation. The design properties of usefulness and fitness are used to evaluate participants experiences of how the DSP supports greater connection, coordination and collaboration at a supraorganisational level. A detailed description of the processes and outcomes of this evaluation process is described in chapter 6.

3.4.1.3.5. PADR research phase 5 (participative learning and design theorising).

The evaluation process established a detailed appreciation of how the technology would fare once implemented. It was found that while the FRs (based on the identified value propositions) were adequately met, the conditions for a successful implementation, that is, individual actors realising coordinative and collaborative value over a diverse range of collaborative requirements, were not totally met for all participants. This constraint dominated the participatory reflection and learning phase. The fitness of the instantiation (the evaluation period occurred over an eight-month period) was limited in that all the conditions for advancing coordination and collaboration were not entirely met. The differing perceptions of collaborative value outcomes across different users in this interorganisational space and the difficulties in synchronising resources muddied incentives for engagement and compromised collective use. Further analysis found ecosystem development variables such as governance, sustainability and scalability would be key to increased effectiveness. In this phase it was felt that attempting to understand why and how these variables impacted on efficiency and effectiveness would contribute to the solution design knowledge base and the sustainability of the artefact. It was felt that the design of the DSP required further development incorporating

this new knowledge. Such further development would focus on introducing further functionality based on control or governance measures. This phase occurred in participative client learning and reflection and is described more fully in Chapter 7. Evaluation is thus a critical DSR PADR component. The following section looks at evaluation in DSR and specifically sociotechnical evaluation that serves to inform and align this research's evaluation strategy within the overall research design.

3.5. DSR and Evaluation

The evaluation of artefacts is an important stage in DSR, designed to make sure that the artefact meets its given objectives (Abbas & Munoz, 2021). This is achieved by gathering and analysing evidence (Venable et al., 2012) as to whether that purpose has been achieved. DSR researchers have approached this stage from a number of different perspectives. Hevner et al. (2004) holds that "design artefact is complete and effective when it satisfies the requirements and constraints of the problem it was meant to solve," commonly seen as the utility, or, more recently, the practical usefulness (usability) of the artefact (Gill & Hevner, 2013). Design science evaluation traditionally uses the means–end evaluation (Iivari, 2007), which seeks an evaluation of the utility of the artefact/theory against given requirements. In DSR evaluation the object is to prove that the developed artefact will lead to an improvement in the problem space identified (March & Smith, 1995). Hevner et al. (2004) defined utility as when the designed artefact was seen to satisfy the requirements and constraints of the identified problem space. Evaluation must be adapted to the context within which the artefact (and/or theory) is applied (Peffers, Rothenberger, Tuunanen, & Vaezi, 2012).

Gill & Hevner (2013) later extended this concept of utility to usefulness and design fitness, incorporating the ability of the artefact to evolve within the problem space. Scientific evaluation within the DSR research process is deemed as critical and must include both the utility of the designed artefacts/theory, (the usefulness thereof (Venable, 2015)) and its fitness (Gill & Hevner, 2013). These varied approaches have resulted in a number of different criteria and frameworks that focus on either the artefact or the artefact and theory (Venable, 2015; Venable et al., 2017). A comprehensive review of evaluation methods is offered by Peffers et al. (2012) . A summary of extant evaluation studies is available from Deng et al. (2018) and is given below. Generally speaking, the evaluation of DSR should include the usability and fitness

of the designed artefacts, and the quality of knowledge outcomes (Pries-Heje, Venable, & Baskerville, 2014; Venable, Pries-Heje, & Baskerville, 2016); in other words, that the design theory should lead to the development or redevelopment of artefacts that make an improvement in the problem space.

Deng & Ji (2018) have created a consolidated summary of four guidelines for evaluation, based on a basket of eight authors who have previously addressed evaluation in DSR (Baskerville, Kaul, & Storey, 2015; Gregor & Hevner, 2013; Hevner et al., 2004; March & Smith, 1995; Prat, Comyn-Wattiau, & Akoka, 2015; Pries-Heje, Baskerville, & Venable, 2008; Simon, 1996; Venable, Pries-Heje, & Baskerville, 2012). The summary is shown in the following table:

Table 9: Evaluation Guideline Summary (Adapted from Deng & Ji, 2018)

Guideline	Notes
1. The evaluation of the artefact should involve the intended use and context in which the artefact operates.	Whether the artefact actually works in the intended context is important. This is not simply a function of design. Context will impact on utility and usefulness.
2. The evaluation methods should be matched appropriately with the designed outcomes.	Evaluation methods should be matched with the specific artefact and its purpose.
3. The evaluation of the artefact should include a consideration of the artefact's style (way of doing things, (Simon & Newell, 1971)).	Provides an option to make a choice among alternative designs.
4. The evaluation of DSR should include the long-term organisational impact and societal impact of artefacts.	Something overlooked in the focus on individual, technical impact of designs.

Evaluation frameworks for artefacts have developed specificity in terms of what and how to evaluate (see March & Smith, 1995; Hevner et al., 2004), culminating in Venable and colleagues' (2016) framework for evaluation in design science (FEDS). The framework offers the premise that DSR projects require an evaluation strategy that responds to what to evaluate, when to evaluate, how to evaluate and why to evaluate. Such an evaluation strategy crosses formative and summative evaluation (why/how) and *ex-ante* and *ex-post* evaluation (when), and incorporates a process strategy to guide this research in DSR evaluation as follows (Venable et al., 2016):

- Explicate the goals of the evaluation.

- Choose the evaluation strategy.
- Determine the properties to evaluate.
- Design the individual evaluation episode(s).

The first step, explicate the goals of the evaluation, identifies four possible goals (Venable et al., 2016):

- *Rigour*, in the sense that the artefact does, in fact, generate the desired outcome, and also that it does so in the context it was intended to operate in. These qualities are labelled as efficacy and effectiveness, respectively.
- *Uncertainty and risk reduction*, which places an emphasis on formative evaluation to reduce risk that the artefact will not function well in the intended context, due either to social risk (artefact will not fit into the social context) or technical risk (that the artefact will not work). Research reviews, existing kernel theory and practitioner involvement all contribute to a formative and *ex-ante* evaluation strategy supporting more effective and efficient design.
- *Ethics*, in the sense that evaluation activities should not put participants and stakeholders at risk. Summative evaluation is required to ensure rigour in identifying and reducing risk in this sense.
- *Efficiency:* efficient evaluation seeks to achieve the above goals while ensuring that the costs of evaluation are commensurate. A reasoned evaluation strategy comprised of formative and summative steps can reduce costs and risks that may threaten the design.

The second step, design the evaluation strategy, infers a decision-making process about why, when and how to evaluate, given the objectives of the design project. In this study, where there are uncertainties surrounding the social use of the artefact and its long-term effectiveness, a rigorous evaluation strategy, focusing on naturalistic approaches, has been followed.

The third step, determining the properties to evaluate, necessitates identifying the properties of the artefact (requirements, features, configuration and goals) that will be the subject of the evaluation strategy. The identified properties should be chosen on the basis of how they

contribute to achieving the stated goals and aims of the design and be appropriate to the stage of evaluation (i.e. formative or evaluative).

Step four requires the design of the evaluation strategy. This research's evaluation strategy is discussed in detail in Chapter 6. In this study the stated aims of the design are advancing coordination and collaboration at a supraorganisational level in public health. There is thus substantial social risk. For this reason, a participative evaluation strategy consistent with the PADR DSR process method was chosen. The strategy has both formative (research review, participative design) and summative (naturalistic) evaluation aspects. Given the social and long-term effectiveness risk, an eight-month participative evaluation, capped by semistructured interviews (framed by affordance theory) was developed. The primary property that the evaluation had to be to assess was whether the participating practitioners could realise coordinative and collaborative value from the instantiation that improved their delivery of PHC service. If the participating practitioners could realise such value from the instantiation, in context, then uncertainty about social and long-term effectiveness would be reduced.

The FEDS framework (Venable et al., 2016) and Deng & Ji (2018) guidelines provide a useful general approach framework to consider evaluation in DSR that goes beyond the traditional means–end evaluation framework, criticised for only considering intended outcomes (Bamberger, Tarsilla, & Hesse-Biber, 2016) and not outcomes or consequences not associated with the DSR intended outcomes. Evaluation *is* more difficult in the social domain (van Aken, 2015). In a complex, dynamic social ecosystem such as PHC, where it is difficult to determine all possible causal influences on outcomes, any singular focus on utility (based on requirements) may be limiting. Problems are subjective and can be perceived differently by different people. Solutions represent what is desirable for the problem perceiver and different perceptions of the problem can give rise to different ideas of what represents a solution. In this study, the evaluation guidelines of Deng and Ji (2018) are used to frame a specific sociotechnical evaluation strategy, following those authors' FEDS framework (see Chapter 6).

3.5.1. DSR and sociotechnical evaluation.

Sociotechnical evaluation is an evaluative approach to DSR evaluation that seeks to maximise the sustainability of the DSR solution by recognising the interrelatedness of the sociotechnical dimensions and generating solution design knowledge that optimises the *value* that can be

obtained through the interaction between social and technical subsystems (Emery, 1980, Trist, 1981). The question then arises as to how, methodologically-speaking, the research may effectively analyse this interaction. In such a context any such evaluation objective would need to evaluate multiple interactions with the technology, across multiple users, in the supraorganisational public health context. If collaborative value at a supraorganisational level is a required outcome of this interaction, then an overview of how well the artefact can solve collaborative problems, across the sector, is required. How does the solution design knowledge 'fit' (Gill & Hevner, 2013) different contexts? How does the social and technical interact, across multiple contexts, to generate collaborative value? Here the IS concept of affordances is used as an evaluative methodology for this solution fitness—to identify solution design knowledge that is embedded in different contexts across multiple actors (how the technology interacts with the social to solve collaborative problems across social contexts). Such an approach is also consistent with the research's underpinning philosophy i.e., critical realism, which assumes an independent reality that is subject to our contextually-derived perceptions of that reality. Utilising affordance theory as an evaluation methodology enables the research to seek out the causal mechanisms that give rise to outcomes from this interaction between the technical and the social in a specific context. This greater understanding of why outcomes occur as they do should improve the ultimate solution design knowledge generated.

3.5.1.1. DSR and the sociotechnical artefact.

There are a number of designations of the "artefact" in IS literature, something that gives rise to confusion (Alter, 2015; Iivari, 2017). Terms such as "IT artefact," "IS artefact" and "sociotechnical artefact" are used without any real attempt at explication. According to March and Smith, an IT artefact may be a model, construct, a method or instantiation. Drechsler and Hevner (2018) define IS artefacts in the following manner: first, that an IS artefact consists of technical, social and/or informational components; second, that that this collectively provides functionality; and finally, that it serves to fulfil an information-related or IT or ICT-related purpose. Within this traditional conceptualisation of artefact there is an acceptance that the social world may influence the design of an IT artefact. An artefact in this sense is a purposefully created tool or object used for solving human problems (Orlikowski & Iacono, 2001). Carlsson et al. (2011) and Venable et al. (2012) distinguish between technical and sociotechnical

artefacts, holding that sociotechnical artefacts explicitly allow for consideration of sociotechnical system dimensions, especially those that are social, technical or environmental. Sociotechnical artefacts are seen to be framed by the sociotechnical system they are designed for. The sociotechnical theoretical approach reflects an open system paradigm that seeks to optimise the interaction between the technical and social dimensions (of the sociotechnical system) within a given context (Trist, 1981). In this research, that context is the supraorganisational, public context. In terms of DSR the sociotechnical theoretical approach (Carlsson et al., 2011; McKay & Marshall, 2007; Venable et al., 2012), specifically looks at artefact validation and evaluation in terms of its sociotechnical dimensions.

3.6. Justification for the Research Approach

In designing a technical solution to a context that evidences complex interactions between people, organisations and technology, such complexity needs to be acknowledged. The introduction of a novel technology to facilitate greater collaboration must attempt to ensure there is a fit between the technology and the collaborative objectives users are required or aspire to perform (Zigurs & Buckland, 1998). The primary research approach for the study is the DSR method. The research is conducted in a complex dynamic environment with multiple stakeholders. DSR effectively frames the scope of the study's design and development. A participative methodology with design, development and evaluation cycles grounded in critical realism is an appropriate choice to achieve the research goals in the chosen context. Critical realism is an objective approach that takes into account the subjectivity of actors in terms of their perceptions of value. The designed DSP also had to fit collaborative objectives within the overall service delivery. S-D Logic was therefore relevant kernel theory to inform the design propositions in the research. The DSP may be seen as an intervention operating between PHC actors and their environment that impacts on their work. Therefore a case study research approach (interpretative) framing the research (design and evaluate) was justified. PADR was chosen as the process model suitable to the context and role of the actors in shaping the instantiation. The evaluation process was designed to capture users' experiences of the usefulness and fitness of the artefact. The research accessed a large and diverse range of PHC actors through the PCP, which suggests that the evaluated results are applicable across the PHC field.

3.7. Chapter Summary

Within the IS discipline, DSR research methods have been seen to evolve and change over time (Kuhn, 2012). The objective of this study is to develop solution design knowledge in a dynamic social environment (Drechsler & Hevner, 2018) via participatory DSR methods. CR grounds the research design in its sociotechnical and causal focus. DSR and PADR are viable methodologies to achieve the research objectives in that these methodologies specifically focus on the creation of artefacts that address unsolved problems in dynamic public environments, the rigorous evaluation of how the artefacts do, in fact, address the stated problem and the participatory contribution of solution design knowledge that addresses the identified class of problems. This PADR DSR process method, serves to structure research, and is used to more rigorously address the complex socio-institutional contextual that impacts on the solution design outcomes. This structured approach is supported by the use of kernel theory and justificatory knowledge on both the input and output side of the research design. Given the realisation that the success of the research design value is dependent on the establishment of an associated DSP ecosystem, i.e., collective use, the research design focuses on both the participatory design of a DSP instantiation and subsequent reflection by PHC actors on the establishment and development of an associated service ecosystem. In this research DSR is therefore aligned both with the research goals of the study and the foundational philosophy of the research design. Based on this explanation of the research methodology the thesis now proceeds with a detailed explanation and description of the case study site and approach inclusive of data collection and analysis processes. Table 10 summarises the research design up to this point in the thesis.

Table 10: Summarised Thesis Research Schema (Mathiassen, 2017)

Component	Specification
Problem setting (P).	The PHC sector requires collaboration to combat fragmentation, address whole-of-sector public health problems and improve service delivery. Although extant technology appears to offer solutions, no digital tool has been utilised successfully at a supraorganisational level to facilitate these collaboration objectives.
Area of concern (A)	Twofold: A1. Design theory: limited design theory to date that addresses potential architectural configuration of a collaborative infrastructure at a supraorganisational level.

	A2. Ecosystem establishment and development: difficult to generate use of and interaction with technology within a sector which has many and varied perceptions of digital collaborative value. Realisation of digital collaborative value propositions subject to collective (mutual) use. It is difficult to establish and develop an ecosystem of users where there is no organisational hierarchy and/or roles to mandate such collective use. We do not really understand what will motivate enough users to engage and interact with technology in that context in order to develop critical mass, or a sustainable ecosystem.
Conceptual framing (F)	Use affordance theory and S-D Logic to inform solution design theory. Use affordance theory and emergent ecosystem knowledge to evaluate use and engagement with artefact and to further theorise (non-artefact design theorising) motivation for ecosystem scaling to better inform further development.
Research method (M)	DSR PADR process developing design theorising that leads to artefact solution design knowledge and non-artefact solution design knowledge. The generation of solution design knowledge requires a rich understanding of a complex social setting and in particular, the causes of complex problems inhibiting collaboration.
RQ	RQ1. *How can DSP's in the PHC sector be designed and configured to advance and improve the coordinative and collaborative objectives of PHC service delivery at a supra-organisational level?* *RQ2. How can ecosystem orchestration and affordance theory further our understanding of the sociotechnical opportunities, challenges and constraints in generating collective action possibilities for users in an emergent DSP PHC ecosystem?*
Expected contribution C	C1. Detailed empirical account of the development of solution design theory (design principles based on S-D Logic/affordance theory and participative exploratory research) on supraorganisational collaborative technologies in the public sphere. C2. Contribution to solution design theory (how to design for collaborative technologies in this context). Contribution to solution design theory on collective use and ecosystem scaling.

Chapter 4: The Case Study (PADR phase: Participatory Diagnosing, Problem Formulation and Action Planning)

4.1. Approach and Structure of the Chapter

This chapter describes the case study research approach, case study processes and the outcomes of the case study research that define the objectives of a solution to the problem, or, as defined in the PADR process adopted here, opportunity identification and participatory planning. Further PADR phases (action taking, action evaluation and reflection and learning), also framed by the case study, are discussed in later chapters. This chapter starts with the case study approach and justification (relevant and aligned to the DSR approach) and then discusses the selection of the case study site. This is followed by a description of the case study, its protocols, ethical premises, information sources and finally the evidenced case study findings, which determine the functional requirements (FRs) for the instantiation. In the following chapter, Chapter 5, the FRs are integrated with kernel theory (S-D Logic) insights discussed in Chapter 2, to inform and define the design propositions which govern the build and configuration choices of the instantiation.

4.2. Case Study Justification

Case study can be seen as a research strategy used to describe, test or build theories (Eisenhardt, 1989). The case study method and its associated research is suitable for exploratory and explanatory research with emerging technologies, where existing concepts and theories are inadequate (Chetty, 1996; Yin, 2009), and where actor experience and the specific context are important (Benbasat et al., 1987). This serves to describe this research. When designing for a digital solution that addresses a lack of coordination and collaboration, in a context where there is no organisational hierarchy or roles to incentivise such coordination and collaboration, it is imperative that the context and environment within which PHC actors are operating, is clearly understood. Case studies are therefore appropriate when the context impacts on the design development process (Grimshaw & Draper, 2001). For Yin (2014) the scope of a case study can be defined thus: “A case study is an empirical inquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident” (p. 13). Thus, since this research is

exploring the challenges of digital collaboration at a public, supraorganisational level, the impact of the wider PHC socioeconomic and supraorganisational context is critical. The environment is a complex sociotechnical one (Mumford, 1983) where any successful results achieved will be an outcome of interaction between technology and actors. Design success in this context is thus not only dependent on technology design, but also on the establishment of an associated ecosystem within which multiple stakeholders with diverse collaboration objectives are all expected to interact. A given characteristic of a case study is an in-depth exploration of the dynamics within a single setting (Eisenhardt, 1989) which allows a detailed examination of the complex relationships and processes that constitute that case study context (Eisenhardt, 1989). Case study research is therefore indicated in this research.

Case study research is further indicated where the foci of analysis are the relationships, organisations, and networks operating, in problem-defined situations, that require causal explanations of why things are as they are. The research questions in this study address the objectives of understanding and developing improved digital coordination and collaboration in the PHC sector: this is a relatively bounded exercise of exploring the possible causal mechanisms of digital interaction between and across supraorganisational PHC networks and relationships. It seeks to address the problem of why such supraorganisational coordination and collaboration is not more prevalent in this sector, at this level and to explore digital potential in this regard. A case study is therefore warranted to frame and bound this causal enquiry.

While single case studies present with research reliability risk, single case studies are well-established in the IS literature (Orlikowski & Iacono, 2001; Sarker, Sarker, Sahaym, & Bjørn-Andersen, 2012; Silva & Hirschheim, 2007), where the phenomenon of study is a unique, typical or rare case (Yin, 2003). The phenomena studied in this research (PCP) has rarely been studied (digital coordinative and collaborative objectives and processes at a public, supraorganisational level). The use of a case study for this purpose also serves to enhance rigour, both in terms of the variety of data generation methods employed, but also in terms of analysis, where in-depth examination is required (Dubé & Paré, 2003; Yin, 2003). Further, a qualitative case study approach is appropriate in this research, given the study is interested in exploring the complex interplay among users around the use of collaborative technology in a

specific social context (Lee, 2004). Within DSR, case studies are also often used to iteratively gather FRs and evaluate designed artefacts (Hevner, March, Park, & Ram, 2008).

FRs are, effectively, definitions of what users require from the design: in other words, how the design knowledge will be used (Stellman & Greene, 2005). The first part of the case study is used to define the problem more clearly in order to more optimally develop the FRs for a digital intervention at this level. These FRs are abstracted from the digital value propositions identified participatively within the case study (the exploratory participatory research). These are later integrated and defined into the design propositions for the build of the instantiation, discussed later in Chapter 5. This research also evaluates the developed instantiation using the interpretive case study approach over an eight-month period. The scope of this evaluation concerns both the usefulness of the collaborative technology and the fitness, that the expected value of the DP will continue and evolve over time. Initial participatory evaluation is focused on immediate findings that confirm (or not), the usefulness of the artefacts which then leads to further reflection and analysis concerning the emergence and evolution of the associated ecosystem. Case study research is indicated for such in-depth evaluation requirements (Gregor & Hevner, 2013).

Overall, the case study frames both the participative exploratory research planning and the participatory evaluation of the DSR research design. The case study research strategy is chosen in order to capture as much detail as possible. At the start of the research, the boundaries between the coordinative and collaborative objectives, the use of the instantiation (DSP) and the supraorganisational context are unclear, such that a holistic approach is warranted. A case study is therefore best situated to frame the participatory engagement and variable information collection requirements of this given context.

4.3. Case Study Design: Validity and Reliability

The primary criticism of case studies is an apparent lack of rigour and potential for generalisation (Yin, 2003). In this research this criticism is mitigated by ensuring the case study follows proper methodological rigour (research procedures and processes) and is capable of generalising its findings in an appropriate way. DSR seeks to solve general problems so the solution design knowledge generated must be applicable in practice, effectively generalising beyond the single case and providing for external validity. The DSR process utilised here

develops solution design knowledge relevent to a general class of problems. In this regard, the DSR approach mitigates the risk inherent in a single case study. However, it is recognised that qualitative case study findings cannot be generalised to an entire population (Yin, 2009), therefore the intention of this research is to achieve case study findings that will increase digital coordination and collaboration at a public, supraorganisational level. The research seeks to contribute to developing design theory and design solution knowledge that also can be consistently repeated to generate greater coordination and collaboration at this level in the public sphere. This case study research thus attempts to provide both a clear statement of design principles and a greater understanding of the constraints and opportunities of digital coordination and collaboration at this level in the public sector.

In the matter of construct validity, Yin's (2003) advice to use multiple sources of evidence to generate a chain of evidence is followed. The research was based in a PCP operating in the eastern area of Melbourne. This PCP consists of multiple actors within the PHC sector, across the public/private, for-profit/not-for-profit divides, all seeking to improve coordination and collaboration. This diversity of sources provided a suitable collaborative context for study (Rowlands, 2005), and one that provided rich interpretive data for the research. Various data methods were employed (see data collection) and the participatory approach enabled research partner feedback loops. Construct validity was therefore tested through iterations of design and build (of the instantiation) using kernel theories, participatory partner feedback and data triangulation (focus groups, semistructured interviews and research participation), where multiple participants from the sector were involved in the design and evaluation of the DP. This served to generate validity.

Reliability requires that the case study procedures, if replicated, will provide the same result (Yin, 2003). Lee (1989), however, posited that while it may be impossible to replicate the outcomes of a specific case study, research should be able to test the theory (solution design knowledge) in a different set of initial conditions (in this research that would mean in a different supraorganisational, public setting). To mitigate this, the research develops reliability by clearly presenting the research methodology and case study protocols. Also, by communicating the primary research artefact, the design principles, in a formulated manner.

Yin (2003) further describes internal validity as the process of identifying how given conditions lead to other conditions, in other words, establishing causal relationships. Internal validity for

the purposes of this case study (exploratory research) is reflected by a research design (critical realism/DSR/affordance theory) that foregrounds causal explanation. The participatory DSR approach provides methodological rigour and reliability, given the input from actors in the design and development stages of the research situated in a sociotechnical context. Triangulation (Lincoln & Guba, 1986) is also established with multiple sources of data obtained from focus group data, semistructured interviews and extensive participatory feedback from research partners in the development and use of the collaborative DSP. The DSR-based design, build and evaluation of the instantiation is also justified and bolstered by extant theory, therefore improving the reliability of the research.

Table 11: Case Study Research Validity and Reliability

Validity/Reliability	Description	Case study approach and justification
Construct validity	That the case study research investigates what it claims to investigate.	Use of multiple sources/perspectives (case study participants) of evidence in the context of the research.
Internal validity	Cause and effect relationship between intervention and outcome.	Affordance framework (Participatory evaluation/variable perspectives/theoretical explanation), what can this technology do for me?
External validity	How well the data can be applied to more general situations.	DSR application logic in other domains (generalising for greater digital coordination and collaboration).
Reliability	Operations of study can be repeated.	Strong research design/multiple participants and results. DSR Case study protocol. (generalising for greater digital coordination and collaboration).

4.4. Case Study Selection and Description

The methodological design is based on a single, longitudinal case study framed by a participatory DSR process in the primary health care sector in the eastern metropolitan division of Melbourne. The longitudinal study was conducted from 2015 to 2019. Here case study research and the DSR method are used to satisfy participatory requirements for design planning and exploring and understanding user behaviour relative to the research artefact. The design of digital collaborative tools for a public, supraorganisational context is not supported by developed, extant design theory. This is indicated in the lack of sector-wide collaborative digital tools. There is a need to develop theory to

facilitate the design of digital tools for public sector, supraorganisational use. In this the case study site needed to present with an opportunity to develop emergent theory (Eisenhardt, 1989) in this area, enable the researchers to consider both the relationships and challenges of collaboration at a supraorganisational level in the PHC sector, and finally to enable the consideration of the impact of these relationships and challenges on the design and use of a DSP. The research site location in the eastern metropole of Melbourne was at the time actively involved in attempts to improve supraorganisational coordination and collaboration and were willing to participate in the research. The organisations and individuals involved consisted of PHC practioners and managers from public and PHC agencies and the Department of Human and Health Services (DHHS) participating in a geographically bounded PHC service coordination and delivery network, (then a primary care partnership (PCP), currently known as a primary health network (PHN)). These public health actors were actively engaged in supraorganisational collaboration and were both able to contribute to and realise the benefits of digital collaboration. Since they were willing to participate in the research, this site was chosen for the research. One peer-to-peer community artefact (Riasanow, Burckhardt, Soto Setzke, Böhm, & Krcmar, 2018) in the form of an instantiation was researched and designed in order to explore and identify core design configurations. The instantiation was named SALUS after the Roman god of welfare.

While a single case study was envisaged, the site, a PCP, was appropriate in that it is a collaborative network consisting of many varied organisations in the public health sphere attempting to collaborate at a supraorganisational level around PCP service delivery. Ergo, it is well placed to participate in design planning and evaluation around the potential of public sector, digital collaboration at this level. PCPs were established in 2000 to increase efficiencies, reduce PHC fragmentation, improve service coordination and deliver 'integrated health promotion' (Victoria, 2010). There were 31 PCPs established in Australia with an average of around 40 PHC organisations attached to each PCP. This involves coordinating a large number of organisations and personnel in delivering public health initiatives. One of the primary roles of the PCP is collaboration around PHC needs and gaps and the commissioning of interventions to address these need and gaps. As such, the network in itself does not deliver services but individual member organisations might be involved in the delivery of PHC services commissioned by the PCP. Then current health policy priorities as determined by DHHS were as follows:

- Chronic disease

- Mental health
- Alcohol and other drugs
- Digital health
- Aboriginal and Torres Strait Islander health
- Immunisation
- General practice support

Another service context of note for this study is that the DHHS advocates the use of coordination and collaboration in order to achieve a collective impact (an aim that is becoming integral to PHC practice and policy (Kania & Kramer, 2011)). Thus, organisations involved in PHC practice are being increasingly asked to participate in partnerships which necessitate coordination and the sharing of information. Collaboration and coordination is required to occur across numerous actors in the PHC field, such as local hospitals, health professionals, community health organisations, health advocacy groupings, pharmacists, professional and consumer bodies, federal, state and local governments, social service agencies, carers and Aboriginal health organisations (PHN, Eastern Melbourne, 2021). Within the PCP and over the period of the study, these organisations met on a monthly basis and sought to coordinate PCP health priorities in their respective areas of responsibility. These organisations would also have considerable experience with challenges and constraints of collaboration at this level. The case study site therefore necessarily includes public sector collaboration and coordination at a supraorganisational level, and, given actors have continuing organisational roles in this structure, they are best placed to participate in a study to determine requirements for digital collaboration and coordination across the PCP sites.

4.5. Unit of Analysis

Explicitly specifying the unit of analysis provides a focus for the research (Damşa & Jornet, 2021). The unit(s) of analysis in this research are the opportunities and constraints presented by the design and evaluation of a DSP at a supraorganisational, public sector level. Existing coordinative and collaborative activities in the PHC system were first reviewed to identify design opportunities. An instantiation (DSP) was then designed to facilitate greater coordination and collaboration and this design was then evaluated in a contextually relevant case study environment to determine the extent to which it achieved those aims. The level of this particular unit of analysis sits at the supraorganisational level, where actors,

organisations and networks interact at a sectoral level. The case study site is part of a supraorganisational network (PCP) operating at this level.

4.6. Research Ethics

Since the research asks questions around how people interact, coordinate and collaborate inter-organisationally, ethics clearance is required. At an early stage of this research, an ethics plan application was submitted to Swinburne University of Technology, Ethics Review Management (SUTREM) for approval to carry out the research. This ethics plan detailed how research participants were to be informed and managed in terms of their rights and safety during the research process. The research partners, in the form of the Outer East Primary Care Partnership executive committee, granted approval for the research on the 1/04/2015 (Appendix B). The study was approved by the Human Research Ethics Committee of Swinburne University of Technology (HREC No. 2015/037) on 2 April 2015 (Appendix A). As required for ethics approval, the research complies with the National Statement on Ethical Conduct in Human Research (2007), and internal and external regulatory standards, inclusive of secure data use, retention and disposal.

Consent from participants was sought and obtained by means of a formal research consent form (Appendix E). This consent document makes explicit that participation is voluntary and that by signing the consent form and participating in the research, inclusive of the website, the respondent consents to participation in the research. A plain language statement or participant information sheet was made available for participants (Appendix C). All participants were made aware that participation is voluntary, that no consequences would accrue from declining or withdrawing from the research, and that no payment or any other form of incentive would be offered for participation. Information collected from participants would be stored digitally. This digital data, inclusive of any paper documentation, is kept securely locked in the researcher's filing cabinet. Access is limited to the researchers involved with the project as identified in SUTREC's ethics approval. All digital records are password-secured.

Information collected directly from participants is de-identified to anonymised data. While information collected is potentially identifiable from focus groups and face-to-face interviews, such information is stored in a non-identifiable manner so that responses cannot be identified with any individual. Names, email addresses and roles are not stored with feedback and responses. Results of the research have been used in the submission of academic papers but no identifiable data been disclosed. The research data, in accordance with ethics approval, will be stored for five years following the termination of the research

project in order to facilitate dissemination of the results; afterwards, the research data will be disposed of by shredding physical materials and the permanent deletion of digital records. The final report of the study was processed by SUTREM on the 17 September 2021 as having satisfied the terms of the ethics approval.

4.7. Case Study Protocols

The use of a case study protocol is advocated by Yin (2003) in order to ensure reliability.

4.7.1. Data collection

Overall, the data collection process spanned years 2015 to 2019. In order to obtain information on problem identification that would help with configurating the design of the instantiation, the research first initiated exploratory participatory research on how primary health care agencies and the Department of Health and Human Services (DHHS) currently managed coordination issues, information sharing and the leveraging of service value from partnerships and networks. Five focus group discussions were conducted between April and June 2015 consisting of some 35 participants representing health practitioners, health managers and staff from the State of Victoria's DHHS. There was also one semistructured interview conducted with a practitioner unable to attend one of the focus groups, whose current role was to collate activity information for planning purposes. Specifically, the focus groups ran for between one and two hours. The questions for the focus groups explored how agencies and the department currently collect contextual information, the resource implications of this work, how they share this information and with whom, what decisions they make with this information, how these processes constrain greater collaboration or impact on other aspects of planning and implementation, as well as potential digital solutions to this problem space. The DHHS staff were from a regional office and were involved in many of the agencies and thus had a broad view of existing collaborative processes and activities. The content of the conversation did cover other themes, as some department staff had a wider geographical remit than some of the managers and practitioners, which provided an interesting perspective. The focus groups started from a broad perspective and covered the following topics.

- Information about the context in which PHC information is created
- Reasons for and benefits for collecting information
- Processes and support for sharing information
- Ways that the collected information is used
- Limitations with the current processes

- Terminology and vocabularies used
- Collaborations and interactions between providers and users of information
- Possibilities and recommendations for collaborating and sharing information.

The primary objective of this exploratory round (focus groups) was to determine digital value propositions for coordinating and collaborating within the specific sociotechnical context of the primary health care sector. Other data sources included existing available sources depicting current digital attempts to coordinate and connect across organisational boundaries. This information assisted the design of the instantiation by identifying possible functional requirements. Based on this knowledge, a DSP was developed and configured to operationalise the digital value-creating propositions developed in this part of the study. This tool was then tested with public health practioners not involved in the initial exploratory research. Research participants within the PCP were then enrolled for a period of eight months during which the content and functionality of the platform was reviewed and the ability of the platform to realise its value propositions *in situ* were assessed.

Immediately following the design and build, the DSP was subjected to two usability testing sessions with research participants within the PCP. The aim of usability testing was to get user feedback on the general functionality. The user testing process is more fully explained in Chapter 5. Finally 16 in-depth interviews with key participants were conducted. These semi-structured interviews lasted between 46 and 102 minutes. The evaluation strategy and process is more fully explained in Chapters 6 and 7. The objective of this round was to explore practioner' s level of awareness of the affordances of the technology as they sought to identify and realise the value propositions of the DSP in their daily practice and users' ability to perceive the value propositions (what can this technology do for you in this context?). Informed consent was obtained from all research participants in writing and prior to the interview and focus groups. A verbatim transcription was developed from the digital record of the interviews and focus groups. An interview protocol was developed prior to conducting the interviews. Internal documents and publicly available documentation were used in the design, development and analysis phases.

4.7.2. Data analysis procedures.

The analysis was informed by themes identified in the theoretical framework and themes grounded in the data (Corbin & Strauss, 1990). Focus group discussion and semistructured interview transcripts (collated over an eight-month period), were coded and analysed by means of traditional content analysis. Content analysis systematically develops content categories based on coding (Krippendorff, 2004). These analyses were compared between respondents to develop the evaluation findings of the instantiation. More details regarding this process can be found in Chapter 6. One researcher undertook the initial coding and then discussed with the research team. The research participants were then invited to discuss the themes. In the first round of analysis, the focus was on identifying patterns in current collaboration challenges and possible digital value propositions to address these challenges. In the second round, the concept of affordances was used as a theoretical sensitising device to evaluate if and how the instantiation realised these objectives. Here the focus was on identifying participant levels of awareness with regard to both individual and collective PHC collaborative service action possibilities offered by the instantiation. The identification of actualised or realised affordances was made with reference to the data and linkages with existing literature (affordances identified in the social media and communication literature). The data was then participatively reanalysed to identify patterns and bundling of affordances and levels of awareness regarding collective affordances that address collective goals among users. This phase of the analysis was made with reference to Ofe's (2018) 3 main challenges for DP ecosystem development: (1) attracting users and generating network effects; (2) control and coordination; and (3) creating and capturing value. The analysis was guided by questioning the extent to which identified and actualised collective affordances were seen to address these challenges.

4.7.3. Case study information sources.

Eisenhardt (1989) states that combining multiple sources of information and data collection methods within cases studies provide more comprehensive results. Yin (2003) confirms this approach as helping to assist construct validity and reliability. The main sources of evidence used in this case study were documents, digital artefacts, direct and participatory observation and interviews. Documentation was primarily accessed via desk research, exploring PCP

research reports, contracts, websites and collaboration documentation. Semistructured interviews and focus groups were conducted with key PCP actors who were actively engaged in collaboration activities and who had considerable experience of planning and coordinating PHC interventions. Running focus groups with multiple individuals avoided single person report bias. Direct observations and participatory problem identification took place during discussions with PCP participants and stakeholders. Other data sources included existing available artefacts depicting current attempts to coordinate and connect digitally across PCP organisational boundaries.

4.8. Case Study Findings

The following sections now describe the findings of the first part of the case study. These findings are described in terms of the functional requirements, which are derived from the analysis, and participatory feedback generated in the initial exploratory research. Gawer and Cusumano (2014) recommend that, in developing platforms and configuration processes for immature ecosystems associated with DPs, developers first develop a vision of the value propositions of the platform—how might this product/technology or service generate greater value for the ecosystem under consideration? It is through understanding the triggers or generative mechanisms that motivate actors to engage and interact in a DSP that the research is able to identify design and configuration opportunities that might lead to the desired outcomes of increased coordination and collaboration. The following section presents the findings, comprising the problem space as identified by participants, exploratory research identifying practitioners digital value propositions and the subsequent abstraction of the FRs from these digital value propositions.

4.8.1. PADR: participatory diagnosing.

The development of an emergent DSP and its associated ecosystem at this level requires a careful development of value propositions that would serve to sustain platform use. To determine these value propositions, used to inform the FRs and the configuration of the instantiation, initial exploratory research first identified constraints currently limiting greater coordination and collaboration across the sector and then identified potential digital action opportunities to address these constraints. This served to develop a set of value propositions that guided the design and configuration of the DSP. The following primary constraints were identified from the initial exploratory research:

4.8.1.1. Limited supra-organisational professional network association and actor, organisation, network and activity overview.

Sector fragmentation refers to the great diversity of siloed organisations and domains within PHC ,such as the not-for-profit domain, the for-profit domain, local and state government domains and beneficiaries that need to be coordinated to deliver efficient and effective PHC services. The sector is currently a complex ecosystem of diverse institutional arrangements across the public, for-profit and not-for-profit sectors. Attempts to address coordination challenges are seen in cross-sector collaboration requirements which describe cross-boundary and cross-disciplinary approaches to solving the complex problems PHC faces.

Primary health care officers all discussed how much time was involved in collecting information and inefficiency in the current process in terms of not knowing who to contact. Given that there is no database listing networks and practitioners, finding out who the key contacts are can take a considerable amount of time as you are passed from person to person until you happen to locate the information you require. Participants in the exploratory research were concerned to trace individuals as sources of information that would provide context in a particular area, around a specific issue. Bringing a person's experience to the planning and service delivery process can provide context and so aid successful implementation and delivery:

> *Yes, it has taken a long while and I suppose the area we have done the best work in is around food and nutrition...it's a lot of informal conversations...it is very much about partnerships and relationships...if that person was left to council tomorrow it would be rebuilding that all again… It would be a huge task to get where we are now, today. (PHC Manager)*

> *So I wonder whether it's possible to have a profile that you upload as a professional. Then if you maintain that profile, if you then go and work at (a different organisation or team) …, if you maintain your profile…, then the person could follow you. (PHC Practitioner)*

Fellow professionals and their networks are seen as a primary trusted information source. A database based on user profile listing and connecting networks, activities and practitioners should be provided for, creating a personalisation functionality. The user profile should link to projects and activities the user is involved in as well as which networks and committees the user is associated with. The identification of critical experience and expertise can serve to generate productive and valuable knowledge-sharing and enhance critical mass whereby more

and more people derive value from engagement (Marwell & Oliver, 1993; Oliver & Marwell, 2001).

4.8.1.2. Limited information search and analysis capability.

The current context presents with difficulties for PHC actors to identify and access information and to collaborate and coordinate activities across the sector. Compiling information on current PHC programs and activities is considered a routine part of practice that all participants are involved in and, during the research, participants were actively engaged in the practice of collecting information. This practice is initiated whenever new partnerships, organisations, funding and/or programs commence. Participants all mentioned how much time was required to collect contextual information, of not knowing who to contact and various inefficiencies and gaps in the process. It was reported that there is no information search support in the form of accessible databases listing networks, practitioners and activities, and that finding out key contacts can take a considerable amount of time as you are passed from person to person until you locate the PHC actor that has the information you require.

> *It's getting to know who you should be talking to. Sometimes it's not as easy as you think it should be, getting to these people. (PHC practitioner)*

All the participants discussed the time-consuming nature of collecting information and how it was primarily based on developing personal connections over time. This limited both the number of topics and geographical range for which this information can be collected. The rationale for the need is most often expressed as trying to understand where PHC needs were being neglected, or warranting further attention, and to help ensure that any new activity is not replicating an existing project or program. It was also explained that one of the intended goals of compiling this information is to build an evidence base of where there is missing services and prevention programs so that this information can be used to advocate such needs to funding bodies such as government.

> *Well [NAME] and I just come from the local government planning meeting where service mapping yet again was brought up as a, oh my goodness shouldn't we do this, wouldn't it be wonderful if we could do this because then we could be advocating for the fact that this isn't happening and the community needs this and there's all of this anecdotal stuff about what is and what isn't happening. (PHC practitioner)*

The strategies being used for collecting, analysing and presenting information are not currently meeting intended planning and service delivery objectives. Another purpose for searching and collecting information was to inform PHC actors of what services are available to meet the needs of their constituents. Participants identified an online program for entering project information that was being used by some community services across Victoria, but it was not considered a reliable source of information on current practice, being labelled 'horrible' by one participant. Participants felt that the process of entering information was too onerous, the ability to analyse the data was lacking (there was no ability to search the information or undertake analysis of what was occurring within an area for example), and its use had decreased to a point where there was little current information. Thus, in the absence of any reliable source of information, the task of collecting program and project information is repeated by numerous different organisations and partnerships every few years. As well as the inefficiency in this process, it also became apparent that there were certain types of information of relevance not being collected (such as information on networks and committees) and the process itself impeded implementation. Further, if collected there was no real understanding of how to synthesise and make sense of the data. The most common current approach to sharing this information was via conversation. Typically, PHC actors would engage in face-to-face meetings initially and also conduct group meetings and focus groups.

Across all the participants there was no clear indication of a method or strategy for storing, analysing and presenting information. Having collected qualitative, tacit-based information, staff would then try to make the information explicit without any clear method for doing so. The information was not categorised in any meaningful pattern and there was no method for synthesising the information. This sense of 'dumping' the information in a file and creating lists was the extent of current storage and analysis:

> *I can't tell you... so it's not very scientific...it's like so now let's just dump it all into a database... we did that when we started on the people priority...okay what's everyone doing... what's happening in the region?. (PHC practitioner)*

When new information becomes apparent it is stored in this file but again without any sense of categorising or synthesising the information:

> *When new research becomes available or...findings from any consultation or any work we have done it get dropped in that document...so it's a living document*

and continuously grows but if we had to start a new priority area...it would absolutely be a nightmare. (PHC practitioner)

Participants indicated that they are investing a lot of time and resources into a task that they feel is important and yet that provides little value in return. There is considerable inefficiency in multiple organisations and partnerships collecting contextual information. Those undertaking mapping activities themselves were aware of the potential futility of the planning activity they were undertaking and how they were duplicating past planning activities:

I think that's one of the biggest issues with planning, that sometimes you don't even know how much planning others have done. It's not halfway down your own planning that you discover someone else has done that already, why am I duplicating that? Why didn't anyone tell me about that and why are we working together in the first place? So it's quite frustrating…It makes you feel, well they've done it, and you're not using it, why am I doing it again? Is that going to happen to my work as well?. (PHC practitioner)

The time-consuming nature of the task and the amount of information available means that staff only do it within a narrow range of topic and geography. Thus, the ability to extract meaning from the data collected is limited. The end result is that the aim of avoiding duplication of programs and projects fails:

But people also, unless you know what's going on you can't help others to build on what's happening, so lots of people are doing similar sorts of things and believing that they're Robinson Crusoe, when in fact just over in the next suburb or over the hill it might be already existing. (PHC practitioner)

Not only did respondents comment on ongoing duplication, there was also feedback that it stifled new opportunities: not only in lacking flexibility to respond to new priorities as they emerge but also lacking flexibility to invest in new projects due to uncertainty about what else might be being implemented.

A lot of work doesn't go ahead because that mapping is too daunting so I think there's a lot of good work that could have gone ahead that got stopped because of that so if there was just an easy process. (PHC practitioner)

4.8.1.3. No common lexicon: terminology and vocabularies.

PHC practitioners and managers are spending a considerable amount of effort collating contextual information and trying to make this explicit for the purposes of planning and advocacy. However, participants noted they lacked a structure for collecting and coding the

information, had no means of synthesising the data, and there was no evidence that it had been effectively used in decision-making processes.

> *What is out there is completely paralysing, it is overwhelming the data and information that is out there and it actually makes me think I don't want to go there and intuitively I know this is an issue…I will find the best way to make it work but I do not have the time or resources or the why fore…so for me all of these databases that are out there...I just find them quite paralysing…. (PHC practitioner)*

A culture has developed whereby localised attempts are made to turn tacit information and knowledge into explicit information to suit a range of different stakeholders, from those requiring detailed information, such as other practitioners and stakeholders, and managers and government employees that need a more synthesised version. There is little guidance within the PHC literature of how to do this and even why this task should be undertaken. The researchers and participants thought that Jorm et al.'s (Jorm, Churches, & Gruszin, 2009) categorisation would be appropriate as way of coding information. That classification system for public health in Australia consists of six classes: public health function, public health issues, determinants of health, public health settings, methods of interventions and public health resources and infrastructure.

Table 12: Classification of Public Health: Six Top-Level Classes and Their Working Definitions (Jorm, Churches, & Gruszin, 2009)

Class	Working definition
Functions	Public health functions. The purpose of public health interventions, actions, activities and programs.
Health issues	Health, and wellbeing issues that affect health ('issues' includes concerns, topics, problems). Health is defined (by the WHO) as "a state of complete physical, mental and social wellbeing and not merely the absence of disease or infirmity."
Determinants of health	Factors that influence health status and determine health differentials or health inequalities. They include, for example, natural, biological factors, such as age, sex and ethnicity; behaviour and lifestyles, such as smoking, alcohol consumption, diet and physical activity; physical and social factors, including employment and education, housing quality, the workplace and the wider urban and rural environment; and access to health care.
Methods	The methods used by organised public health interventions (actions, activities, programs, services) to protect and promote health and prevent illness, injury and disability, that are designed to change population exposure, behavioural or health status.
Settings	Settings in which public health activities and interventions take place, institutional and social environments, partnerships, and locations (e.g. schools, local government, hospitals, workplaces).

Resources and infrastructure	Resources and infrastructure, the means available for the operation of health systems, including human resources, facilities, equipment and supplies, financial funds and knowledge. It includes both person-time and calendar time.

Subclass structures add to the objective of providing a clear understanding of the activities of the sector. The following table shows two subclasses for each top-level class:

Table 13: Classification of Public Health: Subclasses (Jorm, Churches, & Gruszin, 2009)

Top-level class	Level 2 subclasses		
Functions Primary	• Promote health and prevent disease, disability and injury • Protect from threats to health		
Instrumental	• Ensure public health capability • Build the evidence base for public health		
Health issues	• Health and wellbeing • Injury • Diseases and conditions • Disability and functioning		
Determinants of health	• Environmental • Socioeconomic • External causes of injury • Person-level • Health system		
Methods	• Advocacy and lobbying • Communicable disease control • Community action • Community development • Counselling • Diagnosis • Directed investment • Environmental monitoring • Epidemiologic methods • Exercise of capabilities • Food safety methods • Health education	• Health impact assessment • Immunisation • Infection control Legislation and regulation • Lifestyle advice Management of biological risk • Personal skills development • Political action • Public policy development • Radiation safety methods • Remediation of environment methods	• Research and evaluation • Road safety methods • Screening to detect disease/risk factors • Social action • Social marketing • Training and workforce development methods • Treatment methods • Urban planning methods • Vector control methods • Waste management methods • Other methods of intervention
Settings	• Educational settings • Healthcare settings Local government and communities settings Transport setting	• Home settings • Workplace settings. Includes LOCATIONS – classification of	• Other settings

		geographical areas (e.g. postcodes). • Transport setting	
Resources and infrastructure	• Administrative • Funds • Information systems • Legislative infrastructure	• Organisational systems • Partnerships • Physical infrastructure • Policies	• Technical • Time • Workforce • Workforce development capacity

Participants noted that more work would be needed to customise which type of contextual information to codify and which should remain tacit in the current context.

4.9. Initial Case Study Findings Summary: Digital Value Proposition Clusters

The complexity and breadth of Australian public health challenges the ability of primary health care practitioners to collaborate more efficiently. PHC practice across the sector needs to address the problem of connecting, viewing and accessing, collating and updating primary health care program and intervention information more efficiently. Existing digital interfaces are inadequate and there is no process by which information can be filtered. Efficient resource allocation requires that planning and program information be shared across organisations. Retrieving information from other organisations and accessing individual expertise is a major challenge in this sector. The PHC sector is seen to be characterised by a fragmented organisational structure, weak institution coordination, fragmented technical structure, diverse organisational missions and resultant limited visibility and access to information and knowledge. This compromises the strategic objectives of enhanced quality and efficiency in public health delivery identified in the Australian Government's 2018–2022 National Digital Health Strategy (Canfell, Littlewood, Burton-Jones, & Sullivan, 2021). A clear need was identified for a system whereby practitioners could enter activity and access information according to some common, codified system that enabled search and analysis functions. Further, there was the expressed desire for this system to enable a networking function whereby people could quickly locate PHC practitioners to contact when they required more tacit-based information.

Participants were unable to locate any available programs or websites that could deliver on the exact networking and data functions they desired. Social media type programs were not

specific enough (let alone the concomitant privacy and ethical issues in use of such sites) and in the absence of this they were unable to efficiently locate and connect with potential colleagues engaged in similar work for the purpose of coordination and collaboration. This is an impediment to the ability to quickly and effectively form coalitions and networks, which is an important part of PHC work (Goel, Baciu, & Mack, 2014). It was also noted by participants that the current information available for planning is overwhelming and difficult to integrate into practice. As mentioned earlier in this chapter, notions of collective impact are currently prioritised in the PHC sector (Joyce, Green, Carey, & Malbon, 2018). In Victoria, the emphasis on shared data has been targeted at a local government level (Victoria, 2014). There are given resources that provide data profiles on a very large range of health and social indicators from population surveys and other data collected through services and schools (Victoria, 2014). Notwithstanding the potential limitation of whether local-based initiatives can yield population gains in the sense of being applicable to wider populations (Merzel & D'Afflitti, 2003), this study has found that integrating these resources with local practice data is problematic. There is equally, no system in place to monitor something as simple as reach, let alone other measures on the effectiveness of PHC intervention projects. At a practice level, practitioners and managers are finding it difficult to connect the different information sources together based on work activity across these multiple settings. There is a growing need to create digital tools that can capture local level practice, facilitate interaction and aggregate this information so that there is an ability to link together different data types and sources and then engage in meaningful collective impact approaches.

Based on this evidenced analysis, the following digital value propositions clusters were identified:

1. Supraorganisational professional network association and actor, organisation, network and activity overview

   Digital Value Proposition: The provision of a centralised, internet-based DSP generating content and based on personalised social interaction would enable PHC actors to gain an oversight of all activities relevant to their strategic planning purposes. There is a benefit to be gained by being more informed and interconnected with their peers. More efficient access to, and utilisation of, planning and program information will enable the primary health care sector to better plan and

manage information dissemination and utilisation, promote heightened visibility and knowledge-sharing giving rise to greater connectivity and more efficient information-sharing.

2. Information provision and the sharing of resources

   Digital Value Proposition: Systemising and categorising available information within the primary health care sector will enable the use and availability of information, creating greater opportunities for connectivity, information-sharing and coordination, improving connectivity and coordination. There is an obvious benefit to actors in organising resources across the sector in an easily accessible manner.

   Digital Value Proposition: A search and analysis capability. A search function to effectively locate information across practitioner, intervention, network or organisation databases. The provision of a digitally searchable information structure would enable the searcher to gain an oversight of project and collaboration activities relevant to their information and planning purposes, promoting efficient access to information, increasing the efficient access and utilisation of information across the sector.

3. A common lexicon: terminology and vocabularies as opposed to multiple jargons and health classifications

   Digital Value Proposition: The development of a centralised database based on user profile that lists and connects networks, activities and practitioners is valued. This will trigger greater connectivity and trust in the information, helping to generate critical mass and facilitating the processes of coordination and collaboration, thereby improving the efficiency and coordination of primary health care services. That also enhances practitioner access to tacit information.

4.10. Functional Requirements for the DSP

In this section the study defines what the instantiation is intended to achieve, based on the initial case study findings (the value propositions). Concrete functional requirements for a DSP, identified in the case study with participants, are now developed that will address specific participant perceptions of digital PHC coordinative and collaborative value. These functional requirements will inform the design propositions

for the instantiation. They define the specific functionality identified by participants to address the problem space. As such, they tell the designers what is expected to be achieved, but, importantly, not how this may be achieved. Design propositions (identified in Chapter 5) and formulated by means of the CIMO-Logic are a more prescriptive input, giving the designers more complete information on what to do in this context in order to achieve the value propositions communicated in the initial case study findings. Design propositions formulated by means of the CIMO-Logic provide a causal understanding on how the digital value propositions might be achieved, making the designers are more informed, and better positioned, to address the solution space. These functional requirements will be articulated in terms of the participatory value proposition clusters identified above, which provide a structured and guided framework for the identification of the design propositions.

4.10.1. Functional requirements for Value Proposition Cluster 1.

The findings of the case study show how current information access is informal, and how coordination is ad hoc and based on personal networks. Each organisation has their own specific organisational structure, goals and software systems. Participants noted that there were no structures in place that would facilitate the sharing of information necessary for health promotion planning. The diverse organisational and technical structures of the various PHC organisations preclude proprietary interfaces because none could guarantee handling of information to allow for continual updating. The information coordination challenges range from the sheer multiplicity of sources, the inability to quickly source and focus on the information needed and the resultant lack of oversight over existing planning and activities. Information exchange and interaction is limited and dependant on the personal networks of individual actors and organisations. Actors and organisations are thus unaware of what information other organisations and actors have or are able to provide. Equally, given the diverse information needs of organisations, not knowing what information to provide hampers the proactive provision of information. This gives rise to the problem that there is no single point of access for individuals and organisations to see who is providing what, from where, to whom, when, how and in association with whom. There is an apparent need for a centralised information repository (where to go to find out who, what, where and with what effect) that flexibly encourages the dissemination of both explicit and tacit information that is relevant to a multiplicity of organisations with differing practice logics and varying information needs.

> This leads to the first requirement: that the DSP should be a one-stop shop for entering and sharing PHC information.

The case study also showed that PHC practitioners and PHC service planning and delivery could benefit from greater connectivity and interaction.

> This also gives rise to the second requirement: that the DSP should support open connectivity and facilitate coordination among practitioners.

The case study showed that PHC information needs are diverse and that there is a need for both tacit (expertise) and explicit information. Explicit information in the PHC planning and service delivery context refers to information about who is doing what, where and when. Tacit information and knowledge from a PHC planning and service delivery perspective refers to the context within which a particular PHC intervention or activity is planned, specifically, the information required to shape and design an intervention or activity within a particular environment (Rychetnik, Frommer, Hawe, & Shiell, 2002). Tacit knowledge is based on and acquired through experience and practice, specific to context (Ambrosini & Bowman, 2001), and can be referred to as expertise. Organisational science sees tacit knowledge as a valuable organisational resource (Nonaka, 1994; Nonaka & Toyama, 2002). Such information is difficult to codify and even more difficult to elicit. However, such context-defined information is regarded as crucial to the success of PHC planning and service delivery. Previous studies refer to the importance of tacit information to the planning requirements of health promotion initiatives (Kothari et al., 2012). Participants in the participatory problem identification stage were concerned to trace individuals as sources of information that would provide context in a particular area, around a specific issue. The limitation of explicit information is that it does not allow users to understand information in context, how it is used in practice or how it changes over time. For example, people often move on from a project, activity or network and take with them all the related knowledge and expertise. Being able to identify, locate and contact such an individual would avoid having to retrace mapping work that has already been done. This issue refers to the difficulty in sharing expertise and contextual information.

> This leads to the third requirement, that the DSP should support the profiling of users with their associated experience and expertise.

4.10.2. Functional requirements for Value Proposition Cluster 2.

The provision of a digitally searchable, centralised information structure would enable the searcher to gain an oversight of project and collaboration activities relevant to their planning purposes. Practitioners and PHC managers focused on the difficulties experienced in sourcing and collating up-to-date information through existing processes. A great deal of time was wasted in trying to source the

information required for planning purposes. Information on networks was lacking. Existing interfaces between PHC actors are seen as inadequate in sharing planning and program activities. The ability to flexibly search for information with advanced search functionalities was seen as essential.

> This leads to the fourth requirement, that the DSP should support flexible information search, browsing and querying.

To avoid misunderstandings and misinterpretation of information and to promote the effective interpretation and utilisation of information, the DSP should provide contextual information to support and assist the correct entering of data. Practitioners looked for contextual user instructions to be developed in the form of assistant query drop-down options relevant to user activity.

> This leads to the fifth requirement, that the DSP should enable and provide information on the entering of information, the interpretation and use of information.

In addition, the DSP should offer mechanisms that enable users to keep track of changes and updates to information. Personal expertise develops and changes with time, and such information will need to be kept up to date. Information that is out of date will result in a decrease in trust by users in the information.

> This gives rise to the sixth requirement, that the DSP should provide mechanisms to support and keep track of amendments to information.

4.10.3. Functional requirements for Value Proposition Cluster 3.

There is no agreed definition of context, no common understanding of the context of the PHC sector. Currently, the situation is characterised by a lack of standardisation, a lack of common definitions, a lack of reliable information and no standard approach to extracting and analysing information. Definitions of health and community service terminologies are required to be provided to users in order to provide more clarity around the meanings of PHC titles and categories. This would be of assistance to primary health care workers and volunteers, whose knowledge of primary health care terminology might be limited. Categorisation of any such DSP data repository must be able to produce sharable digital information through the creation of a common lexicon and classification of health promotion activity (Gruszin, Jorm, Churches, & Straton, 2006). The objective must be to promote standardisation and disseminate information in a readily understandable form. It is important, in any sector-wide digital infrastructure, to use consistent and agreed terminology.

This leads to the seventh requirement, that the DSP should employ a common language to describe PHC activities and interventions.

The eighth and final requirement, requires that the DSP should support the categorisation, structuring and ordering of information to facilitate ease of understanding and use.

This is related to the seventh requirement as it also focuses on the ordering of data. However, the seventh requirement prioritises a common language whereas the eighth requirement focuses on the structured ordering of data within the DSP.

4.11. Summary: Case Study Value Propositions and FR Findings

Table 14: Functional Requirements for a DSP at a Supra-Organisational Level

Value Proposition Cluster	Functional requirements
1. Supraorganisational professional network association, actor, organisation, network and activity overview.	2. The DSP should be a one-stop shop for entering and sharing PHC information and expertise. 3. The DSP should support connectivity and facilitate coordination among users. 4. The DSP should support the profiling of users with their associated experience and expertise.
1. Information provision and the sharing of resources.	5. The DSP should support flexible information search, browsing and querying. 6. The DSP should enable, and provide information on the entering of information, the interpretation and use of information. 7. The DSP should provide mechanisms to support and keep track of amendments to information.
2. A common lexicon: terminology and vocabularies	8. The DSP should employ a common language to describe PHC activities and interventions. 9. the DSP should support the categorisation, structuring and ordering of information to facilitate ease of understanding and use.

4.12. Chapter Summary

In Chapter 4 the research identified clusters of digital value propositions which were used as a structured framework to derive the FRs for the instantiation; that is, what must be achieved in order to realise the digital value propositions. These FRs will be aggregated into the design propositions identified in the next chapter. Table 14 summarises the FRs based on the digital value propositions identified by practitioners. Further FRs will also be derived from other

sources , notably the S-D Logic kernel theory explored in Chapter 2 and integrated into this research in Chapter 5. It is posited that this represents a more rigorous approach to the identification of the design propositions and resultant architectural choices for the configuration of the instantiation. This study will next, in Chapter 5, describe the development of the design propositions and the configuration choices for the instantiation.

Chapter 5: The Design Propositions and Configuration Choices (PADR Phase: Participatory Action Taking)

5.1. Structure of the Chapter

This chapter builds on the FRs identified in the case study findings of the previous chapter. These FRs are to be integrated with FRs derived from the literature and aggregated into design propositions that will inform the design of the instantiation. The instantiation will be used to evaluate to what extent the value propositions identified by the research participants can be realised. That evaluation knowledge will lead to the abstraction of design principles, the primary research artefact, which will provide solution design knowledge for improved sectoral digital coordination and collaboration in the future. A design proposition is an input to a problem needing solution, offering guidance on decisions needed to achieve an outcome, and improving our understanding about potential design outcomes (Denyer et al., 2008). Practitioner expertise and experience (FRs, Chapter 4), S-D Logic and extant social media affordances (FRs developed from kernel theory, Chapter 5) are used to inform the design propositions (Lusch et al., 2007). The chapter also identifies and discusses the configuration choices of the DSP instantiation.

The chapter starts with an outline of the process for the definition of design propositions. Following this, the design propositions are defined based on case study analysis, the FRs developed in the previous chapter and the integration of kernel theory (S-D Logic and social media affordances). The design propositions are seen as high-level directions for the build and architectural configuration choices for the instantiation, targeting the service-orientated context within which the design is to be implemented. Following this defining of the design propositions, the chapter describes and justifies the architectural design choices of the instantiation and the instantiation is tested by participants. The chapter concludes with a summary of this part of the research process.

5.2. Determining the Design Propositions

The study's approach to the development of the design propositions has been divided into three steps:

1. Given approach to the definition of the design propositions
2. Identification and integration of kernel theory-informed FRs
3. Identification and communication of the design propositions by means of CIMO-Logic.

5.2.1. Step 1: Approach to defining the design propositions.

The prescriptive knowledge that underpins the design principles of a design theory are known as design propositions (Denyer et al., 2008). Design propositions contain prescriptive knowledge of how to approach possible solutions for a particular problem and why one approaches it in a given manner in order to achieve a particular result. Prescriptive knowledge has therefore, as its logic, if you want to achieve a particular outcome (O) in a particular context (C), use this specific intervention (I) (Denyer et al., 2008). Design propositions are based on the development of prescriptive knowledge, which leads to the design and evaluation of interventions that produce outcomes crucial to solving problems (Denyer et al., 2008). Design principles are abstractions that communicate design knowledge that provides a general solution to that particular class of problems. Denyer et al. (2008) propose the CIMO-Logic framework as a suitable vehicle to develop sociotechnical design propositions. The CIMO-Logic framework is appropriate for the sociotechnical approach of the research in that it can identify both technical and social causal mechanisms thus facilitating a better understanding of the causal mechanisms underpinning this prescriptive knowledge. To achieve this, CIMO-Logic proposes a given structure for defining the design propositions, starting with problematic contexts (C), then the introduction of a specific intervention (I), which consists of a purposeful action designed to address a design problem, in turn triggering a generative mechanism (M), producing a certain outcome (O) (Denyer et al., 2008). Mechanisms (M) effectively explain why that specific intervention (I) generates a certain outcome (O). Costa et al. (2018) introduce a more focused sociotechnical perspective by dividing the mechanisms (M) of the formula (the triggers activated by the intervention (I) that generate an outcome (O)), into firstly the technical instrument that facilitates the intervention and secondly, the social mechanisms that are triggered by this technical intervention. This is critical for this research given that the desired outcomes of the digital intervention (instantiation) ae effectively created through social interaction among users by means of the instantiation. The effect of this is to generate a more rigorous sociotechnical focus to the design propositions. Within the DSR PADR methodology of this study, evaluation will focus on evaluating how the use of the instantiation configuration design triggers these generative mechanisms that deliver the required outcomes. By seeking to understand where PHC actors see benefit in engaging and interacting (via the value propositions), the design is better able to incentivise and manage interactions and relationships among actors and between the technology and actors. The affordance framework is mobilised to guide this evaluation process. By asking what can the technology do for you? or, in this context, does the

technology realise the value proposition you originally perceived and defined?, the research is able to meet the first two of Deng and colleagues' (2018) evaluation guidelines : first, to evaluate the artefact according to the intended use and context; and second, to match the evaluation methods appropriately with the designed outcomes (see Chapter 6). This will ensure the ensuing solution design knowledge is more aligned to the supraorganisational-level problem space.

Design propositions can be seen as the first steps towards design knowledge (Carlsson et al., 2011), where propositions are generated to guide the design of the instantiation. In themselves they do not represent a solution to the problem but, as propositions, offer input for potential solution design knowledge (Denyer et al., 2008). The design propositions defined in this research are an outcome of an iterative search combining extant research, extant kernel theory and a participatory analysis of the problem space, resulting in the identification of functional requirements (see also Chapter 4).

In order to generate the design propositions, the following process was followed. Firstly, FRs identified from kernel theory (S-D Logic) are identified and then aggregated with the FRs developed from the findings of the case study. Following this the aggregated FRs are reframed in their identified clusters by means of CIMO-Logic to present with both more robust and more sociotechnical design propositions. CIMO-Logic asks how and why a specific intervention in a given context (in this instance a problematic sociotechnical context) will achieve a certain outcome (Denyer et al., 2008). Table 15 summarises the CIMO-Logic.

Table 15: CIMO-Logic (Adapted from: Denyer et al., 2008)

COMPONENT	DESCRIPTION
CONTEXT	The internal and external environment, comprising of individual and organisational relationships, the sociopolitical institutional system and its interdependencies, individual and organisational missions and goals. Further, the nature of the relevant technical systems.
INTERVENTIONS	A purposeful action seeking to provide a solution or influence outcomes with regard to an identified problem, a product, process, strategy. The interventions practitioners can use to influence behaviour or achieve an intended outcome. It is important to note that interventions are always introduced and embedded in a social system (context).
MECHANISMS	The social and/or technical mechanism triggered by the intervention or aspect of the intervention in a certain context. The mechanisms are thus context-dependant. It is to all intents and purposes a theory as to why certain outcomes emerge in that specific context.
OUTCOMES	The result of the intervention, if the intended outcome has been achieved.

5.2.1.1. The CIMO-Logic.

CIMO-Logic helps the research formulate the design propositions in a manner that aids designers and practitioners design the form of the instantiation and its configurational choices. The first objective in this process is to identify the generative (causal) mechanisms (Denyer et al., 2008). Causal mechanisms offer an understanding as to why a particular intervention will result in a particular outcome. The advantages of this within the CIMO-Logic is that the researcher has the opportunity to consider both technical intervention and resultant causal mechanism(s) generated by the intervention and is thus able to more clearly define outcomes. The above design process is more rigorous because it accommodates the contextually-defined social dynamics which ultimately impact on outcomes. The advantage of this approach is its developed understanding of the underlying generative mechanisms—of why the intervention generates a certain outcome in that particular (health) context (Pawson, Greenhalgh, Brennan, & Glidewell, 2014). See below, for example, a design proposition generated for this research constructed with CIMO-Logic:

> The development and configuration of a DSP enabling individuals, networks and organisations active in the PHC supraorganisational space (Context) to digitally upload and share their profiles (Technical Intervention) will facilitate greater visibility of and connectivity for all actors (Social Mechanism) and this heightened visibility may trigger greater actor interaction and coordination across the sector (Outcome).

Such a mechanism has both technical and social perspectives. From a technical perspective, the portal gives the user the digital capability to both share their information and access a broad range of PHC actors and actions taking place in the sector. From a social perspective, the ability to professionally profile both individual actors and actions gives actors a means of extending their professional profile within the sector and promoting their expertise. This will serve to generate trust in the information (professional interaction) and service value provided to interact and improve their own service delivery. Both digital intervention and social mechanisms should work in concert to encourage engagement and thus facilitate greater connectivity and coordination. The design of such collaborative information-sharing artefacts must therefore not only meet the technical networking and information-sharing needs of the users but must also be situated within the constraints and opportunities of the extant PHC landscape.

At this point the research has developed FRs from exploratory study with participants and determined how the design propositions are to be formulated. S-D Logic is now introduced as a theoretical sensitising device to further conceptualise how users will be incentivised to digitally share resources and engage in the provision of mutual services in this supraorganisational public landscape (Vargo & Lusch, 2011). The objective of this is to use S-D Logic and resultant service thinking to further inform the design propositions, given service represents the foundation of all social and public exchange in the PHC ecosystem. FRs derived from S-D Logic will be integrated with the existing FRs to develop design propositions that will provide a more comprehensive foundation for the configuration choices of the instantiation.

5.2.2. Step 2: Identification and integration of S-D Logic-informed FRs.

Building on the FRs already identified, this section incorporates the contribution S-D Logic can make in the requirements analysis and subsequent development of design propositions. The kernel theory S-D Logic and its public sector implications were explored in depth in Chapter 2 . This section will identify the implications of S-D Logic for the design solution; it reviews the public sector implications of using S-D Logic and then identifies key S-D Logic value propositions for the research. It begins with a consideration of service platforms, service ecosystems and the creation of service value through the lens of S-D Logic that underpins the generation of S-D Logic-informed FRs; it goes on to identify the S-D Logic value propositions derived from its potential application in the public sector. These are then consolidated into five S-D Logic value propositions from which a set of S-D Logic-informed FRs are developed. The original participatory-derived FRs (see Chapter 4) are then combined with these S-D Logic-informed FRs in order to develop the study's final design propositions.

5.2.2.1. S-D Logic design implications: service platforms, ecosystems and value.

Lusch and Nambisan (2015) conceptualise S-D Logic perspectives on service innovation across a network-centric (Nambisan & Sawhney, 2011), information-centric (Glazer, 1991) and value-centric (Vargo & Lusch, 2008) focus. These perspectives are based on the four metatheoretical foundations of S-D Logic discussed in Chapter 2: actor-to-actor networks, resource liquefaction, resource density and resource integration (Vargo & Lusch, 2008, 2016). S-D Logic sees service as the process of providing and/or exchanging something that is perceived as beneficial to either the provider or another entity. This service might consist of tangible resources (operan*d* resources) or intangible resources (operan*t* resources). Operant resources, such as skills and expertise, are the most pivotal for service innovation and are the most difficult to transfer (Lusch & Nambisan, 2015). ICTs may

enable the more effective spatial and temporal transfer of these resources across actor-to-actor networks. Resource liquefaction, as indicated in Chapter 2, separates information from its physical form or from the device that contains it (Lusch & Nambisan, 2015) and makes it available for broader consumption and sharing with others. Resource density refers to the ability to bring contextually relevant knowledge (Lusch & Nambisan, 2015) to bear, in a place and a time where it can be accessed as needed, by others. Resource integration refers to the re-bundling of information, or the combination of information with other resources, to generate service innovation and delivery. DSPs offer benefits across time and space in presenting digital service capabilities that may operationalise the four metatheoretical foundations of S-D Logic, but, as indicated, this is impacted by the requirement to deliver a service ecosystem around the DSP.

5.2.2.1.1. Service platforms (DSPs).

S-D Logic holds that a service platform (referred to in this study as a DSP), advances resource liquefaction and density. The configuration choices, or architectural structure of the platform, will determine how easily actors can identify, access, integrate or otherwise use such resources. Attention needs to be paid to the structure of platforms in order to maximise resource liquefaction and density and so enhance service exchange and innovation (Lusch & Nambisan, 2015). The greater the density of the resource offering, the more diverse the value propositions, thus creating potential for greater engagement. How the platform is configured to facilitate and coordinate the interaction of resources and actors will impact on value propositions and the realisation thereof (Hein, Scheiber, Böhm, Weking, & Krcmar, 2018).

5.2.2.1.2. Service ecosystems

A service ecosystem may be defined as a loosely coupled, self-adjusted and self-contained network of actors connected by shared value propositions and institutional logic (Lusch & Nambisan, 2015). A service ecosystem such as the one proposed in this research for the supraorganisational PHC sector would seek to digitally connect multiple PHC actors in order to exchange information, knowledge and expertise in a shared institutional framework (shared worldview) and context (Australian PHC) that effectively creates service value through resource liquefaction and integration. Lusch and Nambisan (2015) identify three critical areas that the development of such a proposed ecosystem would need to consider:

The first area is the structural flexibility and integrity of the platform ecosystem. Here structural flexibility refers to the ease and ability with which actors may connect and integrate resources in a context where those actors enjoy agency; that is, they are free to enter, interact or not, and form connections and networks as and if they see value. Thus, attention needs to be paid to how actors, and configurations of actors may easily engage and interact within the ecosystem. Structural integrity refers to the ties or relationships that are developed between actors and the manner in which these ties may generate more interaction and engagement, i.e., the degree of coupling. It is therefore important to structure the resource offerings in such a manner that would generate and promote such ties. There is obviously a play-off here as well, as the greater the agency of actors (structural flexibility) in the ecosystem, the less options there are to more closely structure relationships and ties (focusing on how interaction may occur and how value is realised from these interactions). More closely structured relationships and ties would limit the ability of actors to explore further avenues of service exchange (structural integrity) possible with greater agency. However, Lusch and Nambisan (2015) posit that other factors may mitigate such constraints, such as facilitating the development of trust among actors.

Second, the ecosystem needs to ensure that that actors share the same worldview, referred to in the PHC context as the same institutional logic. In order to productively share resources and exchange services, actors need to be working from a common set of organisational understandings and evaluation methods. A common lexicon, for example, reinforces a shared worldview. Lusch and Nambisan (2015) and Weick (1995), refer to this as "cognitive distance." A sizeable gap in cognitive distance between actors would limit the ability of actors to recognise shared resources and exchange coordination opportunities. Given the actors within the proposed PHC supraorganisational context share the same institutional logic (the Australian PHC sector), this is treated as a given in the development of the S-D Logic-informed value propositions.

Finally, Lusch and Nambisan (2015) posit that the service ecosystem should provide for an "architecture of participation" referring to the governance processes of the service ecosystem. This is the manner in which actors' behaviours in interacting are coordinated and how service exchange and value realisation is facilitated. It means providing transparent rules of engagement.

5.2.2.1.3. Service ecosystem value co-creation.

From an S-D Logic perspective, the platform enabling the interaction of actors shapes the co-creation and realisation of value (Hein et al., 2018). Actors may have various roles, as service offerors (those who present resources for integration) and as service beneficiaries (the beneficiaries of resources). S-D Logic provides for three broad roles for actors, dependent on the service exchange and the type of resource integration (Lusch & Nambisan, 2015). The first role, ideator, distributes knowledge about specific resource needs, which can then be integrated; the second role, designer, mixes and matches existing resources to develop new service opportunities; the third role, the intermediary, cross-pollinates knowledge among multiple services.

The S-D Logic dimensions identified above are integrated into the identification of the S-D Logic value propositions developed in Table 16 below.

Table 16: S-D Logic Value Propositions and their Relationship to the Public Sector (Adapted from (Trischler & Charles, 2019)

S-D Logic foundational premise	Public sector S-D Logic	S-D Logic value propositions
FP1 Service is the fundamental basis of exchange	• In public service platforms and ecosystems the user should always be able to co-create value in various forms and specific contexts. • End users in public service platforms and ecosystems are not passive recipients of value but are resource integrators and thus cocreators of value.	• The DSP should facilitate opportunities for PHC actors to easily interact and to share and consume expertise and knowledge. In effect, to co-design service delivery.
FP2 Indirect exchange masks the fundamental basis of exchange	• Public service platforms and ecosystems need to consider how value co-creation activities take place and evolve between collectively organised actors.	• The DSP should rely on PHC actors to determine how resources should be shared and integrated at this level.
FP3 Goods are distribution mechanisms for service provision	• All exchanges in the public sector are service exchanges	• The DSP should facilitate service exchange opportunities with PHC actors' desired level of involvement.
FP4 Operant resources are the	• A fundamental aim of public service platforms and ecosystems should be to	• The DSP should facilitate the mobilisation and sharing of PHC actors

fundamental source of strategic benefit.	support value co-creation activities to address public problems. • Public service platforms and ecosystems should include the identification and support of emergent solutions driven by different actors.	operant resources for the benefit of all.
FP5 All economies are service economies	• Likewise the public sector	• Generic to S-D Logic. No specific value proposition.
FP6 Value is co-created by multiple actors, always including the beneficiary.	• Public service platforms and ecosystems provide an important basis for coordinating resources within a sector composed of multiple actors with different interests and experiences. • Public service platforms and ecosystems need to consider value co-creation activities that occur independently or beyond dyadic exchanges with the service-providing organisation. • Public service platforms and ecosystems need to evaluate the effect of government interventions on collective actions involving various actors with different interests. • Instead of directing individual organisations to deliver solutions, public service platforms and ecosystems should enable relevant actors to address public problems collaboratively.	• The DSP should provide opportunities for all PHC actors (individuals, networks organisations, projects), to share resources, connect and collaborate in the delivery of PHC services.
FP7 Actors cannot deliver value but can participate in the creation and offering of value propositions	• Public service platforms and ecosystems requires an understanding of why and how actors coordinate themselves around specific value co-creation activities.	• The DSP should rely on PHC actors to determine how resources should be shared and integrated at this level.
FP8 A service-centred view is inherently beneficiary orientated and relational	• Public service platforms and ecosystems are required to understand the users' value creation process in order to establish a suitable technical configuration for users to	• The DSP should provide for ease of use and access by all PHC actors.

	connect, integrate resources and collaborate.	
FP9 All social and economic actors are resource integrators	• Public service actors are both providers and consumers of services	• The DSP should provide opportunities for all PHC actors (individuals, networks organisations, projects), to integrate resources, connect and collaborate in the delivery of PHC services.
FP10 Value is always uniquely and phenomenologically determined by the beneficiary.	• Value is generated in use.	• The DSP should be configured and designed in such a way so as to allow users to determine how to integrate resources.
FP11 Value co-creation is coordinated through actor-generated institutions and institutional arrangements	• Public service platforms and ecosystems needs to consider how users create value based on the provision of a given resource configuration. • Policy makers need to evaluate the effect of government interventions on collective actions involving various actors with different interests.	• The DSP should be configured and designed in such a way so as to allow users to determine how to integrate resources.

5.2.2.1.4. Public sector implications of S-D Logic and its value propositions.

Catering for redundancy across the S-D-Logic value propositions above, S-D Logic value propositions may be consolidated into five key value propositions:

1. The DSP should facilitate ease of use and access opportunities for PHC actors to easily interact and to share and consume expertise and knowledge.
2. The DSP should rely on PHC actors to determine how resources should be shared and integrated at this level.
3. The DSP should facilitate service exchange opportunities with the users' desired level of involvement.
4. The DSP should facilitate the mobilisation and sharing of PHC actors operant resources for the benefit of all.
5. The DSP should be configured and designed in such a way so as to allow users to determine how to integrate resources.

5.2.2.1.5. S-D Logic functional requirements.

In this section the study develops the FRs derived from the five key S-D Logic value propositions:

S-D Logic Value Proposition 1: ***The DSP should facilitate ease-of-use and access opportunities for PHC actors to easily interact and to share and consume expertise and knowledge.***

S-D Logic posits that decreasing communication and interaction costs will facilitate greater interaction and more opportunities for resource integration and service exchange and thus the generation of co-created service value. Shared knowledge and expertise constitute the resources upon which value, in terms of enhanced service delivery, is generated. This ability to access resources more effectively will enhance the collaborative competence (the ability of PHC actors to integrate resources between themselves) at a supraorganisational level of individual PHC actors and the sector as a whole. This value proposition provides for structural flexibility in the form of greater agency which, in turn, will provide more service value-generating opportunities. This leads to the first S-D Logic-derived FR:

> that the DSP should be open and accessible to all PHC actors and that data should be presented in an optimum manner to facilitate user exploitation of that data.

S-D Logic Value Proposition 2: ***The DSP should rely on PHC actors to determine how resources should be shared and integrated at this level.***

PHC actors, in the form of practitioners from across the sector with their needs-specific knowledges, are best positioned to determine how resources should be presented and integrated. Harvesting their understanding of what is required in terms of resource needs, expectations and use-requirements will best position the DSP to generate service value. This value proposition also underpins the choice of PADR methodology and provides for structural integrity in the form of loosely coupled ties pertinent at the supraorganisational level. It also provides for the process of determining the architecture of participation. This leads to the second S-D Logic FR:

> that PHC actors should determine service resources and their classification and integration (practice) at the supraorganisational level.

S-D Logic Value Proposition 3: ***The DSP should facilitate service exchange opportunities with the users desired level of involvement.***

This S-D Logic value proposition seeks to ensure that engagement and participation is not burdensome. Where actors are able to determine their level of involvement so the options for interaction will be improved and engagement will be facilitated. This contributes to structural integrity and value co-creation. This leads to the third S-D Logic FR:

that users should be able to determine their desired level of involvement.

S-D Logic Value Proposition 4: ***The DSP should facilitate the mobilisation and sharing of PHC actors operant resources for the benefit of all.***

By focusing firstly, on practitioners experience and expertise, and secondly, the effective mobilisation of those resources, the DSP will facilitate access to sufficient operant resources for value generation when resources are integrated. This addresses the co-creation of value where actors are both offerors and consumers of value. This leads to the fourth S-D Logic FR:

that the DSP should facilitate the capture, aggregation and distribution of operant resources, ensuring that all actors can find value.

S-D Logic Value Proposition 5: ***The DSP should be configured and designed in such a way so as to allow users to determine how to integrate and consume resources***.

Service delivery value is generated by multiple PHC actors from multiple processes. Ensuring the optimum resources are present at the right time to address diverse resource needs – the effective mobilisation of resources – requires that the DSP presents with a broad array of resources and PHC practitioners, that these resources are open to all practitioners, and presented in a manner that the user determines how and where value is to be generated. This value proposition is consistent with S-D Logic which holds that value is always uniquely and phenomenologically determined by the beneficiary (FP10). This leads to the fifth and final S-D Logic FR:

That the DSP should facilitate user determination of where value is captured.

Table 17, below, presents the combined FRs from both the exploratory research and S-D Logic.

Table 17: Participatory and S-D Logic-Derived Functional Requirements

Participation-derived FRs	S-D Logic-derived FRs
1. The DSP should be a one-stop-shop for entering and sharing PHC information and expertise.	9. The DSP should be open and accessible to all PHC actors and that data should be presented in an

2. The DSP should support connectivity and facilitate coordination among actors. 3. The DSP should support the profiling of actors with their associated experience and expertise. 4. The DSP should support flexible information search, browsing and querying. 5. The DSP should enable, and provide information on the entering of information, the interpretation and use of information. 6. The DSP should provide mechanisms to support and keep track of amendments to information. 7. The DSP should employ a common language to describe PHC activities and interventions. 8. The DSP should support the categorisation, structuring and ordering of information to facilitate ease of understanding and use.	optimum manner to facilitate user exploitation of that data. 10. That PHC actors should determine resources, their classification and integration (practice) at the supraorganisational level. 11. That actors should be able to determine their desired level of involvement. 12. That the DSP should facilitate the capture, aggregation and distribution of operant resources, ensuring that all actors can find value. 13. The DSP should facilitate actor determination of where value is captured.

In the following section the study integrates the FRs into design propositions based on the CIMO-Logic.

5.2.3. Step 3: Communicating the design propositions with CIMO-Logic.

In this third step the design propositions are consolidated and developed from the above FRs. In all instances of the design propositions, the context is the same, that is, the supraorganisational PHC landscape. This reflects a common institutional framework and common values. The relevant FRs from which the design propositions are developed are followed by the design proposition being articulated in the CIMO-Logic. Where applicable generative mechanisms are defined as technical or social.

5.2.3.1. Design Proposition 1.

- FR1: The DSP should be a one-stop shop for entering and sharing PHC information and expertise.
- FR 9: The DSP should be open and accessible to all PHC actors and that data should be presented in an optimum manner to facilitate actor exploitation of that data.
- FR 12: The DSP should facilitate the capture, aggregation and distribution of operant resources, ensuring that all actors can find value.
- FR 6: The DSP should provide mechanisms to support and keep track of amendments to information.

Design Proposition 1: Providing a centralised and structured digital information structure, that is accessible and open to all PHC practitioners, will enable PHC actors to gain oversight of sectoral project and collaboration activities **(Digital Intervention (I))**. More efficient access to **(Technical Mechanism (TM))**, and therefore better utilisation of PHC sector, planning and program information will enable the PHC sector to better manage information dissemination and utilisation and generate heightened visibility and interaction **(Social Mechanism (M))**, giving rise to more extensive and efficient knowledge-sharing, coordination and collaboration, which are sector priorities **(Outcome (O)).**

5.2.3.2. Design Proposition 2.

- **FR 2:** The DSP should support connectivity and facilitate coordination among actors.
- **FR 4:** The DSP should support flexible information search, browsing and querying.
- **FR 5:** The DSP should enable, and provide information on the entering of information, the interpretation and use of information.

Design Proposition 2: The provision of a digitally searchable information structure across PHC activities and actors **(Digital Intervention (I)),** would enable PHC actors greater ease of access to resources relevant to their service delivery needs, promoting more efficient access to resources (**Technical Mechanism (M))**, thereby increasing the potential for service value co-creation **(Outcome (O))**.

5.2.3.3. Design Proposition 3.

- **FR 7:** The DSP should employ a common language to describe PHC activities and interventions.
- **FR 8:** The DSP should support the categorisation, structuring and ordering of information to facilitate ease of understanding and use.

Design Proposition 3: Systemising and categorising available resources according to a common framework and language of PHC resources **(Digital Intervention (I))** will promote ease of interaction **(Social Mechanism (M))** and resource integration **(Technical Mechanism (M))**, thereby improving connectivity, information sharing and coordination **(Outcome (O))**.

5.2.3.4. Design Proposition 4.

- **FR 3**: The DSP should support the profiling of actors with their associated experience and expertise.

Design Proposition four: Developing a database based on actor profiles that lists and connects actors, their networks and activities **(Digital Intervention (I))** will serve to trigger professional trust in the information, helping to generate interaction and facilitating the processes of coordination and collaboration **(Social Mechanism (M))** thereby improving the efficiency and coordination service value co-creation **(Outcome (O)).**

5.2.3.5. Design Proposition 5.

- **FR 10:** PHC actors should determine resources, their classification and integration (practice) at the supraorganisational level.
- **FR 11:** Actors should be able to determine their desired level of involvement.
- **FR 13:** The DSP should facilitate actor determination of where value is captured.

Design Proposition 5: Facilitating practitioner involvement and contribution to the design and development of the technology **(Intervention (I)),** will facilitate greater trust and acceptance, thereby promoting greater engagement **(Social Mechanism (M))** and improving connectivity, information sharing and coordination, which are sector priorities **(Outcome (O)).**

5.2.4. Overview of design propositions.

In the previous section the study developed the design propositions from the FRs by means of CIMO-Logic. The FRs were derived from firstly, the participatory PADR Phase 2, opportunity identification and participative planning, and addressed the identified value proposition clusters. Secondly, FRs were derived from kernel theory, S-D Logic. The following section describes the design and development of the DSP instantiation based on the design propositions. The instantiation was designed and tested in collaboration with participating partners in the third phase of the PADR process, the action-taking or design phase.

5.3. Functions of the Instantiation

In the following section the study lists the proposed functions associated with design propositions.

Table 18: Design Propositions and Functions

Design Proposition	Functions

Design Proposition 1: Providing a centralised and structured digital information structure, accessible and open to all PHC practitioners, enables PHC actors to gain oversight of sectoral project and collaboration activities. More efficient access to, and therefore better utilisation of planning and program information will enable the PHC sector to better manage information dissemination and utilisation, generate heightened visibility and interaction, giving rise to more extensive and efficient knowledge-sharing, coordination and collaboration, which are sector priorities.	• Actors have a single point of access to data. • Actors can register (password access) and add data. • Actors can view data across datasets (actor, project, network). • Actors can view an overview of all profiles, activities and networks. • All data is accessible to all actors.
Design Proposition 2: The provision of a digitally searchable information structure across PHC activities and actors would enable PHC actors greater ease of access to resources relevant to their service delivery needs, promoting more efficient access to resources thereby increasing the potential for service value co-creation.	• Actors can retrieve data by keywords across datasets. • Data can be viewed online. • Actors can retrieve data by query across project, network (intervention), actor. • Data search can also be filtered by geospatial (postcodes) and temporal filters.
Design Proposition 3: Systemising and categorising available resources according to a common framework and language of PHC resources will promote ease of interaction and resource integration, thereby improving connectivity, information sharing and coordination.	• Data is collated according to the Jorm public health classification framework, as amended by the participative research process. • A selection of explanatory information is available via drop-down box about how the classification works and how data may be entered. • Actors are flagged every 6 months to maintain currency of data.
Design Proposition 4: Developing a database based on actor profiles that lists and connects actors, their networks and activities will serve to trigger trust in the information, helping to generate interaction and facilitating the processes of coordination and collaboration thereby improving efficiency and coordination in service delivery.	• Actors can create a profile. • Actors can upload data regarding roles, contact details, responsibilities, professional activities and experience. • Data is linked via profile.
Design Proposition 5: Practitioner involvement and contribution to the design and development of the technology will facilitate greater trust and acceptance, thereby promoting greater engagement and improving connectivity, information sharing and coordination, which are sector priorities	• Peer-to-peer interaction • Practitioners have open access

5.4. Architectural Configuration

The instantiation design is governed by the configuration choices for the DSP. In Table 18, the configuration choices are described in terms of the design propositions. The instantiation is a working version of the proposed system the study utilises for the purposes of evaluation. From this design, build and evaluate process the design principles, which are the primary artefact of this study and the vehicle by which solution knowledge regarding the problem space is captured, are abstracted. Building and evaluating the instantiation will enable the study to explore options, constraints, weaknesses and risks which might otherwise remain unknown. Equally, the instantiation and its naturalistic evaluation within the PADR DSR process enables researchers and actors to physically evaluate as to how the proposed solution addresses identified needs. The instantiation must also allow for ongoing testing and evaluation and be able to respond to developing user requirements, as the architectural design of the instantiation plays a critical role in facilitating and generating the ecosystem that fulfils the digital value propositions for actors. These configuration choices will be evaluated for ways in which they generate or constrain resource sharing and service exchange amongst practioners.

5.4.1. Approach to the configuration of the instantiation.

The study uses Blaschke et al. (2019) sociotechnical DP architectural dimensions to identify and frame the architectural configuration that will optimise the ability of actors to co-create PHC service value. A DSP with a centralised information repository (where to go to find out who, what, where and with what effect)—one that flexibly provides broader visibility and greater interaction, ease of dissemination of both explicit and tacit information and integration of resources delivers PHC service delivery value. This shifts information and knowledge-sharing from a spatially and temporally limited process to a decentralised process, whereby the dissemination and uptake of information is continuous. The following table looks at the architectural and governance configurations of the instantiation based on the five design propositions:

- Internet-based, independent access
- A centralised, standardised data repository
- Categorising and sharing searchable information
- Profiling of individual professionals, organisations, networks and activities (experience and expertise)

- Actor, organisation, network and activity overview, visibility and connectivity.

5.4.2. Configuration of SALUS.

Table 19 presents the design proposition, the configuration choice aligned to that design proposition and an explanatory comment.

Table 19: Sociotechnical Configuration of SALUS (Adapted from Blaschke et al., 2019)

Design Proposition	Configuration choice	Comment
Design Proposition 1: By providing a centralised and structured digital information structure, accessible and open to all PHC practitioners, may enable PHC actors to gain oversight of sectoral project and collaboration activities. More efficient access to, and therefore better utilisation of planning and program information will enable the PHC sector to better manage information dissemination and utilisation, generate heightened visibility and interaction, giving rise to more extensive and efficient knowledge-sharing, coordination and collaboration, which are sector priorities. **Design Proposition 5**: Practising practitioner involvement and contribution to the design and development of the technology will facilitate greater trust and acceptance, thereby promoting greater engagement and improving connectivity, information sharing and coordination, which are sector priorities	**Digital Infrastructure Dimension-Open Access**: A web portal with unobstructed access permission for primary health care professionals to an established digital infrastructure (the internet) that results in immediate and free access.	**An internet-based portal** would enhance ease of use and access for participating professionals in a loosely coupled, peer-to-peer community. This would enable users to gain an oversight of project and collaboration activities relevant to their strategic planning purposes. More efficient access to planning and program information will enable the primary health care sector to better plan and manage information dissemination and utilisation, promote heightened visibility and knowledge-sharing giving rise to greater connectivity and information sharing.
Design Proposition 2: The provision of a digitally searchable information structure across PHC activities and actors would enable PHC actors greater ease of access to resources relevant to their service delivery needs, promoting more efficient access to resources thereby increasing the potential for service value co-creation. **Design Proposition 3:** Systemising and categorising available resources	**Technical Core Dimension-Resource openness**: opening the DSP's core resources. architecture that promotes end user interaction and facilitating service exchange. All resources are	**A centralised, standardised, digitally searchable data repository**. This repository allows for the classification and standardisation of the PHC sector in order to disseminate readily understandable and usable information (Jorm, Gruszin, & Churches, 2009). Multidimensional classification of public health is utilised to base the

according to a common framework and language of PHC resources will promote ease of interaction and resource integration, thereby improving connectivity, information sharing and coordination.	available to all users.	categorisation of the nature and scope of primary health care activities in the proposed tool. This enables the use and availability of information, creating greater opportunities for connectivity, information sharing and coordination.
Design Proposition 4: Developing a database based on actor profiles that lists and connects actors, their networks and activities will serve to trigger trust in the information, helping to generate interaction and facilitating the processes of coordination and collaboration thereby improving the efficiency and coordination service value co-creation.	**Ecosystem Dimension-Federated network**: A peer-to-peer, outward looking, vertically disintegrated open-loop ecosystem.	**Profiling of individual actors, organisations, networks and activities**. Fellow professionals and their networks are seen to be a primary information source. A database based on user profile listing and connecting networks, activities and practitioners creates profile functionality. The user profile links to projects and activities the user is involved in as well as which networks and committees the user is associated with. By developing a database based on user profile that lists and connects networks, activities and practitioners will trigger greater connectivity and trust in the information, helping to generate critical mass and facilitating the processes of coordination and collaboration, thereby improving the efficiency and coordination of primary health care services.
Design Proposition 2: The provision of a digitally searchable information structure across PHC activities and actors would enable PHC actors greater ease of access to resources relevant to their service delivery needs, promoting more efficient access to resources thereby increasing the potential for service value co-creation.	**Service Dimension-Exchange orientation:** designed to reduce transaction costs in direct exchanges (one-to-one).	The provision of a searchable information structure to enable the searcher to target, gain oversight and exchange information around individuals, organisations, networks and project activities, across the sector, relevant to their information needs and planning purposes, thereby promoting greater connectivity and more efficient access to, and utilisation of, information.

The above configuration allows for all relevant information to be maintained in a central repository, but information can also be filtered to meet specific information needs. The

internet-based repository makes the creation, modification and updating of information resources possible. Internet access maintains the repository separate to and independent of individual organisational structure. It allows for multiple people to collaborate and encourages a sector-wide view of the health promotion landscape. The configuration described above affords users in the primary health care sector the ability to pursue several connectivity and information-sharing actions designed to address the digital value propositions identified earlier. Participants can create and share their profiles, presenting experience, expertise, networks, activities and contact details; they can also manage and edit their own profiles. In order for knowledge to be shared across the primary health care sector with diverse users, sector-wide, requires a common understanding and language for activities and roles. During the exploratory research it was identified that the Jorm et al. (2009) classification scheme is a good starting point for standardising the activities in this area. The primary purpose in using the classification system is to improve the use and availability of primary health care information through the creation of a common lexicon and classification of primary health care activity (Gruszin et al., 2006). This common understanding is seen to afford the coordination of planning activities, improving decision making and allowing for the easier audit of activities. The user would have the option of filtering information according to project, activity and network on a geographical basis. This standardisation of information generates searchability affordances across keyword, actor, project and network. A series of given fields with drop-down boxes and defined public health information categories facilitates standardisation and classification of activities and projects.

The instantiation was constructed under the project name SALUS (after the Roman god of welfare), a reference to the core competency of the PHC sector. The instantiation was made available to participants via a website. Figure 8 below shows a screenshot of the landing page with an invitation to actors to register by entering their profile data. The provided screenshots have been anonymised for inclusion in this study.

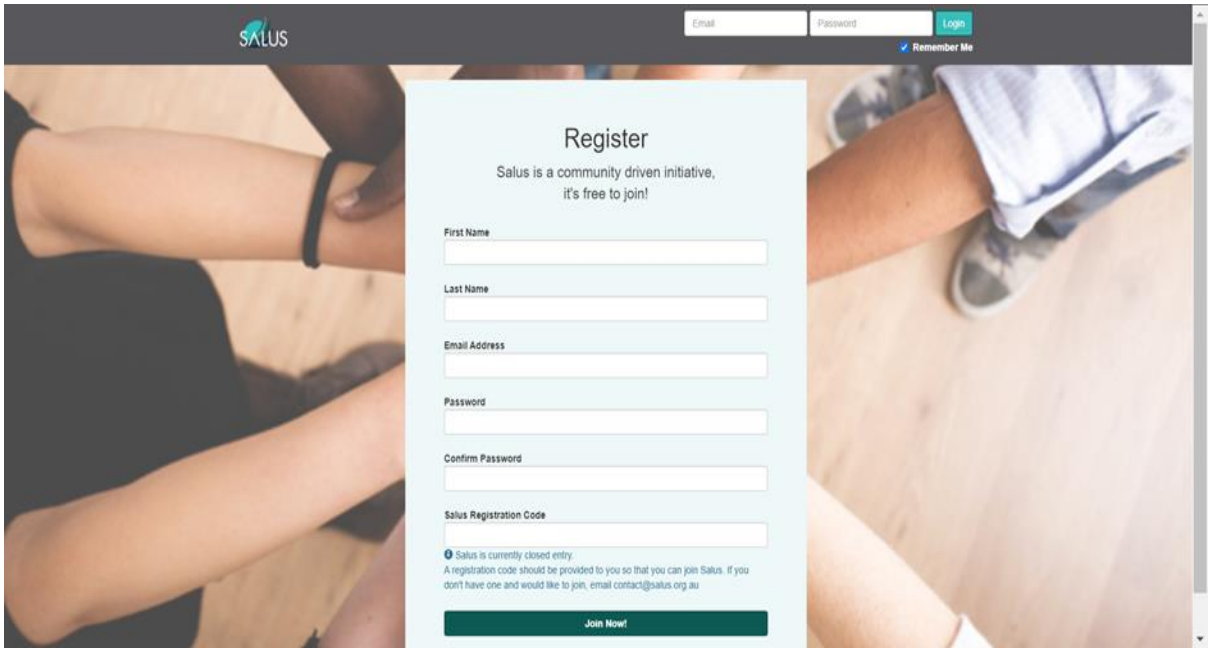

Figure 8: Screenshot: SALUS Landing Page

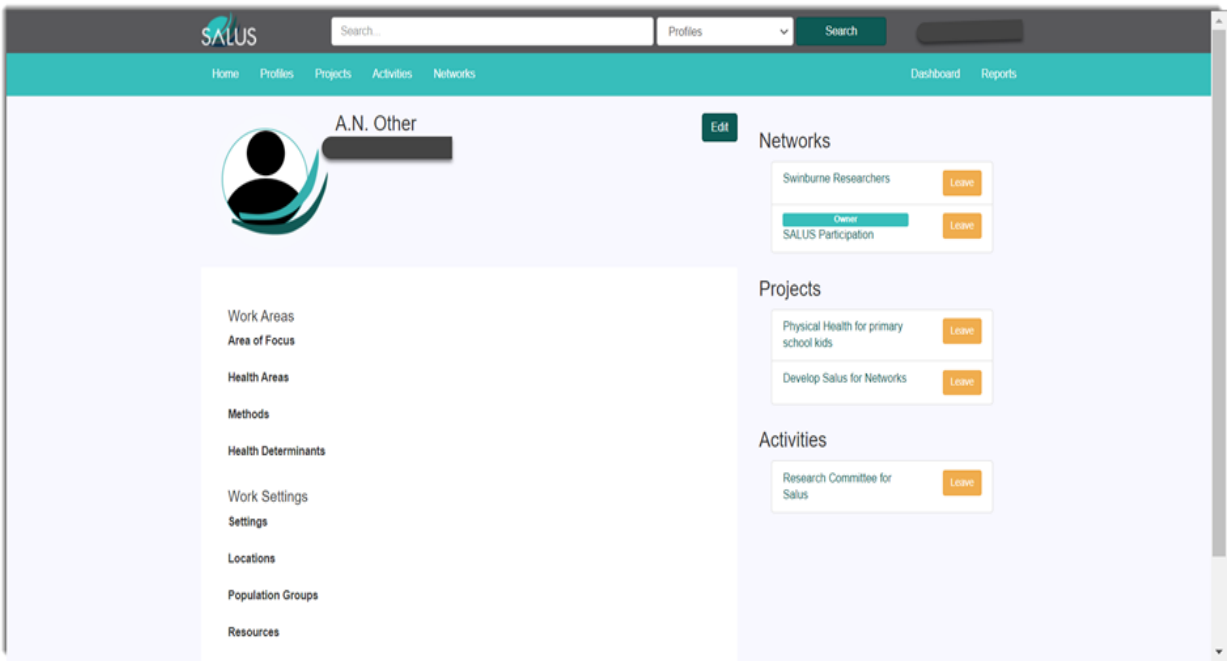

Figure 9: Screenshot: SALUS Profile Page for Actors

The instantiation allowed for actors to enter data across projects, activities and networks. Profile data, inclusive of contact details, is available to other registered actors.

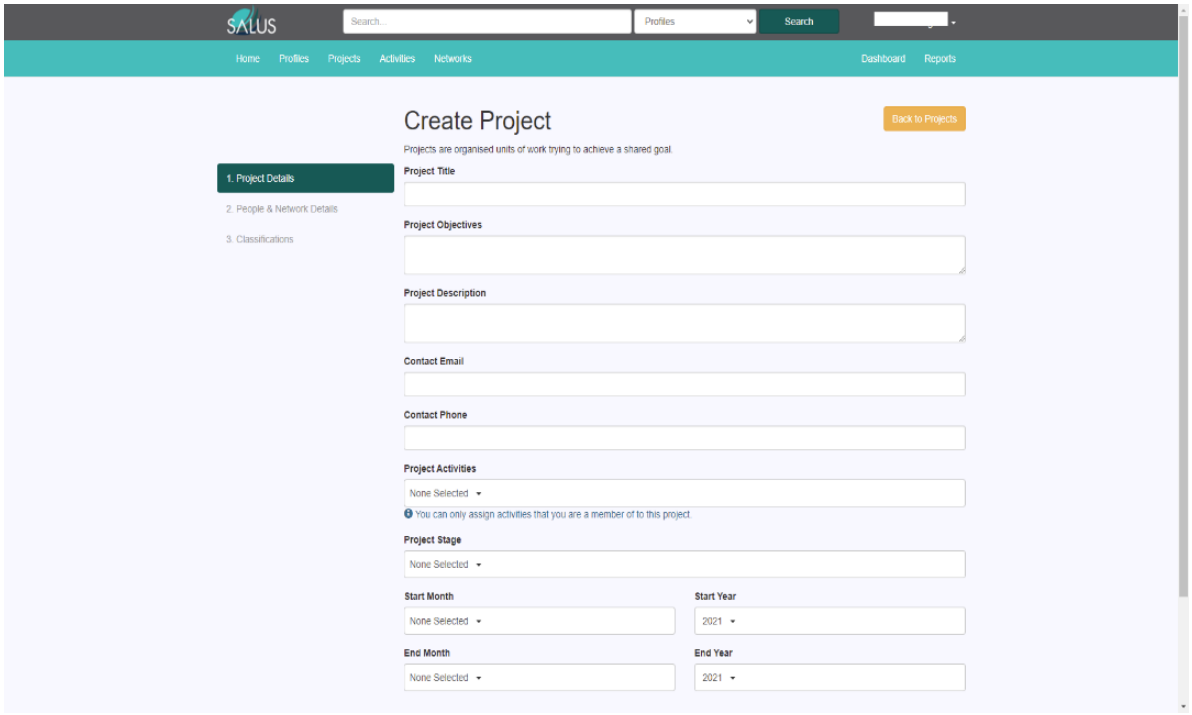

Figure 10: Screenshot: SALUS Create Project Page

The collation of data in this manner allows for keyword search and dataset overview. Keyword search can be filtered according to dataset: either profile, activity, project or network. From any dataset actors can filter and analyse data in more depth.

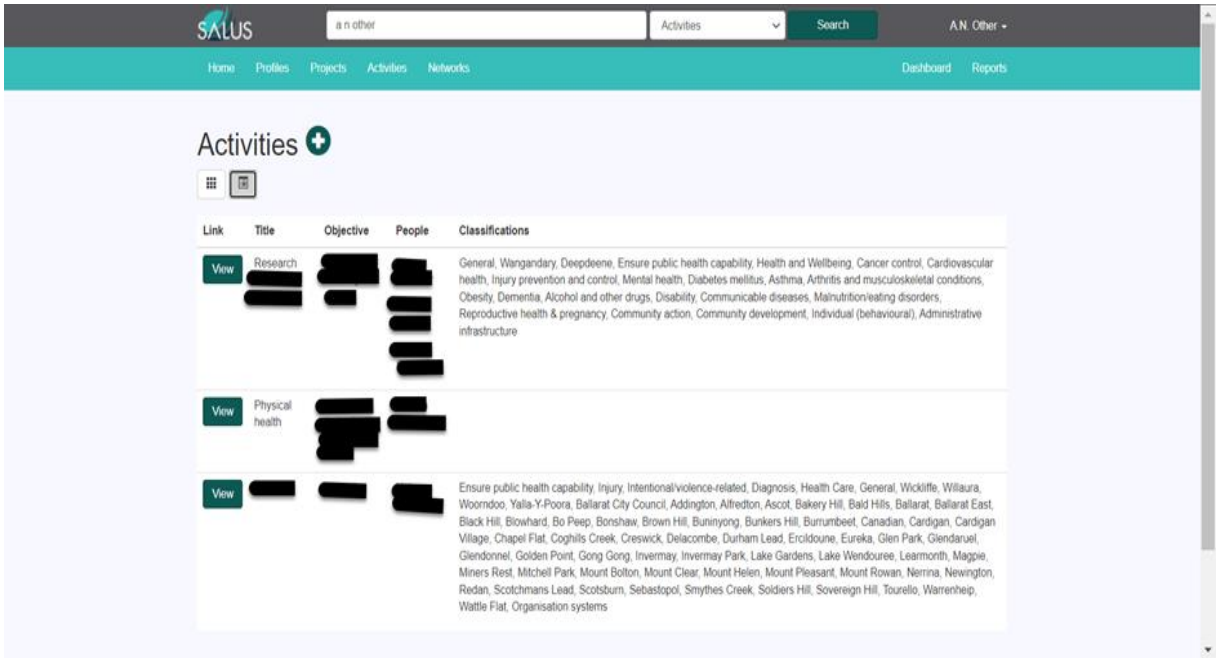

Figure 11: SALUS Search Dataset Overview

5.5. Instantiation Testing

The instantiation was subject to alpha testing (Sommerville, 2011) to address defects. Thereafter the instantiation was subjected to two user testing sessions (beta testing) with participant users within the PCP. The aim of the usability testing was to get user feedback on the general functionality and users' perceptions (interaction testing) of the tool. The testing was carried out under controlled conditions. Participants were introduced to the instantiation, given a short overview of its functionality, firstly asked to carry out predefined tasks and then secondly, asked to navigate through the system, entering and modifying their own data. Participants were asked to discuss their actions with the research team in order that the team could understand usability issues. Participants were also asked about further usability requirements, individual and collaborative potentialities and possible further innovative uses.

The usability testing sessions were followed by a survey in which participants were asked about their personal experience in using the prototype and their assessment of its usefulness to them as PHC practitioners. Usefulness and relevancy of information was confirmed. Overall, participants perceived a benefit to the tool, seeing its potential to assist them in their roles and indicated that they would use the tool. However, just under half the participants indicated apprehension in using the tool confidently, indicating usability issues centred around accessibility, privacy, ease of use and presentation. Based on this user feedback, the tool was improved in terms of usability in the following respects:

Definitions of health and community service terminologies were discussed with actors in order to provide more contextual clarity around the meanings of the classifying titles and categories. This would be of assistance to primary health care workers and volunteers, whose knowledge of primary health care terminology might be limited. More complete contextual user instructions were developed in the form of assistant query drop-down options relevant to user activity and in the form of explanatory help videos available to users. A number of functionality issues were pointed out by testers and resolved. Comments regarding the appearance of the website were resolved with the appointment of a graphic designer to improve appearance and attractiveness to users. User feedback concerning the capturing of network, project and personal information was resolved. For example, in the capturing of project data, the stage of the project and completion timeline information was supplied. The population groups targeted in primary health care activities were included. A number of search functionality issues were raised and addressed.

5.6. Chapter Summary

Supraorganisational coordination and collaboration levels in the PHC sector are recognised as limited. The DSP instantiation was developed to evaluate how a DSP could address these challenges with the objective of developing nascent design theory that could assist the sector to better coordinate and collaborate. The designed instantiation seeks to deliver the following functionality: to serve as a central entry and focal point for accessing information on primary health care actors, activities and networks. The centralised, open configuration will serve to delocalise information and knowledge (resource liquefaction) through heightened visibility and information sharing. Equally, individual users are to have the ability to search and view other users' profiles and content, with the potential of creating networks and channels to form connections with others. The design allows for all relevant information to be maintained in the central repository but, at the same time, information can be filtered to meet specific information needs. The internet-based repository makes the creation, modification and updating of information resources through multiple sources possible. Central internet access maintains the repository separate to and independent of individual organisational structure. It allows for multiple actors to collaborate and encourages a sector-wide view of the PHC landscape.

This chapter addressed the development and definition of the design propositions by means of the CIMO-Logic and subsequent development of the instantiation. The development of the instantiation encompassed the following steps: firstly, defining the objectives of the instantiation in terms of the value propositions; secondly, developing the FRs and the main functions required to meet its objectives; thirdly, building the instantiation and, finally, testing the instantiation for useability. The functions that would be required of the instantiation to meet its objectives were identified. From this the configuration choices that would be deemed to most optimally realise the functions of the instantiation architecture were defined. The instantiation was then developed to iteratively test and evaluate its coordinative and collaborative capability.

Hevner et al., (2014) emphasises that a DSR project is required to primarily focus on the research artefact. In Chapter 6, the study describes the ex-post naturalistic evaluation of the instantiation and formulates the design principles responding to the evaluation of the

usefulness and fitness of the solution—how well does the solution address the given problem (as reflected in the digital value propositions identified by the participants) in the current application context, and can coordinative and collaborative relationships be developed by means of the technology?

Chapter 6: Evaluation and Development of the Design Principles (PADR Phase: Participatory Impact Evaluation)

6.1. Structure of the Chapter

In this chapter the study addresses the penultimate phase of the research and evaluates how the use of the instantiation, in the context within which it is to be used, either does or does not realise the value propositions identified in Chapter 4 . In doing so it seeks to answer Research Question 1 below:

> *RQ 1: How can DSPs in the PHC sector be designed and configured to advance and improve the coordinative and collaborative objectives of PHC service delivery at a supra-organisational level?*

That is, does the instantiation facilitate the realisation of the digital value objectives set by participants in PADR research phase 2 and communicated as design propositions in Chapter 5, Section 5.2.3.? The outcome of this evaluation phase is communicated in the form of a specific set of design principles, reflecting solution design knowledge perhaps more suitable for users wishing to apply it in a specific solution space (Vom Brocke, Winter, et al., 2020). This chapter (PADR Phase 4, Participative Evaluation), in response to RQ 1 develops an initial set of design principles to provide guidance on the build of DSPs seeking to generate greater coordinative and collaborative value at a supraorganisational level in the public health sector. This serves to develop artefact centred design knowledge learned from the DSR project that addresses solution knowledge for design processes. Chapter 7 (PADR phase 5, Participative Learning and Design Theorising) will address design knowledge (non-artefact centred) that increases our understanding of the dynamic sociotechnical processes that underpin and impact on the outcomes of this evaluation phase.

To achieve this, this chapter first presents the evaluation strategy and the research participants active in that evaluation. The manner in which the design principles are formulated, a critical aspect in terms of how the solution design knowledge is communicated, is then discussed. This is followed by the evaluation outcomes of the semistructured interviews with participants (framed by affordance theory, which is the key analytical instrument for the evaluation), addressing the realisation of the design propositions. By posing the questions of where, when, how and with whom the instantiation generates value, as defined by the value propositions defined in Chapter 4, Section 4.10, a participative, sociotechnical evaluation was carried out. This use of affordance theory enabled the research to evaluate actors' perceptions and capabilities in realising the design propositions, identifying the relevent causal mechanisms and thereby generating useful, prescriptive solution design knowledge (Vom Brocke, Winter, et al., 2020). Such an

evaluation also allows for the identification of any causal mechanisms not anticipated in the initial design propositions. Equally the evaluation results further assess the solution's ability to adapt or provide for changes or unforeseen aspects of the problem area—critical in any sociotechnical space. In Chapter 7, further discussion and analysis is presented as part of PADR phase 5, addressing and revisiting this particular solution space and the outcomes of PADR phase 4, the participatory impact evaluation. A revised set of design principles, forming a second set of design principles, is then derived from the learnings generated from this analysis and which then serve to address the fitness or ability of the solution to evolve in a broader problem space (Vom Brocke, Winter, et al., 2020). This final analysis will serve to answer Research Question 2.

6.2. The Participative Sociotechnical Evaluation Strategy

The evaluation strategy described in this chapter was conducted within the PADR case study research framework, informed and guided by the Venables et al. (2016) framework for evaluation in design science (FEDS), human risk and effectiveness evaluation strategy, where the major design risk is seen to be social, and user-orientated (as opposed to a solely technical challenge). The human risk and effectiveness evaluation strategy is consistent with this study's sociotechnical approach to the DSR process, in other words the PADR process method. This strategy places an emphasis on naturalistic evaluation, both *ex-ante* and *ex-post*. *Ex-ante* naturalistic evaluation seeks to ensure the relevance of both the problem being addressed and the identified design requirements for the instantiation (Venables et al., 2016). In these instances the objective is to improve the design process and thus outcomes through the involvement of practioner participants to determine the value propositions of the proposed solution. *Ex-post* naturalistic evaluation seeks to confirm firstly, the usefulness of the design artefact, in that the artefact does realise its value propositions in its designated working environment; i.e., that participant users are able to generate the desired coordinative and collaborative value (Venables et al., 2016). Secondly, fitness, in that the solution is capable of adapting and evolving to the longer-term complexities of the broader problem space (digital ecosystem development). Following the FEDS evaluation framework, the following evaluation steps for the instantiation were laid out:

1. Firstly, identify the goals of the evaluation and, consistent with the human risk and effectiveness evaluation strategy of FEDS, seek multiple evaluations across both the formative and summative dimensions. These evaluations are required to reduce the uncertainty or risk where that risk and uncertainty in design outcomes are associated with social and human use and where the value-

generating potential of the design is to continue in the long run (Venables et al., 2016). The first evaluation objective is to reduce the uncertainty inherent in the design process where initially there is limited knowledge and understanding of the problem being addressed. Here the *research background chapter* forms an artificial, *ex-ante*, formative evaluation attempt to validate the relevance of the problem. Given the lack of extant research, the study then turns to naturalistic *ex-ante* formative evaluation in the form of *participatory, exploratory research* to validate relevance of the problem and the completeness of the goals of the research and the design propositions participatively identified. From here the evaluation goals now turn to *ex-post,* naturalistic summative evaluation that seeks to increase the rigour by which the design principles are defined, with the objective of delivering long-term robustness for the research artefact.

2. The second step of the FEDS framework is to design the *ex-post,* naturalistic summative evaluation strategy. In terms of Venables and colleagues' (2016) evaluation strategies, the obvious focus is on the element of human risk and effectiveness, where the major risk in the study is the requirement for human actors to digitally interact in a dynamic sociotechnical environment in the absence of any organisational hierarchical overview. This research refers to this evaluation approach as a sociotechnical evaluation strategy that employs the affordance lens to establish how the social and the technical contexts interact and impact on the design in order to optimally configure and manage the technology.
3. The third step is to determine the properties to be evaluated: These are the properties that will determine the outcome of the DSR study, which is the generation of coordinative and collaborative public health service value created and realised PHC practioners. At this step whether the digital intervention does in fact trigger the required generative mechanisms that will foster interaction and thus ecosystem development?
4. Finally, the specific evaluation processes and activities are designed. Table 20 summarises the evaluation strategy and specific evaluation processes of this research.

The following table, Table 20, presenting the evaluation strategy is adapted from Venables et al. (2016) framework for evaluation in design science (FEDS), human risk and effectiveness evaluation strategy.

Table 20: Evaluation Strategy (adapted from Venables et al., 2016)

Evaluation goals	Evaluation processes and activities	Evaluation output
Problem relevance & importance: that the identified problem presents a	*Ex-ante*: Formative, artificial:	Validated problem statement. PHC actors lack the required levels of

true reflection of practitioners concerns.	1. Research background, review of the problem in the literature. Formative, naturalistic: 1. Participatory problem identification (focus groups).	coordination and collaboration to optimise PHC service delivery.
Completeness and meaningfulness of design propositions: that the design propositions represent a true reflection of potential digital service value.	*Ex-ante*: Formative, naturalistic: 1. Participatory identification of digital value propositions (focus groups). Formative, artificial: 1. Literature search: Integrating the public sector implications of S-D Logic's foundational premises to add rigour to the development of the design propositions. The relevance of functional social media affordances to the design solution.	Evidenced design propositions.
Effective and efficient DPs. DPs that are understandable, facilitate the realisation of the desired coordinative and collaborative value and are at the desired level of abstraction for platform designers (practitioners and researchers) to make productive use of.	*Ex-post:* Summative, naturalistic , 1. Participatory evaluation of instantiation (semistructured affordance-based interviews). 2. Participative learning and reflection.	Validating DPs against design propositions with practitioners in the context they are to be operationalised. Participative reflection and learning that aids in a greater understanding of the challenges, issues and constraints of the context (ecosystem development).

The *ex-ante* evaluation process also enables the research to identify generative or causal mechanisms that may not have been accounted for in the participatory exploratory research (see Chapter 2 for the contribution of SD-Logic in the public sector and social media affordances to the design of the instantiation). In subsequent *ex-post* and naturalistic summative evaluation phases the research is able to evaluate whether the built digital instantiation and configuration thereof incentivises and manages the required engagement and interaction well enough to realise ecosystem development. This participative, sociotechnical evaluation strategy enables a deeper understanding of what advances or constrains the realisation of PHC service value co-creation, thereby informing the first part of the primary solution design knowledge objectives of the research—prescriptive knowledge for solution design. This defines the desired outcomes and solution design knowledge for the problem space. This evaluation strategy serves to strengthen the validity of the design principles.

Deng and colleagues' (2018) comprehensive review of the state of DSR theoretical knowledge provides an adequate reference point to further assess the evaluation strategy (see Chapter 3, Section 3.5. for a

fuller discussion). That review, noting that DSR evaluation practice has yet to fully mature, identified four guidelines for DSR evaluation from eight key papers focusing on DSR evaluation. The following table summarises these sources.

Table 21: Sources of the DSR Evaluation Guidelines (Deng et al., 2018)

Table 21: Sources of the DSR Evaluation Guidelines				
Citation	G1	G2	G3	G4
Simon (1996)	X		X	
March and Smith (1995)	X	X		
Hevner et al. (2004)	X	X	X	
Pries-Heje et al. (2008)	X	X		
Gregor and Hevner (2013)	X			
Baskerville et al. (2015)		X		
Prat et al. (2015)		X		X
Venable et al. (2016)	X	X	X	X

The following table assesses the research evaluation strategy consistent with Deng and colleagues' (2018) guidelines for evaluation, evidencing how the evaluation strategy conforms to the Deng et al. (2018) guidelines. The PADR DSR process method is seen to more fully complement and integrate the sociotechnical evaluation strategy in that it requires extensive participation by actors in all facets of the DSR process, inclusive of the evaluation.

Table 22: Evaluation Guidelines (adapted from Deng et al., 2018)

Guideline	Evaluation strategy
G1. The evaluation of the artefact should involve the intended use and context in which the artefact operates.	The sociotechnical evaluation strategy comprises both ex-ante, formative and ex-post, summative aspects (see Table 20). Participatory identification and evaluation of the problem and goals, participative design and evaluation of usefulness and fitness, inclusive of a participative reflection of learnings as required by the PADR framework serves to ground the design and design outcomes (design principles) in the intended use and context of the artefact.
G2. The evaluation methods should be matched appropriately with the designed outcomes.	The instantiation is a sociotechnical system. The affordance lens utilised within the PADR DSR process framework brings together the social and technical aspects of the evaluation. The instantiation is trialled over a period of 8 months in the context it is designed for, by practitioners seeking to realise communicative goals they identified. The trial period is followed by semistructured interviews.
G3. The evaluation of the artefact should include a consideration of the artefact's style (way of doing things, (Simon & Newell, 1971)).	There is no real alternative design. Social media affordances are initially evaluated for relevance. Where there is relevance to the participants' goals, those social media affordances are incorporated into the design and configuration choices of the instantiation.

G4. The evaluation of DSR should include the long-term organisational and social impact and the ability of the solution to adapt to change.	A further discussion and analysis (Chapter 7) is incorporated as part of the PADR reflection and learning phase. This further discussion and analysis justifies a revisiting of the design principles, analyses the social impact of the design and broadens the projectability (Vom Brocke, Winter, et al., 2020) of the solution.

The assessment of the sociotechnical evaluation strategy in terms of the Deng et al. (2018) guidelines confirms its potential to evaluate how the design addresses the coordination and collaboration challenges of the problem space.

6.3. Evaluation Participants

The different types of actors and roles operating at a supraorganisational level were described in Chapter 4. Actors participating in the PADR process committed to an initial exploratory research phase and consultation around the planning, design and the configuration of the instantiation. This was followed by an eight-month in-context trial and evaluation period, capped by the semistructured interviews. This period incorporated participant and researcher reflection and learning that addressed contextual constraints and challenges, thereby adding to solution design knowledge outcomes (Vaishnavi & Kuechler, 2004). Since these different actors represented different sectors of PHC, they had different perceptions of the potential value that could be generated and thus different goals for the use of the instantiation. As such they represent a good cross-section of this supraorganisational sector. The privacy of the participants remained an ethical consideration, as discussed in Chapter 4, section 4.6; therefore they are not identified by name but simply by their roles.

In the exploratory research phase, five focus group discussions were conducted between April and June 2015, consisting of some 35 participants representing health practitioners, health managers and staff from the state of Victoria's Department of Health and Human Services (DHHS). While the majority of these focus groups originated from the PCP of the Eastern metropolitan region, there were also focus groups representing DHHS regional authorities. There was also one semistructured interview conducted with a practitioner unable to attend one of the focus groups, whose current role it was to collate activity information for planning purposes.

The following section details the 16 actors who participated in the semistructured interviews. These participants were four PHC officers and managers representing the DHHS, six umbrella community health service organisations, two representatives from the PCP itself, two single issue community health project managers and two local government community health officers.

6.3.1. DHHS officers.

Primary health care officers from the DHHS who participated in the research have a regional role and are responsible for managing the implementation of public health policy in the area as well as administering the community health programs that serve to coordinate community health services. These DHHS officers originated from both the central office and a regional office and thus were able to provide a broad overview of the sector. They had established relationships with a broad range of service providers and actors within PHC, had responsibility for the coordination of PHC and were thus well situated to reflect on collaboration and coordination issues within the PHC sector.

6.3.2. PHC managers

PHC managers are primarily responsible for implementing and managing community health projects in accordance with public health policy. Participating PHC managers originated from community health organisations and regional PHC networks. These officers were actively engaged in the delivery of PHC projects and initiatives and were subject to all the challenges, constraints and opportunities of the sector in planning their day-to-day-activities. Participants were required to register with the SALUS instantiation. To do this they were provided with an access code to register; they then created a profile by entering their data (professional role, expertise, organisations, networks and projects) and were subsequently able to explore the search, engagement and interactive functions and outcomes of the DSP. The choice of participants reflected an attempt to include a representation of all actors who might need to be involved with the DP, as recommended by Gregor et al. (2020).

Table 23: Roles of Actors in the Use of the Instantiation. (Adapted from Gregor et al. 2020)

Actors	Role
Health service implementers	Those seeking to implement the solution design knowledge in a specific context. In this study that would refer to the central DHHS managers and the PHC who

	commissioned the study and other participants who seek to utilise digital technology to facilitate greater coordination and collaboration between enactors and users.
Health users	Those whose needs and goals may be achieved by use of the artefact. In this study that would refer to the broad category of primary health care officers whose function is to implement public health policy.
Health enactors	Those who use emerging solution design knowledge to achieve the aims of the DSP. In this study that would refer to the participants who operationalised the instantiation. But, in general, users and enactors here are the same.
Health theorisers	Those who reflect on the solution design knowledge in an applicable context and record that knowledge to an abstract domain. In this study that would be both the researchers and the participants involved in the problem defining stage and the participatory reflection and learning phase of the PADR DSR process.

PHC managers and officers participation in the research are at once, implementers within the context of the participatory design framework, users of the research product in the context for which it is designed and theorisers in the form of their participation in the reflective learning process that gives rise to the DPs, the research artefact. They are also, but to a lesser extent enactors.

A key aspect of the solution design knowledge (see Chapter 3, Section 3.5) sought in this research is the formulation and communication of design principles, the prescriptive statements of the solution design knowledge and the primary artefact created, which serves to define and communicate the structure, organisation and functioning of the (proposed) technology (Gregor & Jones, 2007). The formulation of such design principles requires attention in that the manner in which design principles are communicated will impact on the useability and reusability of those design principles (Wache, Möller, Schoormann, Strobel, & Petrik, 2022). The following section discusses the manner in which this research approaches the formulation and communication of the design principles.

6.4. Design Principles

Design principles essentially serve to communicate the solution design knowledge generated as an outcome of the research in order to make that knowledge usable by both practitioners and researchers. The purpose of design principles is thus to communicate design knowledge—knowledge that can be applied in different situations, and which constitutes a basis for action. Within DSR design principles are the predominate means of accumulating and re-using design knowledge (Chandra Kruse & Seidel, 2017; Gregor et al., 2020). This design knowledge needs to provide actionable solutions

for organisational problems but also to provide a framework for a greater understanding of the problem the actionable solution sets out to address (van Aken, 2004). Design principles thus present knowledge about both instances of a class of artefacts (Sein et al., 2011) and the problems they seek to confront. Consistent with Vom Brocke et al. (2020), this research will present two sets of design principles, one focused on the usability of the solution and thus more applicable to practitioners seeking to provide a solution to an organisational problem, and the other more focused on the projectability of the solution, that develops a broader understanding of digital ecosystem development in the problem space, thereby enabling a broader application of the solution design knowledge.

6.4.1. Formulating the design principles.

Both Cronholm and Göbel (2018) and Gregor et al. (2020) note that there are few prescriptive guidelines in the literature that govern the formulation of design principles. Specifically, and firstly, the literature raises concerns regarding levels of abstraction relevant to design principles and thus their generalisability or projectability (Gregor & Hevner, 2013, Cronholm & Göbel, 2018). Secondly, concerns are raised around the issue that the formulation of design principles generally pay limited attention to the users of the solution design knowledge (design principles) and even less to the usage dynamic that occurs in the sociotechnical interaction of users and technology (Gregor & Hevner, 2013). The outcome of this is to bring into question both the reusability and application of design principles in other contexts and the ability of different users of the solution design knowledge to properly utilise or further build on the knowledge base of the problem and solution space.

For the purposes of formulating the design principles for this DSR project, the next section will examine the level of abstraction within design principles, in particular, how different actors might use the solution design knowledge based on where actors might find value in design principles. Following this, the chapter will examine the relevance of sociotechnical interaction (usage dynamic) to the formulation of design principles. Artefact mutability is identified by Gregor and Jones (2007) as a problematic issue in developing design theory in IS. Finally, the study will present Gregor et al.'s (2020) schema for the formulation of design principles that represents the selected process in which this study's design principles are formulated and communicated to address the literature's concerns regarding levels of abstraction and the usage dynamic.

6.4.2. Abstraction (level) of design principles.

Design principles are intended to structure and guide the design of solution artefacts (Sein et al., 2011) but they may vary according to the level of abstraction presented. Reusability of design knowledge is critical in terms of applicability and actionability of design principles and this may occur at multiple levels. In order to optimise the use of the design principles, different actors may require different levels of abstraction. Chandra et al. (2015) comment on this aspect in terms of the generalisability of the design principles, arguing for a sufficiently high level of abstraction so as to ensure that the design principles are applicable to "different instantiations in different contexts": in other words, that artefacts should be applicable to a general class of problems. Van Aken, (2004) sees design principles as "a prescription for a design exemplar," a general solution that requires adaptation to solve a specific problem in a specific context. Thus, while high levels of abstraction tend to ensure greater applicability or reusability of the design principles across a broader problem space, these high levels of generality may also pose problems for practitioners seeking a specific understanding of how to apply the design principles in practice. In other words, they may question the design principles' fitness to build a particular solution artefact. Design principles focusing on a defined context are more suitable for practitioners seeking guidance for a build but have a less relevance to situations requiring greater applicability and reuse across multiple contexts and problems. Existing principles require careful consideration for reuse in other contexts because, as Wache et al. (2022) note, the formulation of design principles is, "a non-trivial matter" for DSR.

This thesis will address the formulation of design principles as they pertain to levels of abstraction in the following manner: the thesis will endeavour to deliver two sets of design principles, both of which could be seen as an outcome of the DSR process and both of which seek to address the conundrum posed by the question of abstraction. The first set of design principles, identified in this chapter, is primarily focused on practitioners (users, enactors and implementers) seeking guidance for use and are a direct outcome of the evaluation of the instantiation in context. These design principles look towards actionable success in the specific context. The second set of design principles are an outcome of the PADR phase 5, reflection and learning, and result from lessons learned and knowledge gained about the mutability of the instantiation. Thus, this second set of design principles contains further design principles that reflects this socio-technical learning. These design principles are intended more for the

theorisers identified by Gregor et al., 2020 and reflect the non-artefact-centred solution design knowledge developed during the operation of PADR phase 5.

6.4.3. The sociotechnical dynamic and the second set of design principles.

The process leading up the formulation of the second set of design principles was a participatory reflection on the challenges around the use of the instantiation. It considered the learnings from this interaction between the social and the technological in the development of the digital ecosystem and also how this knowledge could be harnessed in a way to help both practitioners and researchers better understand the use of the technology. Here the objective was to generate a wider applicability for the solution design knowledge. Given the aim of the research is greater coordination and collaboration at a supraorganisational level, it is important that we understand how and why the technology engages social actors both in terms of the interaction between social actors and the technology and the resultant interaction between social actors. The literature notes that the designed features of the technology may not be used in quite the way intended by the designers, or that new opportunities or constraints in the use of the technology (ecosystem development) might arise (DeSanctis & Poole, 1994; Orlikowski, 1992). It is also important that any change in the way actors collaborate or develop new relationships as a result of their use of the technology is understood, explored and communicated. The interaction of the social and the technological enables the researchers and participants to productively explore any emergent properties and behaviours (Gregor & Jones, 2007) that might impact on the solution design knowledge of the research. The solution design knowledge communicated therefore needs to reflect this requirement for adaptability and change. New knowledge gained is incorporated in the second set of design principles (presented in Chapter 7) which also seeks to provide additional justificatory knowledge or theory. This second set of design principles therefore reflects the fact that use of the artefact features may generate unpredictable results (Gregor et al., 2020), in the form of new constraints or opportunities for the design goals of greater coordination and collaboration at the supraorganisational level.

6.4.4. Design principle formulation.

The following section will examine the chosen formulation of the design principles, based on Gregor et al.'s (2020) "Research Perspectives: The Anatomy of a Design Principle." The Gregor and Jones (2007) formulation of solution design principles sought to specifically address the issue where the design principles are to represent solution design knowledge for sociotechnical systems. In other words, where there is a need to present useful knowledge that reflects both artefact features and user interaction.

Therefore, this study adopts this approach to formulate design principles that explain how artefact features will generate the design aims in terms of user activity. This needs to be done both in terms of the technical mechanisms, where artefact features are designed to generate a certain outcome and the social and sociotechnical mechanisms where user interaction may allow interaction and action possibilities for users and groups of users. Such design principles need also to reflect an appropriate level of abstraction, firstly, for those who seek to apply them in practice and secondly for those who seek to build on the solution design knowledge.

Gregor et al.'s 2020 schema for specifying design principles addresses the issues outlined above as follows:

- Firstly, in a sociotechnical context, that design principles should pay attention to the different actors that seek to utilise design principles, that of the implementer (applies the abstract design principle in a specific context), the user (whose needs and goals are to be realised in the design), enactors (as per users) and theorisers (those who reflect and record the solution design knowledge and record that knowledge to an abstract domain). This is done in order to ensure that the design principles are communicated in a manner such that they are understandable and applicable to as wide a range as possible, of potential actor-users.
- Secondly, that design principles should pay attention to complexity and the associated level of generalisability and projectability. In other words that the design principles need to be both useful and understandable to practitioners seeking to build and researchers seeking to understand.
- Thirdly, that design principles should pay attention to cause; that is, how will a particular feature generate a particular outcome? On both a technical level and in terms of what the feature may afford in a particular context, when a user interacts with the technology (see this research's use of affordance theory).
- And finally, that design principles need to pay attention to a fuller understanding of the underlying causal relationships (Gregor et al., 2020). An understanding of these causal relationships advances both the design principles' usefulness and a more general applicability. Any justificatory knowledge underpinning the DP should therefore be provided.

Gregor and Jones's (2007) design principle schema, similar to the CIMO-Logic but providing a rationale rather than an outcome, is expressed in words as follows:

Design Principle: For Implementer (I) to achieve or allow for Aim (A) for User (U) in Context (C), employ Mechanisms (M1, M2, … Mn), involving Enactors (E1, E2, … En), because of Rationale (R).

And, in diagrammatic form:

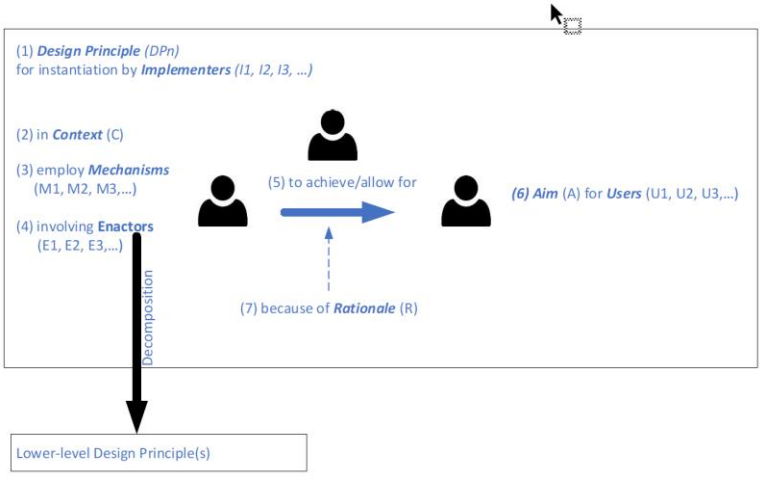

Figure 12: Diagram of the Design Principle Schema. (Gregor & Jones, 2020)

6.5. Evaluation Analysis and the Response to RQ 1

In order to carry out sociotechnical evaluation of the instantiation, affordance theory was used as the primary evaluation tool to assess use and service value: that is, to validate the defined design propositions. The evaluation sought to assess the coordination and collaborative service value generated by the particular configuration of the instantiation. This evaluation process would determine how well the designed configuration of the DSP (reflected in the instantiation) realised the original value propositions (see Chapter 5) by analysing the affordances the instantiation offered to the participants. The use of affordances in the evaluation process enables the research not only to explore the features and functions of the technology, the DSP, but also to explore how the actors see the technology addressing their needs and goals as determined by their organisational context (Majchrzak & Markus, 2021). By exploring how participants are able to actualise the affordance to meet their needs and goals, the analysis is able to determine whether, in sum, specific coordinative and collaborative value propositions are met. In order to explore this, the research asked questions like "How did you use SALUS to realise your original value propositions (of the technology) here?" and "What was

the result?" From this affordance analysis of how the instantiation was used to realise the design propositions a set of five design principles was codified.

In the following sections each validated design (value) proposition and resultant design principle is dealt with sequentially.

6.5.1. Design Principle 1. Generate actionable information.

Design Principle 1 seeks to verify the realisation of, and codify the value proposition identified as follows in Design Proposition 1:

> *By providing a centralized and structured digital information structure, that is accessible and open to all PHC practitioners, may enable PHC actors to gain a sector oversight of project and collaboration activities (Digital Intervention (I)). More efficient access to, and therefore better utilisation of planning and program information will enable the PHC sector to better manage information dissemination and utilisation, generate heightened visibility and interaction (Social Mechanism (M)), giving rise to more extensive and efficient knowledge-sharing, coordination and collaboration, which are sector priorities (Outcome (O)).*

6.5.1.1. Generate actionable information overview.

That participants were initially concerned with uploading their data and exploring the visibility generated by others uploading their data indicates that the affordance of visibility is perceived. Multiple participants reflected broadly on the affordances generated by their enrolment and uploading of data with this feature of the DSP. The affordance of being able to upload their data and generate actionable information alongside other participants' uploaded data is realised. This information was then leveraged to facilitate greater connectivity and coordination, primarily in the form of identifying possible collaboration partners and connecting with them. More specifically we see participants confirming the realisation of Value Proposition 1 in that the generated data enables an overview of activities and knowledge-sharing in the sector, generating data that is actionable in terms of greater connectivity and coordination:

> *We also like the way people can inform, more broadly of their work, that's also another way that we can keep on top of what's happening. (PHC practitioner)*

Participants identified a more rigorous manner in which to identify potential partners and thus greater connectivity and coordination,

> *"It helps us identify partners to work with. And it helps bring, I guess, a bit more rigor and legitimacy to what to what we do when we're working with others and can hold each other accountable…". (PHC Practioner)*

Further, the identification of activities, events and interventions generated greater visibility in the sector,

> *it's got the capacity to connect people together. Mm-hmm to, um, find like work, to assist in formative evaluation to, um, yeah. Build networks with, with people working in similar areas or to learn lessons from people. Who've done things before to, to, uh, stop you failing because someone else has tried to do the exact same thing and it didn't work for these reasons that negative evaluation stuff has got all of that. (PHC manager)*

And

> *It isn't just a platform for information, it's a place where people can find out about events, intervention opportunities, as well as what have you done in your catchment (PHC practitioner)*

The research found that that the affordance of heightened sector visibility through the addition of profile data was a powerful inducement for users to engage with the platform, upload their data and engage with other users. However, while attracting and inducing users to engage with the technology was successful, and constituted the establishment and beginnings of an ecosystem, the ongoing development of the ecosystem (fully actualising this affordance) proved a challenge for participants:

> *"And in terms of the networking tool the sense I got was that it would be something that people would float in and float out of, depending on, depending on where they were. It's not something that, that you know, is something like you say, a social networking tool in the sense that they'd be in every day. And that this, to my mind, this would have negative implications for the ability of say this to achieve critical mass, where everybody can see a value in it". (PHC Manager)*

> *"Yeah. That's right. And that's what, that's how that's exactly how I sort of saw it as well thinking that's right. People aren't just gonna put this stuff up and unless there's a reason and if there is, okay." (PHC Manager)*

The consequences of this limitation, the scaling of the ecosystem, and responses to this limitation are more fully discussed in chapter 7 (PADR phase 5: Participative learning and reflection).

Table 24: Design Principle 1

Description: Generate actionable information	
For Implementer I to achieve or allow Aim A for User U	For designers (implementer I) to ensure PHC officers and managers (users U) can access a centralised digital information structure (DSP) where they can upload and link their experience and expertise in PHC to their profile (aim A).
Context	At a supraorganisational level in PHC, where there is a lack of sector-wide coordination and collaboration (of PHC actors and activities).
Mechanism (s)	1. Open, accessible centralised digital information structure (technical). 2. Link experience and expertise to a personal digital profile (social).
Rationale	Because greater access to a centralised information repository will enable users to better view, disseminate and utilise experience and expertise across the sector, which will, in turn, generate more extensive and efficient knowledge-sharing, coordination and collaboration.

6.5.2. Design Principle 2: Facilitate digital search.

Design Principle 2 seeks to codify the realisation of the value proposition identified in Design Proposition 2 below:

"The provision of a digitally searchable information structure across PHC activities and actors (Digital Intervention (I)), would enable PHC actors greater ease of access to resources relevant to their service delivery needs (Mechanism (M)), promoting more efficient access to resources and thereby increasing the potential for service value co-creation (Outcome (O))."

6.5.2.1. Facilitate digital search overview.

The affordance of being able to digitally search for information pertinent to a user's requirements and objectives generates increased value for the user in that the user can search across individual profiles, PHC projects and activities and existing networks. User perception and actualisation of this affordance is clearly illustrated by the following responses:

> *You know, the huge benefit of… is that you can capture all the data and play with it and manipulate it and utilize it, interrogate it, produce reports. (PHC manager)*

And, where users can search for information that is pertinent to their requirements:

It also gives you the chance to provide a forum where you can follow up on leads related to projects, um, where it's not maybe that you want to do that project, but you want to see what other people have done within the space because you want to do something slightly different or you want to get lessons from what people have done or things like that. (PHC practitioner)

Search affordance realisation is confirmed by the following responses:

Search the information and cross-tabulate and you get different lenses over the information to better inform practice and you … understand where gaps are, where we can do better and where we may be putting too much effort and need to shift it elsewhere so we get a much better picture. (PHC manager)

Or if we see that someone, for example …. we know has got … accreditation and so we contact them directly and approach them and ask for some guidance or some benchmarking around how they achieve that. (PHC practitioner)

Look, so there are ongoing networks you know, health promotion networks within particular regions, and it will just start from there. There's a repository of information that you can go to identify who you need to be talking to or connecting with. (PHC practitioner)

The research shows that the affordance to digitally search the data across different categories generates specific coordinative and collaborative value for users promoting engagement.

Table 25: Design Principle 2

Facilitate digital search	
For Implementer I to achieve or allow Aim A for User U	For designers (implementer I) to ensure PHC officers and managers (users U) can digitally search a centralised digital information structure across individual, project, activity and network data sets.
Context	At a supraorganisational level in PHC, where there is a lack of sector-wide coordination and collaboration (of PHC actors and activities).
Mechanism (s)	Ensure users can easily access data (technical) which is pertinent and relevant to their function and objectives (social).
Rationale	Because the ability to digitally search across individual, project, activity and network data sets quickly delivers relevant data to the searcher.

6.5.3. Design Principle 3: Provide a common language.

Design Principle 3 seeks to codify the realisation of the value proposition identified in Design Proposition 3:

"Systemising and categorising available resources according to a common framework and language of PHC resources (Digital Intervention (I)) will promote ease of interaction and resource integration (Social Mechanism (M)), thereby improving connectivity, information-sharing and coordination (Outcome (O))."

6.5.3.1. Provide a common language overview.

Participants perceived the constraints in the lack of a common categorisation and language:

> *Language communication, um, a shared language is basically one of the, the first things that I noticed when I came here 12 years ago is that you, you've got in a room, you might have obesity, for example, in Eastern Health. You might have a community health service, and you might have the local government all sitting around the table, all concerned about the issue of obesity within their community, but how they can have an impact on that and … the lens that they look at that through is very different. So they all look at it from a very different lens, but yet they're all trying to head in the one direction. So the challenge was always to get them to speak the same language. (PHC Manager)*

Adapting the Jorm's et al. (2009) public health categorisation was found to be an appropriate way to realise the affordance of structuring and categorising the collection of information in a way that generates a more effective and efficient dissemination and utilisation of information.

> *So here we have a, a uniform way of naming and particularly monitoring projects given the diversity of practice. (PHC manager)*

The actualisation and realisation of this affordance better enables search and analysis functions and therefore greater opportunities for information sharing and coordination.

Table 26: Design Principle 3

Description: Provide a common language	
For Implementer I to achieve or allow Aim A for User U	For participant designers (implementer I) to develop a common classification and categorisation of PHC resources and activities to enable a common cross-sector understanding of PHC resources and activities.
Context	At a supraorganisational level in PHC, where there is a lack of sector-wide coordination and collaboration (of PHC actors and activities).
Mechanism (s)	A common classification and categorisation of PHC resources and activities (technical) will ensure users can easily communicate and understand roles, activities and projects across the sector (social).
Rationale	Because multiple PHC jurisdictions (federal, state, local government) have developed their own categorisation of activities that will hamper information sharing at a supraorganisational level.

6.5.4. Design Principle 4: Link to individuals.

Design Principle 4 seeks to codify the value proposition identified in Design Proposition 4:

"Developing a database based on actor profiles that lists and connects actors, their networks and activities (Digital Intervention (I)) will serve to trigger trust in the information, helping to generate interaction and facilitating the processes of coordination and collaboration (Social Mechanism (M)) thereby improving the efficiency and coordination service value co-creation (Outcome (O))".

6.5.4.1. Link to individuals overview.

The affordance of being able to link personal experience and expertise to an individual profile in order to generate trust in the information is perceived as valuable:

> *So we are looking at something that's on several levels. We are looking at something that's on a personal level in terms of your own personal network, in terms of your own personal interests, the flagging of events, et cetera. This gives evidence-based approaches, things that are working, challenges that you've looked at and how you've overcome them and ways you can adapt programs to local situations. (PHC practitioner)*

And:

> *So if I'm a, if I'm a new prevention coordinator come into the region, I can look in and I can see all the stuff … uploaded. I get it profiled. I can connect with her. (PHC practitioner)*

> *It gives you a sense of how important it is that those projects are associated with an individual rather than an organisation, because yes, it might be something that happened here at access health and community this year, but in five years' time, I'm gonna be somewhere else. Right. But the [next] person's still gonna know who I am. (PHC practitioner)*

Further, that will ensure the information is understood in context:

> *I think, we will be sharing outcomes, successes, failures, so that we learn from what we're doing, and we move on. But also, we can make sure that we're collaborating with the right people. So, you know, if you're working, for instance, in family violence, how do you know that you're collaborating with all of the significant and relevant family violence parties? Which is a good, which can be a good thing. (PHC practitioner)*

And that the information, linked to an individual, stays relevant and up to date:

> *Because it's a person-centred tool and over your career you work across a whole lot of different areas. So…your work portfolio might cover mental health, which could then be family violence, and alcohol abuse, whatever. But it also might be physical activity or something else. So…in two years' time, you might move on to something different. So…I don't see it as an issue-specific tool, it's a generic tool that provides support from practitioners to collaborate in a genuine … way. (PHC practitioner)*

Table 27: Design Principle 4

Description: Link to individuals	
For Implementer I to achieve or allow Aim A for User U	For designers (implementer I) to link sector information (actors, projects, activities, networks) to individual profiles (users) will improve the sharing of knowledge, trust in that knowledge and capacity to understand that knowledge in context for users.
Context	At a supraorganisational level in PHC, where there is a lack of sector-wide coordination and collaboration (of PHC actors and activities).
Mechanism (s)	Individual profiles (technical) ensures users can link experience and expertise with their personal profile (social).
Rationale	Because linking the data to individual practitioners active in the field will ensure data stays up to date, generates trust in the data and enables users to understand information in context.

6.5.5. Design Principle 5: Involve practitioners.

Design Principle 5 seeks to codify the realisation of the value proposition identified in Design Proposition 5.

"Practicing practitioner involvement and contribution to the design and development of the technology (Intervention (I)), will facilitate greater trust and acceptance, thereby promoting greater engagement (Social Mechanism (M)) and improving connectivity, information-sharing and coordination, which are sector priorities (Outcome (O))".

6.5.5.1. Involve practitioners overview.

While not technically an affordance arising as a function from the engagement of the social and the technological, incorporating participants in the design and delivery of the technology will ensure that the solutions generated address and are relevant to the problems experienced by practitioners and that the mutability of the artefact can be continuously evaluated.

> *For instance, if you're wanting to work in a particular setting and make change in a particular setting, it's integral to be partnering and collaborating with that particular setting and other players and actors within that setting. So it's just part of best practice. (PHC practitioner)*

The emphasis on practitioner involvement is perceived as critically important:

> *It is a really important thing for practitioners to be connecting with other practitioners on specific issues and developing that networking function, that's all working to a certain degree. (PHC manager)*

Further, the contribution of practitioners to more closely align the solution to the problem space was identified:

> *So the understanding is, I think traditionally in public health, that we've thought that the limited perspectives of a few key stakeholders is enough to understand the problem. What we've failed to do is actually realize that there are many in different perspectives. So involving as many as possible builds the evidence base about what works and what doesn't. It's a more organized approach to where you're coming together. Yes, yes. We can step out outside of the organizational boundaries and think about that more broadly. (PHC manager)*

Table 28: Design Principle 5

Involve practitioners	
For Implementer I to achieve or allow Aim A for User U	For designers (implementer I) to enable users to participate in the design and delivery of the DSP in order to facilitate connectivity, information sharing and service coordination.
Context	At a supraorganisational level in PHC, where there is a lack of sector-wide coordination and collaboration (of PHC actors and activities).
Mechanism (s)	Ensure implementors are users and vice versa so as to take advantage of practitioner expertise.
Rationale	Because in this manner information- sharing and service delivery collaboration remains relevant to user objectives.

6.6. Summary of Design Principles.

The following table summarises the five design principles and associates each design principle with the prospective affordance and the design proposition it seeks to address.

Table 29: Summary of Design Principles

Design Principle	Linked affordance/mechanism	Value/Design Proposition
Design Principle 1: Generate actionable information.	The instantiation should enable users to upload data and explore greater sector visibility by viewing other participants uploaded data.	Provide a centralised and structured digital information structure that is accessible and open to all PHC practitioners, which will enable PHC actors to both profile their data and gain sector oversight of other project and collaboration activities.
Design Principle 2: *Facilitate digital search.*	The instantiation should enable users to digitally search for information pertinent to a user's	Provide a digitally searchable information structure across PHC activities and actors that would enable PHC actors greater ease of access to resources relevant to their

	requirements and objectives.	service delivery needs, thereby promoting more efficient access to PHC resources.
Design Principle 3: Provide a common language.	The instantiation should provide a common framework and language of PHC resources in order to enable a greater understanding of PHC activities, projects and networks across the PHC landscape.	Provide a systematic categorisation of available resources (based on a common framework and language of PHC resources) that will promote ease of interaction and resource integration.
Design Principle 4: Link to individuals.	The instantiation should provide the capability to link experience and expertise to an individual's profile.	Provide a database based on actor profiles that lists and connects actors, their networks, activities and projects, that will serve to trigger trust in the information.
Design Principle 5: Involve practitioners.	The instantiation should provide for the participation of practitioners in the design and evaluation of the artefact as this will generate a much closer fit between problem space and solution space.	Provide for the involvement of practitioners in order to more closely identify and align the problem space and the solution fit.

6.7. Chapter Summary

This chapter describes the ex-post, naturalistic evaluation outcomes for the study. The qualitative, sociotechnical evaluation and associated outcomes identified and communicated in the form of the design principles serves to answer Research Question 1. The objective for the naturalistic evaluation was to evaluate the instantiation in the context for which it was developed, and with actors who will be using the DSP, in an attempt to realise the value propositions they initially defined. Realisation of these digital value propositions would achieve greater coordination and collaboration in the context and meet the research objectives. The instantiation represents the complete DSP system design described in Chapter 5. The evaluation of the instantiation looks at all dimensions of the DSP system in its context of projected use (Prat et al., 2015) Further analysis of this projected use is provided in Chapter 7.

The *in situ* evaluation of the instantiation was capped with 16 semistructured interviews conducted with actors (evaluation participants) who had used the system over an eight-month period. These actors represented a viable cross-section of practitioners in the PHC sector. The evaluation participants used the instantiation in a manner that saw them seek to realise the

connective, coordinative and collaborative value propositions originally described in Chapter 4. The design propositions participatively identified and developed from these value propositions in Chapter 5 guided the design of the interview questionnaire, which is reproduced in Appendix G. The evaluation used these value propositions as indicators to assess the realisation of the instantiations' s objectives in the given context.

The semistructured interviews were framed by affordance theory, used here as an analytical tool to integrate the social and the technical in the evaluation strategy. The interview asked participants to reflect on the extent to which the design realised the value propositions. The evaluation outcomes were abstracted to the initial five design principles. The findings confirmed that design principles two to five (addressing the functional elements of a digitally searchable information structure, creating a common lexicon and framework for PHC activities and resources, developing a database based on actor profiles and integrating practitioner involvement in the design and development of the DSP), were all effectively realised. Participants found these architectural and configuration elements effective in allowing them to achieve their coordinative and collaborative goals in the PHC sector. At this point these findings could be used to further develop and improve DSPs for use in the public sector at a supraorganisational level. Bodies in the public health sector could use such systems for developing and communicating policy and project goals.

However, in regard to Design Principle 1, participants reported limitations in efficient access to actionable information. Given the lack of institutional leverage and being heavily dependent on coordination with other actors to deliver those information sources, a problem in terms of resource synchronisation became apparent. This challenge is synonymous with the establishment of an emergent ecosystem and raises questions as to how to design in a manner that can optimally orchestrate the development of the wider ecosystem. These challenges and other themes emergent from the evaluation phase are analysed and discussed in the following chapter, Chapter 7, Discussion.

Chapter 7: Discussion (PADR Phase: Participatory Reflection and Learning)

7.1. Approach and Structure of the Chapter

This section introduces a discussion of the evaluation findings and links with the findings reported in Chapter 6. As discussed in Chapter 3, this research makes a number of solution design knowledge contributions. The previous chapter (Chapter 6) discussed solution design knowledge that codifies and communicates sociotechnical solution design knowledge in the form of design principles reflecting the architectural and configurational choices of the DSP. This constituted PADR Phase 4, impact evaluation, and consisted of an ex post naturalistic evaluation to determine whether the instantiation was capable of realising the goals of the participant actors. The findings of this evaluation process contribute to the creation of solution design knowledge, perhaps more applicable for the practitioner focused on DSR project builds in the public supraorganisational space. The abstraction and communication of design principles in Chapter 6 resulted primarily from an evaluative analysis of the use of the instantiation, framed by the sociotechnical affordance framework. Here the evaluation examined how interaction between the specific configuration of the DSP and participant actors with specific goals (in the context for which it was intended) could realise those goals. However, this evaluation found that not all actors could achieve their coordinative and collaborative goals. Over the eight-month evaluation period challenges were encountered in terms of scaling the DSP ecosystem and generating network effects. These challenges will be explored in the participative reflection and analysis phase (Chapter 7), with the objective of improving our understanding of the problem and solution space and looking to see where the application of the solution(s) and its design could be improved. This is helpful, as such reflection can positively impact on the adaptability and thus the long-term viability of the proposed solution.

The chapter starts with an explanation of this discussion context, placing it in the context of the research design and the affordance lens which frames the overall evaluation process. The chapter then explores the process of design theorising in DSR, focusing on abstraction and reflection processes (Gregor, Müller, & Seidel, 2013) pertinent to this stage of the DSR PADR process. A discussion exploring the explanatory affordance framework and the challenges of immature ecosystem development emphasising empirical case study evidence then follows.

Following this, the chapter highlights the direction and contribution the research might take as a result of this discussion to further address the research problem and better align or guide the solution design knowledge within the broader problem space. A set of revisited design principles are then presented.

7.2. Context of This Discussion

This research uses an iterative DSR process (PADR) and an interpretive case study research method to design and evaluate a DSP instantiation that seeks to advance coordination and collaboration in the PHC supraorganisational sector. The responses to Research Question 1 were reported in Chapter 6. This chapter focuses on how the findings from the DSR process address Research Question 2. Additional context for this discussion can be found in previous chapters that report on DSR processes. The first chapter discussed the research problem and its justification, culminating in the formulation of the research questions and the research goals. Chapter 2 discussed the research gap, extant research and research opportunities. Chapters 3 and 4 discussed the proposed research methodology, the research context, DSR method and the instantiation's sociotechnical requirements. Chapter 5 discussed the build and configuration of the instantiation. Chapter 6 then evaluated the instantiation in terms of the participants' value propositions, from which the primary research artefact, the design principles were developed. Up to this point, the research has discussed solution design knowledge that justifies and explains the DSR methodology, the PADR process as an appropriate process to address the research problem, the use of the case study method to participatively design the instantiation and the use of affordance theory to evaluate the instantiation in terms of sociotechnical usefulness and fitness. The evaluation identified specific constraints, specifically in the design's ability to scale the associated ecosystem. This chapter now discusses findings arising from the PADR Phase 5 process, which was applied to generate further learnings, develop a deeper understanding of the problem-solution alignment and to help guide the evolution of the instantiation in its sociotechnical context—in particular, to address the constraint identified above and in Chapter 6.

The affordance-framed evaluation, focusing on meeting the value propositions of the participants, indicated that while participants were mostly able to realise their goals, the eight-month naturalistic evaluation period identified further challenges that were likely to affect the

ongoing use and development of the instantiation. The question of how a designed artefact interacts with its sociotechnical environment and its ability to adapt and evolve to challenges and constraints encountered in that environment is one that is considered in the literature (primarily in the form of artefact mutability, see Gregor et al. (2011)). There is, however, limited guidance in the literature as to how to provide for or manage this expectation of mutability in extant DSR design and evaluation processes. Gregor and Jones (2007) define artefact mutability as changes that occur or are required in the research artefact as that artefact evolves over the build and evaluation process. This is also seen to include any subsequent changes in the theoretical or justificatory knowledge foundations of the research artefact. Orlikowski and Iacono (2001) have long identified this as an unresolved issue for information systems:

> *We believe that the lack of theories about IT artifacts, the ways in which they emerge and evolve over time, and how they become interdependent with socio-economic contexts and practices, are key unresolved issues for our field and ones that will become even more problematic in these dynamic and innovative times. (Orlikowski & Iacono, 2001)*

Or, as Lee (2001) put it, how to deal with the phenomena that emerge when technical and social systems interact over time. Promisingly, Sein et al. (2011) appear to elaborate on this concept of artefact mutability by referring to a process of "guided emergence". These authors refer to the longitudinal effects of mutability (in terms of ongoing researcher and participant reflection) on the design and evaluation of the artefact through its use in its organisational context by the targeted users and beneficiaries. The inference here is that appropriate time frames required for DSR sociotechnical evaluation are of necessity more extensive in nature. This study attempted to address this more extensive sociotechnical evaluation through Sein et al. (2011) concept of guided emergence primarily through the use of PADR methodology (reflective and learning, Phase 5) during which the emergence, evolution, and organisational shaping (supraorganisational in this context) of the instantiation in its social context was continuously evaluated, analysed and developed. The outcomes of this phase generated further solution design knowledge based on this participant reflection and learning, effectively guiding the emergence of the instantiation in its social context and are reflected in a revised set of design principles. This additional solution design knowledge attempts to firstly, provide a solution to the specific scaling challenge encountered and secondly, to provide further justificatory knowledge that underpins this revised solution space (i.e. a revised set of solution

design principles). In this an attempt is made to answer both the how and why solution aspects of the scaling constraint.

The solution design knowledge generated up to this point (Chapter 6) does not explain the conditions that gave rise to this constraint. Further, the solution design knowledge provided up to this point offers no solution to this challenge. It is not known which aspects of the design or of the contextual conditions are required to be addressed in order to address the given constraints. This problem represents an aspect of artefact mutability (as discussed above) not provided for in the theoretical foundations and exploratory research underpinning the design and development stages of this research. Clearly, this aspect needed to be addressed in order to generate greater practical relevance and use of the solution knowledge. Carlsson (2007) identified such challenges for research theory in terms of relevance and the practical, beneficial use of the solution design knowledge and stressed that new solution design knowledge must show evidence that it realises the objectives of the research. The aim of this chapter is therefore to discuss the study's participative reflection and learnings from the evaluation and, in doing so, present some emerging key sociotechnical themes that add to our understanding of problem, solution and context. This chapter therefore consolidates this stage of the design theorising processes and addresses research question 2:

> *RQ 2: How can ecosystem orchestration and affordance theory further our understanding of the sociotechnical opportunities, challenges and constraints in generating collective action possibilities for users in an emergent DSP PHC ecosystem?*

Table 30 presents an overview of the chapter illustrating the emergence of these key themes:

Table 30: Chapter 7 Key themes

Context of research discussion	Key themes
RQ 2: How can affordance theory and ecosystem orchestration further our understanding of the sociotechnical opportunities, challenges and constraints in generating collective action possibilities for users in an emergent DSP PHC ecosystem?	• An affordance framework to explain opportunities and constraints of the DSP and its immature ecosystem: Individual affordances as expressions of collective intent and antecedents of collective affordances. Interaction (or bundling) of these individual (social media affordances and professional social identity) affordances to generate collective affordances that facilitate coordination and collaboration in the PHC supraorganisational sector. • Ecosystem orchestration: opportunities for scaling and generating network effects.

	• The need for DSP governance and direction.

This then, is the context of this discussion chapter: the contextual findings of the first research question are discussed and explored to generate a greater understanding (and therefore alignment) of the problem-solution space thereby explicating more comprehensive nascent design theory as explained by Gregor & Jones (2007)) and, in doing so, answers Research Question 2. The chapter concludes with a communication of the explicated nascent design theory in the form of a revised set of design principles.

7.3. Theorising Processes in the Evaluation Phase

Evaluation may further elaborate on solution design knowledge by discerning or theorising why an artefact (or artefact configuration) works or not in a particular context (Vaishnavi & Kuechler, 2004). However, the literature provides limited guidance as to how this process of "discerning" or theorising should take place. Gregor et al. (2013), reference (Lee, Pries-Heje, & Baskerville, 2011) to show this theorising process happening in a movement that goes from instance problem to instance solution, to abstract problem to abstract solution. This movement is described in terms of abstraction and reflection. Lee, Pries-Heje, & Baskerville (2011) describe abstraction as the process of moving from instance to abstraction, or of developing additional general knowledge and then applying it to a class of problems. This process is accomplished through reflection, a process whereby researchers (in this research researchers and practitioners) think of outcomes and learnings observed in the instance domain, evaluate and analyse such observations and propose and evaluate general solutions to said observed problems. Such analysis in this instance is, of necessity, causal in nature. How, and why did this outcome occur and based on this, how and why might a certain adaptive solution work? Thus, in this research reflective causal analysis was a critical step, examining how the social (an actor's goals in using the technology) interacts with the form and function of the instantiation in the context within which the instantiation is to be used. This is seen in both design and evaluation. Here causal analysis evaluates outcomes, which are determined by the interaction between the form and function of the instantiation, the goals of the user

and the contextual conditions. This is achieved via the sociotechnical evaluation strategy, deploying the affordance lens.

Different logics may be utilised in these theorising processes: firstly, deductive logic, where the design theorising stems from the evaluation of primarily kernel theory and justificatory knowledge; secondly, inductive logic, consisting primarily of empirical observation, and finally abductive, which looks at making sense of observations from existing theory (Gregor et al., 2013). Lee, Pries-Heje, & Baskerville (2011) argue that design theorising is a predominantly an abductive reasoning process focused on intuitive and creative thinking. In this study all three reasoning logics have been used in terms of design theorising across firstly, the identification of the research problem and goals; secondly, the build of the instantiation; and finally, the evaluation of the instantiation. The evaluation examined participant users interacting with the instantiation in the context for which the instantiation was designed to be used. This included participative reflection based on inductive and abductive reasoning on what worked and what did not and led to creative responses regarding how to address what was seen not to work. This also included a search for theoretical justifications that would serve to underpin and scaffold the value of this new knowledge. Thus this reflective learning process is not merely about how principles of form (the configuration and architecture of the instantiation), might be adjusted to improve function (adapted to address identified constraints), in what could be considered in a further iterative design cycle, but rather to develop and communicate a greater understanding of the nature of the problem (Gregor & Jones, 2007).

These theorising processes develop the solution design knowledge outcomes in that a more nuanced understanding of how and why the realisation of participant goals are constrained. Based on this, insights as to how the instantiation might be developed to better function in its context lead to better alignment between problem and solution. This process is seen as consistent with Sein et al.'s (2011) conceptualisation of guided emergence referred to earlier. By applying Gregor et al.'s (2013) design theorising abstraction framework, a causal analysis can be made across the principles of form and function of the instantiation, using the affordance framework.

7.3.1. Principles of form.

The design theorising process evaluated how the configuration of the instantiation (the form) in its targeted context enabled actors to achieve their goals. It looked at how actors perceived the affordances offered by the particular configuration of the instantiation in that environment and then considered how those actors sought to actualise (or not), those affordances. Where identified and perceived affordances were not actualised, reflective questions were posed to address this negative result. What contextual conditions were present that inhibited the actualisation of these affordances? What aspects of the configuration are seen to enable/not enable the actualisation of affordances? What changes in the configuration, or architecture of the solution would be required to enable the actualisation of perceived affordances? Is there any justificatory knowledge (theory) that would generate a greater understanding of how and why perceived affordances were not able to be actualised?

7.3.2. Principles of function.

Based on this new understanding, the design theorising process then looks at how the instantiation might evolve or be adapted in order that actors might be better enabled to actualise the perceived affordances. In other words, what is necessary or what actions are required in order that users could be enabled to realise their goals? Is there any justificatory knowledge that would support any such actions? Such a process would reconsider original solution design knowledge and/or develop new solution design knowledge to address these questions. Causal analysis of this nature evaluates the instantiation in use. The following sections present the outcomes of this causal analysis and reflection.

7.4. Discussion of RQ 2: Evaluation Outcomes

> *What these IT based artifacts have in common is that humans use them in specific contexts and that this use often provides unpredictable results, which is in stark contrast with the premise that a specific design will deterministically lead to an anticipated, measurable result such as improved performance or lowered costs (Gregor et al., 2020, p. 1631).*

The following sections discuss further findings that emerged from the evaluation phase of the research. The discussion first presents an explanatory framework to explain the constraints and opportunities that become apparent as the DSP emerges into sociotechnical practice. This

explanatory framework looks to identify the individual and collective affordances that enable greater coordination and collaboration and to examine why certain affordances are perceived or not perceived, actualised or not actualised. Based on this understanding the research refers to and is guided by justificatory knowledge based on Ofe's (2018) three challenges relevant to immature ecosystem development. This knowledge will deepen our understanding of the causal mechanisms which either afford or constrain the action possibilities that originate as a result of the interaction between the DSP, its configuration and actors seeking to realise their goals. Based on this, the research will offer a revised solution space, reflecting a "guiding" of the evolution of the instantiation in the context within which it is to be used. By means of this reflection and learning process (PADR 5) the research will develop stronger solution design knowledge for both practitioners and researchers seeking to advance greater connection, coordination and collaboration at this supraorganisational level in the public sector.

The primary challenge encountered in the evaluation phase focused almost entirely on generating a critical mass of users to engage with the DSP in order that network effects may be generated, thus scaling the ecosystem. To attract users the DSP must offer a value proposition in the form of broad access to sector experience, expertise and information. However, in order to offer this value proposition, the platform required an existing body of expertise and experience, an ecosystem of users. This conundrum is what every immature platform ecosystem faces. But in this public, supraorganisational space the challenge is compounded by other considerations. First, the proposed ecosystem is an association of loosely coupled actors with perceptions of service value (in the DSP) that are based on individual actors' immediate service delivery objectives, which will be diverse and often temporal. Of import here is the conflict between collective intent to achieve greater coordination and collaboration in the sector and immediate, individual service value goals. On the one hand, participants collectively recognised the importance of the sector's collaboration objectives and could see the connective and collaborative value propositions offered by the DSP in that supraorganisational context; yet equally, they still struggled to see how they would realise their immediate value needs in the emergent ecosystem.

> *I think what it needed was a bit more user experiencey kind of stuff maybe. Yeah. I mean, I, I think I felt that it was a little bit clunky still. (PHC practitioner)*

> *And in terms of the networking tool the sense I got was that it would be something that people would float in and float out of, depending on, depending*

on where they were. It's not something that, that you know, is something like you say, a social networking tool in the sense that they'd be in there every day. (PHC manager)

Reflecting on this, we concluded that there was a need to develop a greater understanding of how DSPs and their emergent ecosystems may be associated with collective intent and action at this level (Majchrzak et al., 2016). Applying a causal analysis would, we thought, illuminate the mechanisms underpinning this dynamic and this would then enable researchers and participants to consider remedial options for solutions that would evolve the instantiation. In this regard, use of the affordance lens promises greater insights regarding DSP orchestration in this context and can develop a deeper knowledge and understanding of the individual and/or collective mechanisms supporting or constraining ecosystem development. This developing understanding is considered as justificatory solution design knowledge, important for further development of the DSP and its associated ecosystem.

7.5. The Explanatory Affordance Framework

The following sections elaborate on this affordance-based justificatory solution design knowledge.

7.5.1. Introduction and overview of the affordance framework.

This part of the discussion will seek to develop an affordance framework that will assist with an examination and analysis of how collective action possibilities are impacted by the configuration of the DSP and how this might assist in better understanding the constraints identified in the evaluation process. To this end, the framework will first recap the social media affordances originally incorporated during the design and build of the DSP. It will then introduce professional social identity affordances as important precursors to collective action possibilities (Weichold & Thonhauser, 2020). Professional social identity affordances are perceived and actualised in conjunction with or bundled with the identified social media affordances. Actualising these bundled individual affordances is an outcome of individuals first perceiving and actualising an affordance of collective action possibilities. This perception of collective action possibilities needs to be combined with social media affordances in order to be actualised in this design. It is only once these bundled individual affordances are actualised that collective affordances become apparent.

The relational perspective of affordances identifies them as a specific use of features generated by individuals who perceive the affordances of the technology from a perspective of collective intent, rather than from an individual one. The actualisation of professional social identity affordances and social media affordances gives rise to particular interlocking effects, generating specific collective interdependencies between users. These collective interdependencies manifest themselves as collective affordances, or options for collective action generated by users' interactions. Collective affordances in this research are the action possibilities available to users to support coordinating and collaborative actions at the supraorganisational level

Actualising (actioning) these collective affordances will facilitate the realisation of the sector's coordinative and collaborative goals. Equally, an inability to generate (or unwillingness to actualise) these collective affordances will obviously hamper ecosystem development and thus the realisation of the sector's coordinative and collaborative goals. It is important to identify these collective mechanisms (affordances) and how they come to be perceived and actualised, as it is the actualisation of these collective affordances that generates PHC service value from within the DSP.

The following figure depicts this framework:

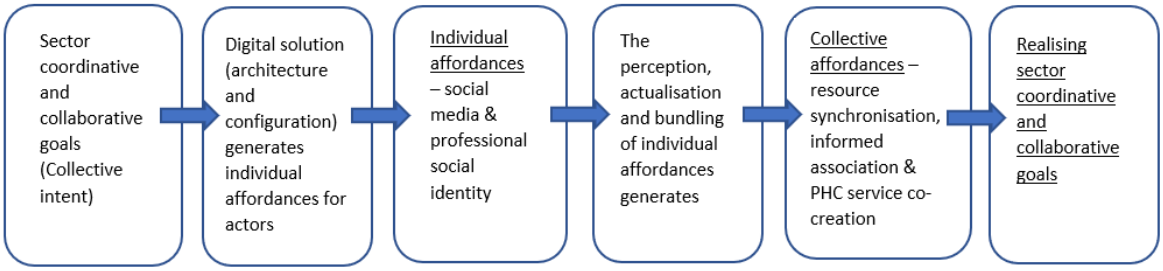

Figure 13: The Explanatory Affordance Framework

7.5.1. Social media affordances.

The DSP SALUS design is based on media platform concepts and thus displays standard social media affordances well-documented in the IS literature in various contexts, either from an individual or an organisational focus (Namisango, Kang, & Beydoun, 2021), and which are listed here in Table 31. Many of the social media affordances have been discussed in Chapter 2 so

are dealt with briefly here. Identified social media affordances, generated by the design and configuration of the instantiation, include firstly, visibility, which enables users to find, view and consume information across a broader horizon (of practising professionals and their activities) than previously (Raja-Yusof, Norman, Abdul-Rahman, & Mohd-Yusoff, 2016; Treem & Leonardi, 2013; Vaast et al., 2017). Secondly, the affordance of searchability (associated with visibility) refers to the ease with which information can be located (Treem & Leonardi, 2013) across a broad context (Rice et al., 2017). Users of SALUS may search across name, project, activity and network to facilitate ease of search. Thirdly, the affordance of information sharing allows users to post, share and consume expertise, experience (Raja-Yusof et al., 2016; Treem & Leonardi, 2013; Vaast et al., 2017), and personal information thus enabling the fourth affordance of connectivity (Vaast et al., 2017; Zheng & Yu, 2016). A key affordance of the study's instantiation, not listed in this roll call of social media affordances, is that of information standardisation. The complexity of the primary health care sector and the diversity of professional, governmental and community organisations and networks present with diverse contexts, differing jargons, vocabularies and references. To this extent the primary health categorisation of Jorm et al. (2009), was adapted to standardise the collation of information and ensure users were contributing to a common, understandable information framework that facilitated ease of visibility, search and connectivity.

An understanding of how this sector's coordinative and collaborative intent may be digitally realised or constrained, based solely on social media affordances identified in Chapter 2, was found to be inadequate. The social media affordances identified in Chapter 2 presume an established ecosystem where value capture (affordance actualisation) in the form of visibility, editability, persistence, association, selectivity and interactivity is possible. They do not, in themselves, constitute a value proposition in the absence of an existing ecosystem of users. At a supraorganisational level these social media affordances are not sufficient in themselves to generate engagement with the DSP, as there are, after all, numerous similar tools available to practising professionals. The social media affordance framework is helpful when explaining individual motivation to realise a connective affordance at an individual level in an existing platform ecosystem. It is not so helpful in explaining individual motivation to engage and realise collective goals at a supraorganisational level in an immature platform ecosystem. In order to generate greater coordination and collaboration at a higher level, the researchers needed to

understand how a collective intent for greater coordination and collaboration interacted with the technical affordances of the DSP (the DSP's form and function) in order to attain the required collective affordances. In order for such collective affordances to be perceived, actors must of necessity have as a goal, a collective intent. The research shows that the individual motivation for such collective intent (greater coordination and collaboration) at a supraorganisational level goes beyond the realisation of social media affordances. Further, we have seen (Chapter 2, Section 2.4.3.) that the IS literature regards collective affordances primarily as the aggregate outcome of individual affordances whereby individual actors all realise the same affordances in pursuit of a group goal (Leonardi, 2013, Spohrer et al., 2007, Strong et al., 2014). For an immature ecosystem to evolve, it was required that different actors would need to both perceive and pursue different individual and collective affordances (goals) motivated by a collective intent. An alternative affordance framework is required to engage and achieve individual and collective objectives given this immature ecosystem. In order to generate engagement and the establishment of a broader ecosystem, additional motivating factors needed to operate.

7.5.2. Professional social identity affordances.

Weichold and Thonhauser (2020) see opportunities for collective action based on collective affordances as an "emergent property" of a collective intent. The realisation of social media and professional social identity affordances based on loose coupling among actors at this level reflects a collective agency that may serve to generate affordances for the collective as a whole. DSPs may facilitate this collective agency in that they present with an opportunity to form a digital collective around this collective intent which, as users engage, generates collective affordances (Weichold & Thonhauser, 2020). At a supraorganisational level, there are limited organisational roles or hierarchies to generate intent. The concept of collective intent aligns well with goals of PHC practising professionals who seek greater coordination and collaboration at the supraorganisational level. The motivation to engage with this collective intent to realise greater coordination and collaboration at a supraorganisational level is certainly not driven at an organisational level.

To develop his notion of collective intent and agency. Weichold and Thonhauser (2020) introduce the concept of embodied social identities (See Social Identity Theory (Turner, Hogg,

Oakes, Reicher, & Wetherell, 1987; Turner & Oakes, 1986)), where individuals may evaluate their environment from the perspective of a specific social identity (Mackie & Smith, 2017); for example, primary health care practitioners, academics, professional athletes, etc. Such evaluation occurs from the perspective of the social group with which the individual identifies. Environmental impacts and inputs on the social group are perceived by the individual from the perspective of the group, or collective. Where an individual acts on the basis of this social identity, such social identity is seen as embodied (Weichold & Thonhauser, 2020). Ergo, a practising professional engaging in actions pursuant to that social identity, and in the interests of that profession, embodies that social identity. The DSP in this research gives practising PHC professionals the opportunity to enact professional social identity affordances (public health) via the social media affordances, thus giving rise to action possibilities for others to enact their professional social identity affordances and, in doing so, generate a collective of practising professionals independent of any coordinating authority. It is the generation of this collective that develops collective action possibilities or collective affordances. Embodied social identity affordances are therefore based on what is relevant for the collective, and action is taken on behalf of the collective. Intent here is motivated by an individual evaluating their environment from the perspective of the collective and actioning collective goals pursuant of that collective intent (Weichold & Thonhauser, 2020). Interaction among individuals based on their embodied social identities will generate affordances, the actualisation of which leads to the generation of a collective, and where interaction among this collective will generate collective affordances (collective intent and agency).

Affordances for professional identity portrayal are affordances in the sense that when the technology is introduced to practising professionals they can perceive the potential of the DSP (a new, digital representation of a professional collective) to facilitate the profession's collective intent for coordination and collaboration. The only way to achieve that collective intent is to enact or embody the corresponding professional social identity affordances through the portrayal of themselves, their networks and experience. This portrayal or embodiment of their professional social identity is realised through the social media affordances that enable the primary health care professional to profile, edit and share professional information for connective and collaborative purposes. Social media affordances

are therefore bundled together with professional social identity affordances (Weichold and Thonhauser, 2020) to generate the potential for collective action through the DSP.

However, the enactment, or actualisation of these professional social identity affordances has to occur jointly and mutually before collective value can start to be realised from the ecosystem. As there is no immediate value to be gained, either individually or organisationally from this initial engagement and portrayal, the incentive to engage is primarily based in a user's understanding of the collective value potential of their combined professional identity portrayal. Ecosystem momentum is seen to occur as others enrol and the shape of the potential ecosystem starts to become apparent. The research identified this via the identification of user awareness of collective affordances. As such, the professional social identity and social media affordances can be identified as an antecedent to collective affordances and therefore the realisation of greater coordination and collaboration in primary health care service delivery.

The most important antecedent to the generation of collective affordances (and thus greater coordination and collaboration) is therefore that bundled grouping of professional social identity and social media affordances that enable the primary healthcare practitioners to enrol, present and manage their professional selves, experience, networks and expertise. A specific feature of the SALUS DSP was to focus on practising professionals, where it was perceived that by linking the data to professional identities, trust, legitimacy and accuracy in the information being shared would be promoted. This would have the benefit of motivating users to ensure such data was kept up to date (professional profiling). The DSP afforded PHC practitioners the potential to portray their professional selves across a much broader audience (O'Riordan, Feller, & Nagle, 2012; Rice et al., 2017), irrespective of location (Treem & Leonardi, 2013). Thus, a SALUS user could interact with specific individuals, projects, networks or activities across a sector-wide field. The effect of this is to delocalise information and facilitate connectivity with specific people/activities/experience in particular areas. The following table links the technology and the professional collaborative objectives with the professional social identity and social media affordances of the DSP.

Table 31: Associating Collective Goals, Professional Social Identity Affordances, Social Media Affordances and SALUS's Technical Configuration

Sector Collaborative Goals	Affordances	SALUS technical configuration	IS literature (similar social media affordances)
Create and make visible healthcare interventions and experience.	**Professional social identity affordances** • Enrol in SALUS • Self-presentation • Profile management Note: Create and portray professional profile, experience and expertise. Enables the maintenance of professional portrayal information over time. Given information is associated with user profiles in a professional context, the probability of information being kept up to date is higher.	Federated network: peer-to-peer profile function across individual, organisation, network activity.	(O'Riordan et al., 2012; Rice et al., 2017; Zheng & Yu, 2016)
Make this information available sector-wide	**DSP media affordances (social media)** • Crossing boundaries • Information sharing • Connectivity • Searchable Note: Ensure that information is available over time and geography.	Exchange orientation: connectivity and interactivity (communication and information sharing).	(O'Riordan et al., 2012; Raja-Yusof et al., 2016; Rice et al., 2017; Treem & Leonardi, 2013; Zheng & Yu, 2016) (Abhari, Davidson, & Xiao, 2017), (Claggett & Karahanna, 2018), (Vaast & Kaganer, 2013)
Allow this information to be kept up to date.	**DSP media affordances (social media)** • Editability • Persistence Note: Record the portrayal, enable the storage and editability of information.	Open access: A centralised standardised editable database.	(Mathiesen, Bandara, & Watson, 2013; Raja-Yusof et al., 2016; Treem & Leonardi, 2013)
Make this information sharable	**DSP media affordances (social media)** • Information standardisation Note: Ensure the information is usable across the diverse areas of primary health care.	Resource openness: Information standardisation affordances arising from a common lexicon generating a searchable data repository.	

7.5.3. Collective affordances.

DSPs enable the generation of user interdependencies that can occur beyond organisational roles. Interdependence refers to how users of the technology interact and rely on each other's contributions to achieve their goals (Vaast et al., 2017). Collective engagement at the supraorganisational level is perceived to rely more on personalised connections and sharing of information (Bennett & Segerberg, 2015; Stohl, Stohl, & Leonardi, 2016) than engagement based on formal organisational roles. This gives rise to particular forms of interdependencies. Interdependence has previously been studied at the intra-organisation level. Coyote & Thompson (1967) identified three key types of interdependencies: pooled, sequential and reciprocal. Pooled interdependence sees actors making contributions independent of others' contributions. Sequential interdependence is where an actor is dependent on others' inputs before being able to contribute. Reciprocal interdependencies refer to a backwards and forwards interaction of contributions (Coyote & Thompson, 1967). Leonardi (2013) likened collective affordances to reciprocal interdependencies and shared affordances to pooled interdependencies (Vaast et al., 2017). In their consideration of social media connective action, Vaast et al. (2017) considered how integrated patterns of feature use impacted on other actors' feature use. This generated distinct types of interdependencies and options for collective action not connected to formal organisational and role-based connective action. Interdependencies or collective action generated in this manner are seen as emergent and based on joint and mutual action and more akin to the Van de Ven et al. (1976) concept of team interdependencies, where the actions of one player will continuously impact on the actions of others and where players interpret their individual actions in terms of collective objectives. This concept of team interdependencies is reflected in the Weichold & Thonhauser (2020) conceptualisation of collective affordances.

Collective affordances, as conceptualised by Weichold & Thonhauser (2020), emerge from the interaction of individuals identifying with a particular social identity, responding to the objectives of that social grouping, and seeking to realise the collective intent. This provides an explanatory framework of relevance to this research. In this research, collective action is generated when individuals are seen to enact their specific social identity in the form of actualising embodied social identity (professional PHC practioner) and social media affordances and engage with other individuals with similar social identities in a collective

action. Bundled together, the actualisation of social identity and social media affordances leads to the generation of collective action possibilities that reflect collective intent and agency. A collective affordance therefore is seen as a collective-level construct that references collective rather than individual intent. A group of individuals, identifying with similar professional goals, and having the means to interact, can develop as a collective and generate collective objectives, giving rise to collective affordances. This study explored participants' awareness of collective affordances arising as an outcome of the actualisation of professional social identity affordances, DSP social media affordances and the subsequent development of a digital collective seeking to realise a collective intent. This occurred in the final semistructured interview process. Participants who had enrolled in SALUS were asked to identify collective action possibilities they could see based on the instantiation configuration and the existing or potential database of users. The intention of this was to confirm whether the configuration and developing ecosystem had the potential to realise the original value propositions of the platform and therefore to scale. Realising the DSP's value propositions entails the actualisation of collective affordances. This means that users must jointly and mutually engage with each other through the professional social identity/social media affordances in order to grow the ecosystem and generate the collective affordances. Collective affordances are therefore those affordances that only become viable or visible to the user based on the joint and mutual actualisation of the professional social identity/social media affordances, in other words the development of that digital collective that forms the basis of the DSP ecosystem. They are affordances of and for the professional collective that forms the basis of the DSP collective.

Table 32: Identified Collective Affordances

Collective affordances	Description
• **Resource synchronisation.** (mobilisation and aggregation of resources)	Mobilising and aggregating resources as a function of collective information sharing enables users to collate, coordinate and leverage experience and expertise to address primary health care issues.
• **Informed association and network generation**	The affordance of informed association and network generation enables users to collectively connect and network around issues and problems, independently of geographic location and organisation, to develop relationships and networks to address primary health care issues.

• PHC service value co-creation. (Cognitive and performance related)	Coordinating and collaborating to deliver more effective and efficient collective primary health care service delivery. Learning, understanding, increasing collective awareness and expertise. Includes the possibility of enhanced innovation in providing solutions and filling service gaps.

The collective affordances of resource synchronisation, informed association and network generation and PHC service co-creation are collective affordances originating as a function of an interacting ecosystem. They are collective action possibilities that serve to realise the primary value propositions of the SALUS DSP, that of increasing the efficiency and effectiveness of primary health care service delivery. This is done by collectively sharing solutions, modifying and aligning existing service solutions and the collective delivery of solutions. The ability to connect and coordinate service delivery, as a collective, enhances primary healthcare service delivery. However, the partial failure to actualise Design Principle 1 served to constrain the realisation of all three collective affordances. Research participants had indicated they were able to actualise the professional social identity affordances and the social media affordances of the technology, the antecedents of the collective affordances, yet, in many instances, saw limited value in engaging further at that point. The following discussion seeks to provide firstly, an explanation of this challenge, and based on this understanding, to suggest further solution design knowledge that addresses this challenge.

7.6. Applying the Affordance Framework

The introduction of the DSP SALUS and making it available for the PCP professionals to enrol commenced the establishment of the platform ecosystem. SALUS's association with a PCP gave the platform an initial broad visibility, but the PCP did not deliberately or purposely drive engagement with the platform or promote its ability to generate service delivery value. However, this initial engagement did occur within the environment of the PCP, in itself an expression of the professional collaborative objectives of the sector and a supraorganisational ecosystem characterised by multiple organisations, interorganisational networks and individuals across both government and community sectors. Individuals participating within this PCP environment were effectively actioning the collaborative goals of the sector, but in a physical, geographically-based manner. The incentives for these individuals engaging with the PCP are organisationally driven, as these practitioners represent their respective organisations at the PCP. PCP

collective goals are primarily to do with coordinating health policy on that level. The DSP can therefore be seen as a digital extension of this endeavour, but facilitating these collaborative goals over a much broader geographical area. However, the DSP itself can issue no professional or organisational directive to engage, and operates with no defining framework (e.g. health directive) to direct its activities. Engagement with the DSP is based on a loose framework of overlapping PHC service delivery needs, driven by PHC sector collaborative objectives.

From an affordance perspective we can thus firstly refer to embodied social identity affordances, where the affordance is based on the interaction between users, the DSP (SALUS) and their professional goals in this specific professional context. The users are aware of collaborative action possibilities with the instantiation , but this awareness is a function of their identification with the PHC professional collective, its objectives and shortcomings and what they can do with the technology in pursuit of these broad objectives rather than their individual PHC organisations. The enactment of these connective, coordinative and collaborative affordances is therefore a reflection of PHC sector objectives and thus an embodiment of their professional social identities (Turner & Oakes, 1986). Secondly, the affordance framework defines and identifies collective affordances, those collaborative affordances that emerge and only become viable as a result of individuals jointly and mutually actualising the professional social identity and social media affordances. Collective affordances are generated as a result of individuals interacting and engaging around individual affordances and collective affordances can only be sequentially perceived as an outcome of this individual action.

Without this formation of a digital collective, collective affordances would not result. In the loosely coupled, supraorganisational PHC environment it proved difficult to scale this digital collective. While actors could perceive the collective affordances they could not actualise them fully until such time as the collective started to generate network effects on a sufficient scale. Actors could actualise the collective affordance of informed association and network generation to a limited extent but struggled to realise the collective affordances of resource synchronisation and PHC service value co-creation. Here the incentives for engagement were simply insufficient, as DSP resources were simply too limited at that stage of the DSP's emergence.

> *It helps with the collective impact that we're trying to achieve at the moment, … but we're probably not really committing to investing in the same action together, if that makes sense. (PHC manager)*

The inability of actors to actualise collective affordances is explained in terms of Design Principle 1, efficiently and effectively accessing resources. The lack of sufficient actor engagement with the DSP constrained scaling and thus the generation of network effects. Little is known about processes of generating network effects in emergent collective intent DSP ecosystems in these public supraorganisational environments. Mature DP ecosystems offer the advantage of an existing user base to further generate network effects and scale the ecosystem (Ofe, 2018). Immature and emergent DSP ecosystems do not. Initiating and managing ecosystem scaling in such emergent supraorganisational contexts is dependent on developing interdependencies and interlocking action among users. This posits that collaborative service value can only be realised if users are jointly and mutually interacting and achieving collaborative goals and realising service value in the form of more efficient and effective service delivery.

The affordance framework enabled the researchers to explain the challenge in a manner that focused the learning and reflection phase of the PADR process around several reflective questions. If practitioners are actualising the individual affordances of social media and professional social identity, and this was primarily a function of an inability to generate network effects and thus value, what changes to the DSP would be required to facilitate and advance the realisation of collective affordances? In other words, how can the research better guide the sociotechnical instantiation and context to scale and therefore generate more efficient and effective collaboration and PHC service value delivery? Exploring the establishment of the DSP and its associated ecosystem based on this framework of collective affordances and interdependencies helps the study understand how actors in this environment are firstly constrained in perceiving and actualising the collective affordances (realising collective collaborative objectives) and linking this back to architecture and configuration choices. Secondly, how actors might be incentivised to engage with the DSP and thus to scale and evolve the DSP ecosystem. Scaling and generating network effects is the prime realisation or outcome of collective affordances. Without ongoing engagement no scaling will be achievable, which will render the collective collaborative value propositions of the platform null and void. It was obvious that the bundled social media and professional social identity affordances were insufficient in themselves, in the matter of scaling the ecosystem, to generate the required levels of engagement and thus PHC service value with the DSP. Here the affordance lens provides

a powerful explanatory framework of the processes and mechanisms underpinning the establishment and development of the DSP in this public, supraorganisational context.

7.7. New Design Knowledge Directions: Ecosystem Scaling

The affordance analysis and reflective questioning led to an exploration of how other DSPs' ecosystems have been established and developed. DSP ecosystems can be seen as sociotechnical interdependent systems. The emergent digital ecosystem must facilitate complex interactions between people and technology, and these interactions are shaped by their environment. Ofe (2020) identified the following integrated themes for DSP builders to consider: first, look at the projected DSP ecosystem and understand what the specific challenges will be in terms of the establishment and emergence of that ecosystem. Second, especially in an emergent ecosystem, think about the issue of attracting users and generating network effects. Third consider the issue of governance and the challenges and opportunities inherent in generating leverage in an emergent DSP ecosystem (Ofe, 2020). The information generated in this exploration of the emergent DSP ecosystem development and based on the affordance analysis caused a revaluation of the design principles based on a deeper understanding of the collective sociotechnical processes affecting the ecosystem's development.

7.7.1. The emerging ecosystem.

Digital platforms and their associated ecosystems are fast coming to the fore as a primary means of business collaboration for value creation (Eaton et al., 2015), as they are able to digitally connect interested parties across a broader context to facilitate the exchange of value. Value is created by users coordinating and sharing resources that serve to produce new or deliver (better) services. In this research, utilising digital means to integrate resources is increasingly seen to advance the efficiency and effectiveness of PHC service delivery ecosystems, thereby generating greater PHC service value. But this exchange of value is dependent on the scaling of that ecosystem and the nature of the community of actors that the platform will coordinate into a network for the purpose of exchanging value. Given the literature focus on mature, for-profit platform systems, there is limited developed guidance on how to establish and scale a public platform ecosystem from establishment. In terms of

developing the instantiation's (SALUS) emerging ecosystem, this lack of guidance presented a challenge. However, collective action and coordination in PHC is increasingly seen as a professional requirement, not an option, as is clearly expressed in the value propositions identified earlier in the study and emphasised by participants in interview.

> *I guess the other point that is true (is) that the Department of Health and Human Services who funds us and a lot of other organisations are also requiring more and more… and expecting to see us working together collectively at a partnership level not just coordinating with each other. (PHC manager)*

And here the instantiation was generally seen as a useful tool to promote ease of collaboration and the exchange of services.

> *I think you can collaborate in a way where you're sharing information, sharing knowledge right through to maybe where you're holding events together… It's a more organised approach to where you're coming together.*
> *(PHC practitioner)*

But this ability to perceive PHC service value did not result in expansion of the ecosystem. Until a critical mass of users was achieved there remained a perception that there was insufficient service value available to be captured on an individual basis. This, in turn, served to constrain engagement with DSP. Generating network effects in order to develop the service value proposition was therefore problematic in this context and complicated the task of driving the development of the platform ecosystem for the purpose of generating scale, as scale is dependent on many actors engaging with the platform and contributing resources.

> *The main thing that comes to mind straight away is that activity levels are just getting started, so like it's a portal for me to review information. Yet there's not that much information on there yet. I would log on and I would start reviewing other people's profiles but at the moment I don't have the urge to do that or to upload my own. (PHC practitioner)*

Equally there was no one actor in control of the instantiation, driving and incentivising engagement.

> *Well, yeah, but PCPs say they don't have any authority over anybody. Yep. So they can't really hold anyone accountable for not doing what they said they would do. And so without that, you, you know, it's kind of at a loss. (PHC manager)*

Ofe, (2018) utilises the term "orchestration" in referring to the establishment and evolution of an immature platform ecosystem (see Chapter 2, section 2.3.4.), as that process of optimising all three elements of architecture, configuration and context to achieve value. The term

orchestration is used in this research to discuss the emergence and development of the platform's ecosystem as it is found to be consistent with the Sein et al. (2011) concept of guided emergence for DSR sociotechnical artefacts.

Based on the Ofe (2020) framework the research identified two primary challenges to ecosystem emergence and development. The first challenge for this DSP was to create and capture value. In this study that refers to PHC service value (information, connectivity and coordinative and collaborative opportunities) which firstly must be perceived in terms of PHC service value by potential users and secondly, must be collectively generated by multiple actors across the PHC sector. The second (integrated with the first) challenge identified by Ofe (2018) is that of attracting sufficient users to the point where the digital ecosystem becomes self-sustaining and then, subsequently, to increase the user base to generate scale. Because in this research context, the creation and capture of value is clearly an outcome of scaling, this research will conflate the two challenges into one from this point. In order to create and capture service value there must be sufficient users generating service resources to attract further users. To achieve this, potential users must be able to perceive a benefit from their engagement with the DSP that will induce them to share their resources on the platform. The final challenge identified by Ofe (2018), that of governance and coordination, refers to control, the formation of partnerships and the ongoing maintenance of the digital ecosystem.

7.7.1.1. Creating and capturing PHC service value and attracting users.

The accumulation of value in an ecosystem has primarily to do with generating interdependencies between the platform and its components (Gawer, 2009) and equally, between users. Generating interdependencies between users is critical in SALUS's context—a supraorganisational, collective endeavour. SALUS has been designed to generate collective primary health care service value through interfaces that provide for the collation and exchange of personalised primary health care experience and expertise. The logic is that individuals, in ascribing to the overall collaborative objectives of the sector and profession, present with varied coordinative needs and PHC service goals. In other words, individual collaborative goals in this diverse PHC ecosystem are variable within the collective objectives of greater collaboration. These individual goals range across networking objectives, visibility across activities and interventions, profiles, networks, projects and access to experience and

knowledge. An individual might wish to access a given network, established in a given locality, or around a specific primary health care issue. They might be interested in finding specific experience or expertise or seeking information around specific PHC interventions or projects. In seeking greater coordination and collaboration collectively, PHC practioners also seek more immediate individual PHC action possibilities, such as collating public health interventions/projects around a specific issue for their own purposes. In this they are generating public health service value in that their intervention can take advantage of others' experience and expertise and can thus be more efficient and effective. The offering of one's own experience and expertise is the *quid pro quo* of capturing this value. This generates the collective value of greater coordination and connectivity and thus represents the service value of collaboration. Registering in SALUS offered practioners opportunities to capture immediate cognitive value, assisting them in their professional practice and thus generating collective service delivery value. However, the potential for this value capture is inextricably linked to the scaling of the emergent ecosystem. In the context of SALUS, the realisation of collective value, or primary health care service value, is dependent on a sufficient number of practising professionals engaging with the DSP, so that a critical mass of users can generate sufficient data in order to scale the network.

This ongoing development and scaling of the ecosystem is therefore core to realising the value propositions of the platform. The introduction of the SALUS instantiation to primary health care actors was the first stage in the establishment of the ecosystem, an ecosystem characterised by multiple interorganisational networks and activities across both government and community sectors within PHC. The ecosystem's evolution would be initially heavily dependent on individual actors registering and uploading their data as a precursor to realising the platform's collective value propositions. The data in question would span individual and organisational profiles, activities, projects and networks. Orchestration of this emergent ecosystem initially started from the core set of research participants involved in the design phase. These actors were employed by the PCP and recognised the platform's potential to support their collective collaborative goals.

> *I guess that, um, that there's a recognition […] that some of these problems are incredibly complex… So I guess there's a recognition that not one single entity service or organisation in itself is able to deal with the complexity of some of these issues. We are moving to more of a collective impact, um, model of work.*

So it is quite fortunate to actually have a more holistic view of what's happening in the sector. (DHHS manager)

It would then allow greater potential for broader collaboration across geographical areas, so what you're doing is also sharing best practice and you know, wins and failures and those sorts of things. (PHC manager)

Importantly also, through the identification of value propositions, they were also aware of the platform's ability to meet their individual requirements for supporting the collective goals, in other words, their immediate individual goals.

There's a repository of information that you can go to identify who you need to be talking to or connecting with. (PHC practitioner)

We're looking at, networking on a more professional level in terms of your specific function in terms of your specific interests". (PHC practitioner)

You know, the stuff that we're trying to gather, which is about policies and planning and structures and systems so that the type of information in my mind is very rare to find in one place. (PHC practitioner)

Orchestration in this instance, therefore, initially developed as a result of actors recognising the affordances of the platform to support both their collective and collaborative goals and their ability to engage with the platform to meet their individual requirements in collaborating. As seen, individual collaborative goals (in other words what individual users would expect to realise through collaboration) in the PHC ecosystem are diverse. Similar to the value proposition of the LinkedIn professional networking platform, SALUS potentially offered actors an opportunity to develop and engage with a professional network but specific to their PHC field. Initially, however, the establishment of the platform ecosystem was reliant on word of mouth via participating individuals (and the PCP) to enrol new users and thus generate and scale a network effect. This goal proved problematic in the timescale of the study. While there were sufficient users to raise awareness of the individual and collective affordances, it was difficult to achieve those affordances fully given the lack of critical mass in the form of users and inputted data. In order to generate collective value a sufficient number of users were required to jointly engage with the instantiation in order that the collective affordances become realisable, thus enabling the synchronisation of resources. There was simply not enough diversity of data and numbers of users to incentivise critical mass. Put another way, insufficient interdependencies (Van de Ven et al., 1976) were generated to sustain the ongoing evolution of the ecosystem in the time scale of the study. Until such time that individuals could

immediately capture PHC service delivery value in the form of individual information requirements and PHC service goals, there was insufficient motivation to engage with SALUS. From an affordance lens perspective, potential users were able to perceive an affordance, whereby they could potentially capture value, but were unable to fully actualise that affordance.

Further, evolving the emerging ecosystem required a long and arduous effort in publicising the platform across multiple areas in the PHC sector. This became a constraint that limited the scaling requirement for extensive interaction and ultimately, endangered the value proposition of the platform. The participants' reflection highlighted the fact that there was no central driving force within the organisation to aid the establishment of an ecosystem. This lack of a central coordinating force that could incentivise the ongoing development of the platform ecosystem was identified as a key issue constraining the generation and scaling of a network. In the commercial sector, incentivising users invariably occurs through pricing mechanisms (Hagiu & Rothman, 2016). In the public sector other incentivising factors, such as removing obstacles to participation (Hagiu & Spulber, 2013) or attracting influential actors (Agostini, Galati, & Gastaldi, 2020), have been seen to advance the legitimacy of the DSP and attract and retain users. Conclusively, (Jha, Pinsonneault, & Dubé, 2016) found that network effects were best driven by forging partnerships with critical stakeholders in the ecosystem. SALUS's association with the PCP gave the platform an initial broad visibility, but other than emphasising the collaborative potential of the technology, the PCP did not otherwise deliberately incentivise engagement or appear to value the platform's capacity to scale. With no clearly defined organisational or individual driving force in the ecosystem it was, effectively, directionless.

7.7.1.2. DSP governance.

To a large extent the lack of a platform leader for SALUS, who could direct and manage interactivity among users, limited the ecosystem's evolution. Establishing and developing a DSP and its associated ecosystem means developing and integrating the core technology and ecosystem such that the combined offering presented service value propositions to multiple actors (Gawer & Cusumano, 2008). The generation and capture of service value in digital platform ecosystems is connected via the architectural configuration decisions through to the management and governance of interactivity and interdependencies among users (Adner & Kapoor, 2011). In this supraorganisational context, capturing and generating collaborative

value is as much a function of managing the interaction and exchange among users in a mutually beneficial manner (Evans, 2012), as it is a function of architectural configuration choices. Actors need to be able to make sense of the value propositions of the technology and these value propositions need to be aligned with the actors' interests (Hu et al., 2016), a key function for platform management and governance. It is also important to recognise that actors and their service needs evolve, and that architectural and governance decisions (platform capabilities) need to address long-term needs as well by providing for new avenues for services (Ofe, 2018). Teece (2018) advises for a process of focusing on "sensing capabilities" in the initial phases of platform development, followed by a process of developing and transforming DSP capabilities (to meet evolving needs) which would be relevant in any expansion of the DSP. Similar to the Sein et al. (2011) concept of "guided emergence," sensing capabilities seeks to identify and develop ongoing value propositions for users to ensure the sustainability of the platform. Developing and transforming DSP capabilities requires innovation and adaptation to new (in this instance service) opportunities as the ecosystem evolves. In this research, sensing capabilities can be seen in the search for, and the development of, the evolving service value propositions of the DSP. Developing platform opportunities (in effect, evolving the supraorganisational ecosystem) goes beyond simply facilitating the generation of network effects to also managing the relationships between users across the ecosystem (Hu et al., 2016).

For the purposes of the design of the instantiation and given the public, supraorganisational context, platform governance was initially considered to refer to the provision of a common understanding of the ecosystem and its collective goals. The DSP ecosystem crosses the boundaries of multiple organisations and networks within the PHC sector, each with different missions and objectives. This could result in ambiguity as to how actors perceived the platform and its value. The original research background review offered differing viewpoints on how to address this. Cusumano and Gawer (2002) advocate strengthening central control over the ecosystem to provide a coherent focus, while Tan et al. (2015) propose openness and self-organising based on negotiation and collaboration to encourage interaction among users. Davis (2013) proposes that actors with social and organisational influence in the ecosystem be prominent in defining the evolving value of the platform. Given the public, supraorganisational context, the original design focused on openness and self-organising.

7.7.1.2.1. DSP direction and incentives.

The reflection phase highlighted that while the architecture and configuration of the DSP were perceived to be sufficiently open to attract engagement, effect a common understanding and generate interaction, the key issues of control and governance and partnering with key sector actors were not addressed fully (Ofe, 2020). Broadening out a common understanding from the original participants had proved more difficult than originally thought. Given the slow uptake and enrolment of users, it was difficult to develop the required level of interaction and interdependencies (Gawer & Cusumano, 2015) that should develop, firstly between platform and user and then secondly between user and user. The participant learning phase (PADR 5) defined this lack of direction and incentive as the primary challenge to developing the platform's ecosystem. Directed platform coordination across the multiple actors in PHC was now considered crucial to achieving critical mass. Within the PHC sector, the recognised leader in the field is the Department of Health and Human Services (DHHS). This body coordinates and provides the majority of funding for all primary health agencies and actions. Given this, discussions were initiated with the department to look at how they could contribute to the achievement of critical mass with the platform ecosystem. In these discussions the DHHS saw an opportunity to digitise and piggyback their funding reporting requirements on the platform ecosystem. One manager said:

> *The data platform is where we can capture all the work and efforts in the health prevention space… there's this constant challenge about, you know, engaging with agencies around what's required, the quality of the reports and plans, and you know, sometimes people aren't great at written communication. Plus you know, if we get that sort of information and detail, it enables us at the back end to manipulate and develop reports and you know search and better inform our responses as a Department of Health and Human Service. (DHHS manager)*

In order to digitally complete the required funding reports, practioners would have to enrol in the platform ecosystem. From the study's perspective this presented an opportunity to coordinate and grow the base of the platform ecosystem.

> *And I think then also that that site can be accessed by others as well because it's also an efficient sort of reporting planning tool which would encourage people… (DHHS manager)*

Following this feedback, it was decided to incorporate a reporting function whereby agencies who were the recipients of funding grants would be required to report on progress and

outcomes through the DSP. This would clearly associate the platform with the DHHS, giving a more centralised and governing focus to the hitherto loose coupling and networking of the emergent platform PHC ecosystem.

7.7.2. Revised governance and control framework.

Participatory reflection and learning looked to generate accelerated network effects by incorporating the incentive of digital reporting within SALUS and recognising the major funder in the sector, DHHS, as the key platform leader. The reporting function was then developed for the platform. For actors the reporting function increased the value proposition of the DSP.

> *It's a platform that can, you know, quietly, easily spit out who's doing what, where… And we can present the data in a way that it would engage people. You can imagine you have a report from an agency, which is 30 pages long. If we can present the data in a way that's more accessible, and you can get onto one page, then we've got an opportunity to say to others, well, they're working in this space, what are you doing, and then find some synergies and link up some work together. So it's a saving time in terms of us redoing the work all the time, and also, to get some historical information because I think what happens is because the plans only come in every four years, and we get reports, every 12 months, we seem to have a new process every four years. And so, you know, we sort of lose historical kind of information. So we had no way and what happens is we put on the F drive here, you know, the shared drive, and it just, and the person leaves and the thing's gone. And, you know, we've got no corporate knowledge that's left. (DHHS manager)*

The advantages in developing an added report functionality for DHHS were therefore significant to achieving critical mass. Recipients of DHHS grants would be obligated to report back on outcomes of their funded projects through the digital reporting function of the DSP. In order to access this function, they would be required to register and upload their data. Compared to the current text-based, manual PHC report data and analysis, digitised reporting in such a standard format has advantages of greater efficiency and reduced time consumption, with a huge potential for automated assistance with analysis, impact evaluation and planning. Creating a digital tool that allows PHC program officers and organisations to report their program objectives, interventions and outcomes on a given template will not only allow for the more efficient collation of that data, but also its aggregation, which in turn allows for useful evaluation. Data aggregation takes place between data collation and analysis. Such digital aggregation also allows for visual summation of the data. The ability to collate, aggregate and present data in a visual summary form (dashboard) is an important component in the digital

identification, mapping and evaluation of impact across geographical, population or health priority areas. For the SALUS designers, incorporating a mandatory reporting function into the platform immediately presented with opportunities to advance that critical base of users offering individual and organisational profiles, activities, projects and networks—effectively developing the PHC collaborative service value proposition. Such reporting is accessed separately, with the use of permitted access functionality. Data is created from funded PHC agencies through a defined reporting process utilising standardised data collection formats based on key evaluation questions or requirements. There are identified priority areas, goals and objectives, key populations, interventions and impact indicators. The effects of these improvements would be several-fold: First, it would serve to direct sectoral engagement with the platform. This would mean that many more actors would engage with the platform, advancing its value proposition considerably. Second, the added association of the DHHS would further embed PHC sector collective objectives, underscoring the platform's professional legitimacy. Finally, the DHHS taking effective control of the DSP would provide for greater control and guidance of the DSP's emergence and evolution.

The above analysis uncovers the contextual challenges of seeking to establish and develop an emergent DSP ecosystem. The affordance framework identified a situation where although actors could realise and actualise social media and professional social identity affordances, and could perceive collective affordances, they were unable to actualise the collective affordances of resource synchronisation and PHC service value co-creation. Reflection on this key constraint led the research to the literature on emergent, immature ecosystem development, which identified platform direction and incentivising engagement as key fault lines in the extant design and development of the instantiation. A PHC service reporting tool managed by the sector leader, the DHHS, was developed as a response to these challenges, evidencing a guided evolution of the platform.

7.8. Primary Artefact: The Revised Design Principles

This following section will re-evaluate the extant solution design knowledge based on this analysis and then provide a revised set of design principles based on this solution design knowledge generated from the learning and reflection phase (PADR 5). This revised set of design principles, informed by the analysis discussed in Chapter 7, follows the same design

principle formulation as followed in Chapter 6, based on Gregor et al., (2020), representing solution design knowledge for sociotechnical systems. An addition design principle, design principle 6, Platform direction and incentivisation, is added.

7.8.1. Design Principle 1.

Design Principle 1	Title: Generate actionable information
For Implementer I to achieve or allow Aim A for User U	For designers (implementer I) to ensure PHC officers and managers (users U) can access a centralised digital information structure (DSP) where they can upload and link their experience and expertise in PHC to their profile (aim A)
Context	At a supraorganisational level in PHC, where there is a lack of sector-wide coordination and collaboration (of PHC actors and activities)
Mechanism (s)	1. Open, accessible centralised digital information structure (technical) 2. Linking experience and expertise to a personal digital profile (social)
Rationale	Greater access to a centralised information repository will enable users to better view, disseminate and utilise experience and expertise across the sector, which will, in turn, generate more extensive and efficient knowledge-sharing, coordination and collaboration.

7.8.2. Design Principle 2.

Design Principle 2	Title: Facilitate digital search
For Implementer I to achieve or allow Aim A for User U	For designers (implementer I) to ensure PHC officers and managers (users U) can digitally search a centralised digital information structure across individual, project, activity and network data sets (Aim A).
Context	To operate at a supraorganisational level in PHC, where there is a lack of sector-wide coordination and collaboration (of PHC actors and activities).
Mechanism (s)	To ensure users can easily access data (technical) which is pertinent and relevant to their function and objectives (social).
Rationale	The ability to digitally search across individual, project, activity and network data sets quickly delivers relevant data to the searcher.

7.8.3. Design Principle 3.

Design Principle 3	Title: Provide a common language
For Implementer I to achieve or allow Aim A for User U	For participant designer (implementer I) to develop a common classification and categorisation of PHC resources and activities for users in order to enable a common cross-sectoral understanding of PHC resources and activities (Aim A).
Context	To operate at a supraorganisational level in PHC, where there is a lack of sector-wide coordination and collaboration (of PHC actors and activities).
Mechanism (s)	A common classification and categorisation of PHC resources and activities (technical) will ensure users can easily communicate and understand roles, activities and projects across the sector (social).
Rationale	Needed because multiple PHC jurisdictions (federal, state, local government) have developed their own categorisations that will hamper information sharing at a supraorganisational level.

7.8.4. Design Principle 4.

Design Principle 4	Title: Link to individuals
For Implementer I to achieve or allow Aim A for User U	Designers (implementer I) can link sector information (actors, projects, activities, networks) to individual profiles (users) thus improving the sharing of knowledge, trust in that knowledge and capacity to understand that knowledge in context for users (Aim A).
Context	At a supraorganisational level in PHC, where there is a lack of sector-wide coordination and collaboration (of PHC actors and activities).
Mechanism (s)	Individual profiles (technical) enable users to link experience and expertise with their personal profile (social).
Rationale	Because linking the data to individual practitioners active in the field will ensure data stays up to date, generates trust in the data and enables users to understand information in context.

7.8.5. Design Principle 5.

Design Principle 5	Title: Involve practitioners
For Implementer I to achieve or allow Aim A for User U	Designers (implementer I) can enable users to participate in the design and delivery of the DSP in order to facilitate connectivity, information sharing and service coordination.
Context	At a supraorganisational level in PHC, where there is a lack of sector-wide coordination and collaboration (of PHC actors and activities).

Mechanism (s)	Ensure implementers are users, and vice versa, to leverage practitioner expertise.
Rationale	Because this is how information sharing and collaboration over service delivery remains relevant to user objectives.

7.8.6. Design Principle 6.

Design Principle 6	Title: Platform direction and incentivisation
Aim, implementer and user	For designers (implementer I) to develop a reporting function for grant holders (users U) such that they are mandated to utilise the DSP (Aim A).
Context	At a supraorganisational level in PHC, where there is a lack of sector-wide coordination and collaboration (of PHC actors and activities).
Mechanism	Obligate users to access the platform in order to report on funding objectives to provide more data to the DSP ecosystem.
Rationale	The effect of this is to appoint a platform leader to direct the ongoing evolution of the platform and to incentivise engagement with the DSP by requiring a level of input from other actors.

7.9. Chapter Summary

This chapter has provided an analysis and discussion of the instantiation evaluation outcomes and thus the impact of the research solution on the problem space. The embodied social identity and collective affordance framework of Weichold and Thonhauser (2020) provides a deeper and richer explanatory framework to explain and understand the opportunities and constraints impacting this public, supraorganisational DSP and its complex, interdependent and immature ecosystem. The chapter highlights, based on the participatory reflection, a new direction in the research—one that sought to address the DSP's failure to generate network effects, in effect to actualise collective affordances. This new direction saw the introduction of a reporting requirement via the major funder of the PHC sector, the DHHS, utilising the DSP. This governance requirement would immediately start to generate critical mass in the form of increased engagement in the DSP and thus address the limitations the evaluation found with regard to Design Principle 1 by facilitating resource synchronisation and ultimately better PHC service delivery. These insights add to the overall body of solution design knowledge.

The discussion reflects research rigour through the use of theoretical guidelines (design theorising) to frame discussion outcomes and their meaning in the research context. An effective research synergy between theory and practice is achieved in the discussion by an extensive drawing on the theoretical literature and industry participation in the DSR evolution. The findings emanating from Research Question 2 (*How can ecosystem orchestration and affordance theory further our understanding of the sociotechnical opportunities, challenges and constraints in generating collective action possibilities for users in an emergent DSP PHC ecosystem?)* were theoretically underpinned by affordance theory (Bygstad et al., 2016; Strong et al., 2014; Volkoff & Strong, 2013; Zammuto et al., 2007), sociotechnical theory (Trist & Emery, 1960), ecosystem orchestration theory (Eaton et al., 2015; Lindgren, Eriksson, & Lyytinen, 2015; Ofe, 2020) and the collective affordance framework of (Weichold & Thonhauser, 2020). This discussion provides meaningful solution design knowledge, enabling the study to present a contribution to research and practice in the area of digital coordination and collaboration in a public, supraorganisational space. The primary artefact and research outcome is the set of design principles as revised in this chapter. The design principles provide solution design knowledge that practitioners and researchers can use to navigate the challenges and opportunities of DSP design and ecosystem development in this public, supraorganisational problem space. On the basis of this knowledge, the contributions and limitations of the research to public, supraorganisational DSP design and development are discussed in Chapter 8, Conclusion.

Chapter 8: Conclusion

8.1. Introduction

This chapter concludes the thesis with a summary of the key research findings, which contributed to the development of a final, revised set of design principles, representing nascent design theory that addresses a class of coordinative and collaborative problems experienced at the public, supraorganisational level in the PHC sector. This summary demonstrates how the research has met its objectives. This research set out to explore the possibilities and challenges of establishing and developing a DSP (SALUS) that would help facilitate the supraorganisational collaborative objectives of the PHC sector. The proposed solution to this particular class of problems—the SALUS platform—is built on a common technology framework, previously applied across many modern systems and websites and used for information sharing, knowledge management and collaboration. Basic features include the ability to register and maintain user accounts and to create user-generated content. It is designed to be able to allow new features to be added to extend core capabilities as users' needs arise.

This concluding chapter includes the following sections: this first section is the introductory overview to the final chapter. A summary of research findings is then presented in section 8.2. The primary research artefact, nascent design theory resulting from the solution design knowledge generated in chapters 6 and 7, is then presented in section 8.3, following the Gregor et al. (2020) schema for specifying design principles. This section consolidates the research's contribution of nascent design theory in terms of Gregor and Jones's (2007) eight key components for design theory contributions. The contribution to practice is described. Section 8.4 discusses limitations of this research. Section 8.5 suggests directions for future research and includes some critical reflections. Section 8.6 summarises the chapter.

8.2. Summary of Research Findings

This section presents an overall reflection on the realisation of the research objectives pertinent to the research questions. The PHC sector has been quite vocal in advocating for greater coordination and collaboration across the whole of the sector. Many problematic

aspects of PHC present as wicked problems and so facilitating greater collaboration in the sector would be an important sociotechnical contribution. However, the PHC sector is notoriously fragmented, siloed and complex and it has proven difficult to gain traction on collective impact. While technology is often promoted as the best way to generate greater coordination and collaboration, designing a DSP in such a complex, fragmented landscape is complicated and encounters a high risk of design failure. This risk is compounded when designing for an open, supraorganisational environment with multiple and diverse stakeholders.

At an early stage of this research, it was decided that the DSR methodology was appropriate, given the basic research objective to design a collaborative tool. However it soon became clear that there was a lack of extant design theory to support the project in addressing the challenges and constraints of the context. Where relevant design knowledge support and theory was found, it was fragmented, incomplete and not easily transferable into useful digital design knowledge for this public, supraorganisational space. The exploratory research therefore aimed to address this uncertainty by participatively designing and developing a sociotechnical solution. A primary key to minimising risk in such a design process is to develop as much participation and collaboration with practitioners and potential users as possible: hence the choice of the PADR DSR process methodology. This method enabled the research artefacts to be developed with the participation of users, across the design continuum of problem space to solution space. An instantiation was developed to realise the evaluation strategy in a naturalistic setting. Naturalistic, *ex-post* evaluation assesses an instantiation in its purposive context (Venable et al., 2012) and can enable the study to more accurately assess the manner in which complex interdependencies within the whole (social, technical and environmental) relate to and impact on each other. The DSR evaluation strategy of this research is adapted from Venables et al. (2016) framework for evaluation in design science (FEDS), human risk and effectiveness evaluation strategy.

In this research, the instantiation is an actual example of an abstract (Gregor & Jones, 2007), based on participatively-derived design propositions, and used to evaluate those design propositions for the purpose of developing nascent design theory in the form of the (revised) design principles. The design principles are formatted and communicated to guide both practitioners (towards better coordination and cooperation in the public sector at a

supraorganisational level) and researchers (to develop a deeper understanding of the problem context). The design principles thus reflect both artefact-centred and non-artefact-centred solution design knowledge to cater for both practitioners and researchers and their nuanced requirements.

A multidimensional evaluation strategy, including both *ex-ante* formative and *ex-post* summative evaluation processes consistent with Venables et al. (2016), was employed to mitigate given uncertainties in solution design knowledge focusing on the problem space. Both *ex-ante* and *ex-post* evaluation processes occurred within the context within which the solution design knowledge was expected to be deployed; with participants who would be ultimate users. The evaluation was conducted within the case study PCP site, a supraorganisational collective of PHC individuals and organisations whose primary mission is to further PHC coordination and collaboration at this level. Evaluation outcomes provided solution design knowledge that indicated the developed instantiation would support greater coordination and collaboration. This was evaluated for all design principles with the exception of Design Principle 1 (Generate actionable information).

Post this, further discussions of the research outcomes with participants found that difficulties in scaling the ecosystem of the DSP constrained the achievement of this first research objective. These discussions also led to the development of additional artefact-centred and non-artefact-centred solution design knowledge. This resulted in the adaptation of governance configurations and the introduction of a reporting function. This development of the research design was seen to impact on ecosystem development and thus help to realise the objectives of Design Principle 1, which the research found to be constrained in use. The evaluation process underscored the importance of ongoing evaluation and reflection to guide the development of an artefact where its emergence is both impacted and shaped by the sociotechnical context. This is critical in a context where an immature platform ecosystem is expected to evolve, as it led to a revision of, and additions to, the design principles summarised in this chapter in section 8.3.

This research study is presented in eight chapters. Chapter 1 discussed the research problem, the research questions and the expected research contributions. In addition the research justification and motivation was given. Two research questions relating to the design and development of the proposed research artefact (solution to the research problem) were

defined in response to the research problem. Underpinning extant justificatory knowledge is identified. An overview of the methodology and projected limitations of the research is also discussed in Chapter 1. Given the wide range of the research and its complex sociotechnical context, a glossary of key terms was also presented in the introduction.

In Chapter 2, academic studies and industry sources related to DSPs and their primary conceptual elements are reviewed and discussed, both in the for-profit and not-for-profit domains. There is a discussion of S-D Logic, social media affordances and affordance theory, and their concomitant use to inform the design and development of the DSP. The research background highlights gaps in the literature regarding the design and development of a public, supraorganisational DSP. Chapter 2 therefore justifies and motivates the research problem and the two research questions. The chapter identifies two research opportunities: firstly, the build of a public DSP at a supraorganisational level and secondly, the emergence and evolution of an associated, immature ecosystem (Ofe, 2018).

Chapter 3 presented and discusses the research philosophy, research design, the DSR research methodology and the DSR process method. The justification for the DSR process method was given. The PADR research phases and research activities responding to the research questions were described and justified. The case study site for the participative design, build and evaluation is identified.

In Chapter 4, the case study approach is justified and the case study design and protocols are presented. The participatively-derived value propositions for the proposed digital solution are determined. Functional requirements, derived from the participant identification of value propositions for the instantiation, are identified within the framework of the case study. The ethical considerations provided for in the research process are given.

In Chapter 5, the design process, the formulation of the design propositions and the impact from kernel theory (the functional requirements identified from S-D Logic and social media affordances) are communicated in detail. The final design propositions are articulated. The architectural structure and the design configuration is described. The functions of the instantiation are listed and preliminary user testing of the artefact is discussed.

In Chapter 6 the sociotechnical evaluation strategy used to design the evaluation process for the instantiation is discussed. The evidence-based evaluation outcomes based on the *ex-post*

naturalistic evaluation are presented. The formulation of the design principles are explained and justified. These outcomes are codified in the form of an initial set of design principles. This served to answer RQ 1.

Chapter 7 analyses and discusses the evaluation outcomes in the context of the research method and research background findings. This evaluation process resulted in new justificatory knowledge giving rise to new solution design knowledge incorporated into a revised set of design principles presented in the chapter.

8.2.1. Research Question 1

The research answers the first research question," *How can DSPs in the PHC sector be designed and configured to advance and improve the coordinative and collaborative objectives of PHC service delivery at a supra-organisational level?"* as follows*:* The research provided design principles based on both participatively-derived requirements for a DSP and on the outcome of a sociotechnical evaluation strategy developed to account for the complex fragmented landscape of the PHC sector. The requirements were abstracted and formulated through focus groups, semistructured interviews, participant input and kernel theory. An instantiation was built and evaluated. The evaluation strategy was adapted from Venables et al.'s (2016) Framework for Evaluation in Design Science (FEDS), human risk and effectiveness evaluation strategy. The PCP of the DHHS Eastern metropole division was the supraorganisational case study organisation and site chosen for the evaluation of the instantiation. This *in situ* evaluation was conducted through both participant usage and experience and capped by semistructured interviews. Usability and fitness were evaluated in terms of participant users achieving their original value propositions for the technology. The results revealed that all but one of the value propositions were able to be achieved and confirmed that the instantiation as designed could achieve greater coordination and collaboration. However, in relation to Design Principle 1, "Generate actionable information," doubts were raised around the possibility of achieving scale. The evaluation was based on the DSR PADR process method. The design and development of the requirements approach is given in detail in Chapters 4 and 5. A detailed account of the architectural and configuration choices for the DSP are discussed in Chapter 5. An account of the sociotechnical evaluation strategy and the formulation of the design

principles is given in Chapter 6. The design principles abstracted from these processes are given in Chapter 6, Section 6.5.1. The sum of these responses serves to answer RQ 1.

8.2.2. Research Question 2

The research answers the second research question, RQ 2, "*How can ecosystem orchestration and affordance theory further our understanding of the sociotechnical opportunities, challenges and constraints in generating collective action possibilities for users in an emergent DSP PHC ecosystem?"* as follows: Based on the questions arising from the difficulty in scaling the DSP, the evaluation was deepened in an effort to firstly understand why this difficulty arose, and secondly to reflect on possible measures that might address this challenge. In this, an attempt was made to guide the emergence of the DSP in a manner that would improve its fitness to address the problem space. The challenge of scaling was first analysed in terms of the given affordance framework, whereby the individual affordances (of the technology in context) are required to be aggregated in order to present with collective affordances, the actualisation of which realise the coordinative and collaborative goals of the research. It was found that the actualisation of individual affordances was insufficient to support their aggregation into collective affordances. This led the research to consider Ofe's (2018) three main orchestration challenges for emergent DSP ecosystem evolution: (1) creating and capturing value; (2); attracting users and generating network effects and (3); control and coordination (governance). Based on this, the inability of the DSP designers to manage and incentivise engagement (platform governance) in this public, supraorganisational space was identified as a primary constraint. The outcome of this reflection and learning phase was the development of increased functionality for the platform in the form of mandated reporting for DHHS, allowing for the recording and aggregation of data within the DHHS health priority areas. As DHHS is the primary funder in the PHC space, it was determined that utilising the DSP for this purpose would address the actualisation of individual affordances, enabling the realisation of collective affordances and thus generating the required critical mass. It would also provide ongoing governance for the platform. This further knowledge prompted a review of the design principles and a revised set of design principles was developed, as presented in Chapter 7, Section 7.8. The analytical frameworks employed for the instantiation and the outcomes of this broadened evaluation, together, answer RQ 2.

8.3. Research Contribution

The following section summarises the research contributions of the thesis that add to the solution design knowledge base. The research investigated a specific class of problems associated with greater coordination and collaboration in a public, supraorganisational setting. There is little extant design research addressing this specific problem domain. The problem domain is of critical interest, given the lack of headway this sector has made towards the required greater coordination and collaboration. A digital solution was proposed and designed and the usefulness and fitness of this proposed solution was evaluated in a naturalistic setting. The problem space is characterised by the complexity and constraints involved in facilitating greater coordination and collaboration in such a public, supraorganisational domain. The solution space is identified in terms of the build of a DSP and the development of its associated ecosystem. Both artefact centred and non-artefact centred solution design knowledge is developed. This research therefore contributes to both theory and practice.

The projected research contributions are presented in Chapter 1, sections 1.7 and 1.8. In terms of theory, the research was expected to develop solution design knowledge that would generate clarification of an under-studied problem domain and would also develop knowledge about the design, build and use of a digital platform to address this problem domain. Further to this, the research was expected to forge a theoretical fit between the potential configuration choices of the solution and the collective action possibilities it generated. In terms of practice, the research was expected to present a set of design principles based on the evaluation of an instantiation (digital solution) that address the problems of greater coordination and collaboration at this level.

In terms of Gregor and Hevner's (2013) knowledge contribution framework discussed in Chapter 3, section 3.3.1.1., the knowledge contributions of this research can be positioned at levels one and two. At level one, the situated implementation of an artefact, an instantiation is designed and developed to evaluate the design propositions in the real-life context of the problem domain. This solution knowledge contribution here is more specific to the design and build of the solution. Further, the evaluated knowledge, abstracted to design principles, constitutes nascent design theory at level two, knowledge as operational principles/architecture, consisting of constructs, methods, models, design principles and

technological rules. Gregor and Hevner (2013) present with a quadrant that classifies the maturity of the problem domain (research problem) and the maturity of the developed artefacts as solutions to the research problem (research solution).

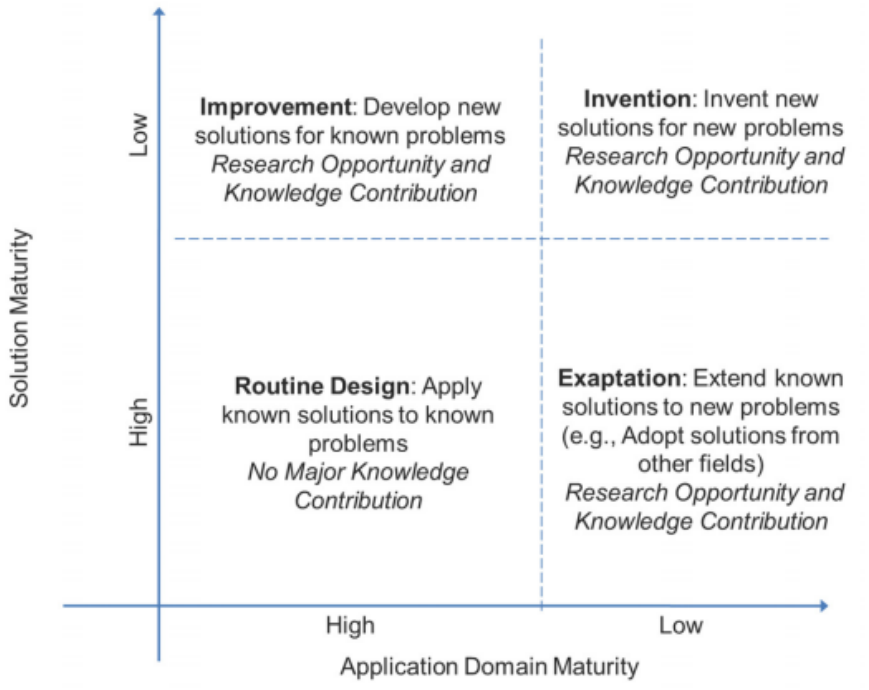

Figure 14: DSR Knowledge Contribution Framework (Gregor & Hevner, 2013)

This research's contribution sits in the improvement square, as the research developed a solution to a known problem. In this problem domain existing solutions are perceived as suboptimal. Extensive analysis of the problem domain generated greater clarity around the problem domain and a more efficient and effective technology was developed to address this problem domain. The primary research artefact is thus level 2 nascent design theory addressing and improving an under-studied problem domain.

8.3.1. Contribution to theory and literature.

This research makes an academic contribution in the following ways. First, the research background identifies a current deficit of literature addressing the challenges faced by digital solutions aimed at increasing coordination and collaboration at a public, supraorganisational level. A review of research and literature found that there are no credible theory contributions that would address this gap. This overview led to the proposal to build a DSP as a potential solution. The solution was first communicated in the form of abstracted design principles. The design principles constitute a new digital approach to this challenge. Previous attempts to

address this lacuna used proprietary digital approaches based on particular project approaches, which served to limit their use in practice. The present study contributes a number of artefacts abstracted from the findings. These artefacts include the design propositions, the instantiation and the revised design principles which could be abstracted to other contexts, thus increasing the external validity of the research.

The utilisation of S-D Logic as kernel theory to produce the design propositions is a useful contribution, given the previous lack of justificatory knowledge to address design in this public, supraorganisational service delivery context. Also, the research uses affordance theory in a novel way from a design perspective, as a sociotechnical tool, in the process of analysing and evaluating the DSP. There is very little guidance in the literature concerning sociotechnical evaluation, but it is an increasingly important consideration for DSR. As digitalisation becomes more and more ubiquitous across organisations and society as a whole, an increasingly digitised sociotechnical context will impact on and shape the creation and evolution of equally complex digital artefacts. This process will present ongoing opportunities and constraints affecting the usefulness and fitness of artefacts, leading to an increasingly major role for longitudinal sociotechnical evaluation. Affordance theory provides DSR with a suitable sociotechnical evaluation framework and thus promises to be a major tool in DSR evaluation processes where causal analysis is required. In this research, the affordance framework generated both design propositions and design principles, providing an effective problem–solution alignment. Affordance theory was also used as a tool for the causal analysis in the evaluation process and was able to further illuminate the problem–solution fit. This approach enabled the researchers to effectively conceptualise the challenges that became apparent in the evaluation phase and to clarify aspects of the problem and solution domains, specifically with regard to the collective action possibilities generated by the DSP. This greater clarity regarding challenges inherent in these domains enabled the research to develop different and more suitable responses to the constraints that emerged. This process was also informed by Ofe's (2018) identification of the major challenges encountered in the establishment and development of immature ecosystems. In his 2018 study, Ofe also noted that public sector DSP ecosystems have received insufficient attention. This research contributes empirically by empirically extending Ofe's 2018 ecosystem orchestration framework to the public sector. This framework, proposed by Ofe, serves to clarify motivation and incentives for DSP ecosystem

development in the public sector and, based on this, remedial action to address the challenges was identified in the form of the revised design principles communicated in Chapter 7, Section 7.8.

Finally the research contributes to DSR by demonstrating an integrated sociotechnical DSR approach governing both the chosen DSR process method, PADR (Chapter 3, Section 3.5.), and the evaluation strategy (Chapter 6, Section 6.2.) that together help address a novel DSR approach to the prescient statement of Orlikowski and Iacono (2001):

> *We believe that the lack of theories about IT artifacts, the ways in which they emerge and evolve over time, and how they become interdependent with socio-economic contexts and practices, are key unresolved issues for our field and ones that will become even more problematic in these dynamic and innovative times. (Orlikowski & Iacono, 2001)*

Those authors pinpointed the pressing need for evaluation of ICT artefacts as they emerge and evolve in their real world settings and the need for DSR to integrate the social and the technical in design, evaluation and guided emergence. The following table summarises the nascent design theory contribution according to the IS design theory of Gregor and Jones (2007).

Table 33: IS Design Theory Components (Gregor & Jones, 2007)

IS design theory components (Gregor & Jones, 2007).	Design theory contributions
Purpose and scope, "What the system is for," The set of goals that specifies the type of artefact to which the theory applies and the scope or boundaries of the theory.	A DSP that improves coordination and collaboration in the public health supraorganisational sector is developed. Existing digital tools and data usually focus on single interventions, are geographically bound or are limited to certain levels within the sector such as local government. This nascent design theory is focused on a sector-wide approach, covering all data. The nascent design theory focuses on how design of the DSP might incentivise and manage interaction and engagement to generate coordinative and collaborative service value in the public domain.
Constructs. Representations of the entities of interest in the theory	The constructs in the nascent design theory are DSR, DSPs, their associated ecosystems, S-D Logic and the affordance framework; social media affordances and coordination and collaboration, sociotechnical approaches and the PADR DSR process method (Chapter 3, section 3.4.1.3.).

Principles of form and function, principles that define the structure, organisation and functioning of the solution design	• Digital value propositions (See Chapter 4) • Instantiation functional requirements (See Chapters 4 & 5) • Design propositions (See Chapter 5)
Artefact mutability, changes in state of the artefact anticipated in the theory, that is, what degree of artefact change is encompassed by the theory	The DSP (contextually based) should be viewed as the core of a potentially greater information and collaborative infrastructure, where functional elements can be adapted and added as is consistent with the concept of a digital platform (as is evident in the addition of a reporting function).
Testable propositions, truth statements about the design theory	In the context of this study 5 design propositions were developed (see Chapter 5). The propositions are testable (design propositions tested in the form of instantiation evaluation, Chapters 6 & 7).
Justificatory knowledge, underlying knowledge or theory from the natural or social or design sciences that gives a basis and explanation for the design (kernel theories).	Given the exploratory nature of the research in the absence of extant design theory, a broad approach on justificatory knowledge was adopted. S-D Logic and affordance theory assisted in identifying design propositions and design principles that guided the design of the research artefact. Ofe's (2018) 3 primary challenges to immature ecosystem development and the Weichold and Thonhauser (2020) collective affordance framework guided the sociotechnical evaluation and analysis phases.
Principles of implementation, a description of processes for implementing the theory (either product or method) in specific contexts.	Six design principles (see Chapter 7) were developed, based on design propositions from which the instantiation was built. The configuration choices supported coordination and collaboration, giving rise to the design principles which may also be applied to the design of other public, supraorganisational DSPs. These design principles are the primary research artefact developed in this research.
Expository instantiation: a physical implementation of the artefact that can assist in representing the theory both as an expository device and for purposes of testing.	In this research an instantiation was developed and evaluated. A sociotechnical, qualitative evaluation examined the extent to which coordination and collaboration was enhanced by the developed instantiation. Research that provides design guidance for DSPs at the supraorganisational level in the public sphere is scarce. Further, the qualitative evaluation approach is suitable for sociotechnical solution design knowledge and can be used and extended by other research looking to design for emergent platform ecosystems.

8.3.2. Contribution to PHC industry and practice.

This research has consistently underscored and indeed baked into the research design, the importance of ensuring that the instantiation and resultant research artefacts are effectively integrated with, and evaluated within, the public, supraorganisational context they are

designed to benefit. The introduction of a new artefact to a particular context not only results in the generation of new work processes and workflows, but also requires to be adapted to existing work processes and workflows. It is this shaping of the artefact in its professional and (supra) organisational context that is the primary causal mechanism for its (guided) emergence. The research demonstrated this practical application of integration and guided emergence through the development of an instantiation and the eight-month *in situ* evaluation process.

From a practical perspective the instantiation's architecture and configuration structure affords practicing professionals in the PHC sector a single digital hub that gives practitioners the ability to access actionable information of relevance to their practice objectives, take advantage of others expertise and experience in terms of benefiting their own PHC service delivery objectives, join and form networks of professional interest and to do this on a much broader sectoral basis than before. Prior to this, sourcing information and expertise and coordinating and collaborating with others had to depend on personal proximity and time-consuming manual searches. These processes are inadequate to realise the sector's coordinative and collaborative goals or individual practioner requirements. The DSP designed and developed in this research does provide a significant improvement in that practising professionals can now gain a much broader overview of the resources available within the sector and connect with that expertise and experience. This helps avoid laborious manual searches, fills gaps in PHC service delivery and generates greater connectivity.

The PHC sector is bedevilled by its fragmented and siloed nature. Wicked public health problems that should be approached on a coordinated, whole-of-sector basis are instead addressed in a piece-meal way, to the detriment of the intended beneficiary, the citizen. With the new DSP, practising professionals can gather information, ensure best practice and connect and coordinate their PHC service delivery across the sector. While this research provides artefact-centred solution knowledge for the PHC sector in the form of an instantiation, the primary research artefacts are the design principles, which are abstracted to a level that potentially can make them applicable to other public, supraorganisational contexts—anywhere, in fact, where greater public coordination and collaboration are required. The research has arguably created an optimally configured DSP for this purpose in this context. The effect of this is to create improved and more effective connectivity and coordinative processes

in the sector. Achieving greater coordination and collaboration, while minimising the manual and cognitive workload required, is a valuable contribution and will be applicable in any public sector site seeking to deliver more effective and efficient service delivery.

The evaluation processes of the research also created valuable justificatory knowledge of relevance to the practitioner seeking to implement, use and manage such a tool. A greater understanding of the dynamic and emergent processes associated with the implementation of such a tool will enable practitioners to shape its evolution more closely to that particular context and its specific requirements. This highlights the importance of providing for a guided emergence of the artefact over time, as discussed by Orlikowski and Iacono, (2001) and Gregor, Müller, and Seidel, (2013), as well as the role of a platform leader to incentivise engagement and manage future platform development. This marks a natural direction for further research. Prior to that discussion, however, the next section will discuss the limitations of the research.

8.4. Limitations of the Research

Chapter 1 of this thesis initially set out the scope of the research, identifying the theoretical foundations, research design, methods and processes. However, given the broad array of knowledge domains that required evaluation in the research background search there is a possibility that areas of expertise and knowledge may have been omitted from this exploration of extant research. This limitation might have greater relevance with regard to alternative industry literature and industry practice. It is possible that more relevant practice and research regarding DSPs and their associated ecosystems is available in these domains.

Qualitative case study research is widely regarded as being limited in terms of its ability to generalise findings to broader contexts. This concern is relevant in the instance of this research. While qualitative case study research provided the in-depth causal analysis required to respond to the research questions, and was necessary to source and build the rich data sets essential for a thorough overview of processes, quantitative analysis might provide different insights from which data generation and collection, research findings and the research artefacts may have benefited. This is especially relevant in this research's evaluation processes, where quantitative analysis may have provided a quicker and more agile response to the "guided emergence" of the instantiation. It is therefore difficult to claim that results from this

research may be generalised to other contexts without many qualifications. Generalisations must necessarily be limited to the public, supraorganisational space.

Another major limitation, regarding external validity, is the selection of one case study organisation. Obviously more case study organisations would increase the validity of the solution design knowledge generated. However, the case study site did represent a large supraorganisational grouping (PCP) at a regional level in PHC. This enabled convenience sampling with regard to research participants, as the PCP gave access to multiple networks, organisations and individuals. Further, evaluation and comparison across multiple and more diverse research participants and different public service supraorganisational settings will have benefited the quality of the research findings and the generalisability of the findings. It remains uncertain how the findings would impact on a different public, supraorganisational setting with perhaps different supraorganisational structures and processes.

For the purposes of this study, only a single design-build-evaluate DSR cycle was conducted. Given the length and complexity of a properly executed DSR cycle, only one such DSR cycle could be executed within the given timeframe. Further, the emphasis placed within this research, on the importance of "guiding" the sociotechnical emergence of the artefact at that most vulnerable stage of its ecosystem development, extended the evaluation period and limited the scope of the research design to one DSR cycle. This focus on evaluation within a DSR project that included both design and build components further limited DSR cycle options to one. Equally, evaluation in this research could have gone on to properly evaluate and analyse the full impact of the integrated reporting function in the instantiation, possibly with a focus on quantitative methods, but unfortunately this remained outside the scope of the present study. However, the research design did incorporate several iterative processes within each of the design-build-evaluate DSR processes, inclusive of the eight-month evaluation cycle, that sought to lessen the impact of these limitations.

The research can claim that its novel DSP is a substantial improvement on existing digital options available to practitioners seeking greater coordination and cooperation in the public, supraorganisational space. It does not, however, claim to have produced best practice in this regard. Best practice, in this context, must be focused on continual "guidance" and sense seeking whereby the digital tool is continually evaluated and developed to maintain its value proposition to users in this context. However, the major research objective was met: that is,

the creation of a digital tool that would serve to facilitate greater coordination and collaboration in the PHC sector. The researchers created and developed a malleable digital tool, fit for continual adaptation and, most importantly, oversaw the integration of users into an evolving ecosystem that will ultimately determine the sustainability of the artefact. In this sense, the research can be considered to have met its objectives.

8.5. Directions for Future Research

> *A critical reflection on research activities is … to develop heuristic design knowledge from the DSR method experience. A critical reflection can create unique connections between disparate sets of research knowledge and consequently new perspectives about this research can be developed (Jasper, 2005).*

A design, build and evaluate DSR project is a not inconsiderable endeavour. When such research objectives include the sustainable implementation and use of project deliverables neither can such a project be straightforward. Such projects require time. In this instance time to participatively define the problem, to identify the value propositions and requirements and to participatively build and to properly evaluate. Time equally, to guide the embedding of that artefact in that context. Therefore the development of the research artefact and its initial implementation in this research can be described as nascent design theory and represents only the initial, foundational steps required to start the development of comprehensive solution design knowledge. There are numerous research objectives that would follow logically from this start.

First and foremost is the requirement to implement and empirically evaluate in other public, supraorganisational contexts. The requirement here would be to both evaluate the suitability of, and the generalisability of the solution design knowledge so communicated in this research. Here the formulation and communication of the nascent design theory has been designed to enable application and evaluation in other contexts. Far too many DSR projects are constructed as stand-alone projects where only technology factors are evaluated. Given the complexity and timeframes of extant DSR projects, the ubiquity of ICT in society and organisations and the tendency for social contexts to shape and evolve digital artefacts, DSR evaluation must also now increasingly provide for this guidance of artefact emergence within this shaping of the technology by the social context. To meet this objective it is necessary to apply and evaluate

the design principles through the adaptation and implementation of the instantiation in other public, supraorganisational contexts.

Secondly, there is a requirement to conduct evaluation of longer-term outcomes in this kind of research. Generating further and deeper evaluation cycles, in this way, will progress the research and further develop the nascent design theory. Consistent with the objective of "guided emergence," further participative evaluation cycles will serve to uncover ongoing options to develop the value propositions of the technology. This will add to the overall body of solution design knowledge.

Thirdly, considerations for future research should therefore also include the exploration of DSR evaluation methods to more fully account for the ongoing social and organisational shaping of DSR artefacts. While several DSR authors have provided sociotechnical evaluation guidance, there is a strong need to advance this guidance, to more fully account for emergence, to underscore the importance of longitudinal data and in the instance of platforms specifically, the role that guided emergence can play in such evaluations.

A fourth important consideration for future research is to build on the iterative design process to further develop solution design knowledge on the development of the associated ecosystem. This would require looking specifically at managing incentives for engagement and interaction and evolving governance mechanisms to optimise the evolution of the ecosystem. An important consideration here is the impact of new partnerships with key actors on the emergence and evolution of the DSP. Given there is no monetary incentive available for public platform leaders to leverage, the provision of other incentives through the role of key partners in engaging and directing the future evolution of the platform is critical. The development of such understanding around the role of key partners would also extend and facilitate a more general application of the solution design knowledge.

The explanatory affordance framework also requires further research. The use of the framework to support how a collective intent can lead to collective action might well be somewhat specific to the PHC context. Further research would need to take into account nuances of sector objectives, structure and culture. The Weichold and Thonhauser (2020) conceptualisation of collective affordances has relevance here but its application might result in different outcomes in other public sectors. Future work should involve the application of the framework in other contexts, in order to clarify the relationship (bundling) between individual

and collective affordances and to build on the identification of collective affordances. This is, after all, the process of guidance or sensing opportunities that will evolve and grow the value proposition of the platform.

8.6. Chapter Summary

This research study has provided an empirically-evidenced, configured DSP for collective action at a public, supraorganisational level. It also contributes a richer understanding of ecosystem development and the collective action possibilities and constraints in an open, public supraorganisational sphere. The collective affordance lens utilised provides a rich explanatory framework to highlight the challenges and constraints inherent in the development of an open, public, supraorganisational digital ecosystem. The study contributes to the limited research available on emergent public, supraorganisational DSPs and DSP ecosystems sustained by collective action in that context.

This knowledge can also assist with the design and development of DSPs and their associated ecosystems that are suited to facilitating collective supraorganisational goals in situations where there is a lack of organisational incentives to do so. The knowledge shared here will help actors to understand the required interdependencies (ecosystem development) of emergent DSP use and also to leverage the ability of existing DSPs to improve their collective interaction practices. Having a better understanding of the opportunities and challenges in seeking to establish and develop an emergent platform ecosystem at this level in the public sector could help steer such efforts more productively in the future. Conceptualising affordances at the collective level can help us to understand incentives for engagement and interaction and thus how to promote digital collective interaction at the supraorganisational level. The key role of control and governance in establishing and developing such platform ecosystems in the public space is underlined. In this, the research project achieved a productive balance between theory and practice through extensive use and integration of the academic literature and the PADR DSR collaborative process method. It consolidated theory and practical expertise and industry experience to design, develop and evaluate the instantiation.

The imperative of “collective impact” as the PHC sector is increasingly required to address in terms of significant cross-sector public health challenges, will drive greater coordination and collaboration at a supraorganisational level in the future. Digital platforms and the

opportunities they offer now provide the means and motivation to advance supraorganisational coordination and collaboration at a much faster pace and on a broader level. Future research can consolidate and grow this opportunity and certain immediate research directions are listed earlier in this chapter. This section also included some critical reflections on the research process as experienced by this researcher. DSR has burgeoned within the IS discipline to be arguably now a core competency. The socio-organisational context within which DSR artefacts are implemented has also grown more complex in terms of IT structures and processes and also because the interconnected nature of problems facing society and organisations is becoming more and more apparent. The effect of this is to underscore the role of evaluation within DSR and the importance of integrating the technical and social aspects of evaluation in its naturalistic setting.

The careful coordination of all the research artefacts developed and described here has generated stronger IS design theory for that problem space. The research has met its twin objectives: first, to provide a digital solution for increased coordination and collaboration and second, to increase our understanding of the opportunities and constraints to digital coordination and collaboration in the PHC sector at the supraorganisational level.

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Appendices

Appendix A: Ethics approval

From: Keith Wilkins **on Behalf of** RES Ethics
Sent: Thursday, 2 April 2015 4:21 PM
To: Stuart McLoughlin
Cc: Andrew Joyce; Helana Scheepers; Belinda Crockett; RES Ethics; Astrid Nordmann
Subject: SHR Project 2015/037 Ethics Clearance

To: Dr Stuart McLoughlin for Dr Andrew Joyce, FBL

Dear Stuart

SHR Project 2015/037 Building Information Systems Capacity for Public Health Collaboration

Dr Andrew Joyce, Stuart McLoughlin, Dr Belinda Crockett, Assoc Prof Helana Scheepers -FBL

Approved Duration: 02/04/2015 to 31/01/2016 [Adjusted]

I refer to the revised protocol for the above project as emailed on 26 March 2015 which was put to delegates of a Subcommittee (SHESC1) of Swinburne's Human Research Ethics Committee (SUHREC) and feedback sent to you on 30 March 2015. Your responses to the feedback, as emailed on 1 April 2015 with attachments, were put to the appointed SHESC1 delegate for consideration and positive feedback received.

I am pleased to advise that, as submitted to date, the project may proceed in line with standard ongoing ethics clearance conditions here outlined.

All human research activity undertaken under Swinburne auspices must conform to Swinburne and external regulatory standards, including the current *National Statement on Ethical Conduct in Human Research* and with respect to secure data use, retention and disposal.

The named Swinburne Chief Investigator/Supervisor remains responsible for any personnel appointed to or associated with the project being made aware of ethics clearance conditions, including research and consent procedures or instruments approved. Any change in chief investigator/supervisor requires timely notification and SUHREC endorsement.

The above project has been approved as submitted for ethical review by or on behalf of SUHREC. Amendments to approved procedures or instruments ordinarily require prior ethical appraisal/clearance. SUHREC must be notified immediately or as soon as possible thereafter of (a) any serious or unexpected adverse effects on participants any redress measures; (b) proposed changes in protocols; and (c) unforeseen events which might affect continued ethical acceptability of the project.

At a minimum, an annual report on the progress of the project is required as well as at the conclusion (or abandonment) of the project. Information on project monitoring, self-audits and progress reports can be found at:
http://www.research.swinburne.edu.au/ethics/human/monitoringReportingChanges/

A duly authorised external or internal audit of the project may be undertaken at any time.

Please contact the Research Ethics Office if you have any queries about ongoing ethics clearance. The SHR project number should be quoted in communication. Researchers should retain a copy of this email as part of project recordkeeping.

Best wishes for the project.

Yours sincerely

Keith for

Astrid Nordmann

SHESC1 Secretary

Keith Wilkins

Secretary, SUHREC & Research Ethics Officer

Swinburne Research (H68)

Swinburne University of Technology

P O Box 218

HAWTHORN VIC 3122

Tel +61 3 9214 5218

Fax +61 3 9214 5267

Appendix B: Participatory partner approval

From: Jacky Close <jacky.close@oepcp.org.au>
Sent: Wednesday, 1 April 2015 2:46 pm
To: Andrew Joyce <ajoyce@swin.edu.au>; Sally Missing <Sally.Missing@iepcp.org.au>
Cc: Kelly Naughton <Kelly.Naughton@oepcp.org.au>; Rebecca Morgan <Rebecca.Morgan@iepcp.org.au>; Belinda Crockett <bcrockett@swin.edu.au>; Stuart McLoughlin <smcloughlin@swin.edu.au>
Subject: Ethics approval information

Hi Andrew

The OEHCSA Executive Committee met this morning and I can confirm that they provide their approval for the project, "Building Information Systems Capacity for Public Health Collaboration" to be conducted with our PCP. The project has been fully explained to our organisational members and they are looking forward to how it can benefit the development of the Well and other collaborative efforts currently being undertaken in the eastern.

Please let me know if you need any further information.

Kind regards Jacky

Jacky Close

Executive Officer

Outer East Health & Community Support Alliance

(Outer East Primary Care Partnership)

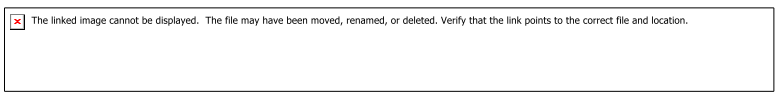
Workdays: Tuesday, Wednesday, Thursday , Friday

Phone: 03 9870 2725

Fax: 03 9870 6164

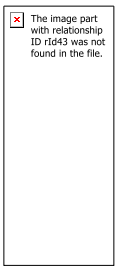
Email: jacky.close@oepcp.org.au

Website: www.oehcsa.org.au



To subscribe to the OEHCSA E-bulletin, please click here

Appendix C: Plain language statement



PLAIN LANGUAGE STATEMENT-PROJECT INFORMATION STATEMENT

Participant information for SALUS

PROJECT TITLE

SALUS – A web-based digital tool that explores our ability to share both explicit and tacit information in complex, multi -organisation collaborative settings.

This plain language statement contains detailed information about the SALUS project. Its purpose is to explain to you as openly and as fully as possible all the ramifications and procedures of the research project so that you can make fully informed decisions as to your participation.

PRINCIPAL INVESTIGATORS

Dr Andrew Joyce, DPsych., is a qualified psychologist with extensive experience in research and publication in the public health field. Andrew is with the Centre for Social Impact, Swinburne University of Technology.

A/Prof. Helana Scheepers (Department of Business Technology and Entrepreneurship, Faculty of Business and Law), research interests include the development, management and adoption of information technology by large and small organisations.

Stuart McLoughlin (Department of Business Technology and Entrepreneurship, Faculty of Business and Law), is a current PhD candidate in the department. The work being conducted on this project is related to his PhD which focuses on the advance of interorganisational knowledge management utilising technology in the community sector.

PROJECT DESCRIPTION

Why are we doing this study?

The overall aim of this study is about understanding how technology can assist us in facilitating information and collaboration between organisations and between groups and individuals across organisations in the public health sector. Public health organisations are being increasingly confronted with complex public health problems. These problems require a response that draws upon the coordinated input of multiple actors across the public, private and community sectors of public health. Any such coordinated response will require the sharing of information and knowledge. However, knowing who to share and collaborate with, what knowledge is required to be shared, when such knowledge and information sharing, and collaboration will be advantageous and how to realise the intention to collaborate and share knowledge are all challenges collaboration–seeking organisations, groups and individuals must grapple with.

While we recognise that such constraints and challenges are not purely technology-based, part of the solution surely lies in new technology platforms and tools (Web 2.0) that facilitate collaboration and knowledge-sharing across organisations. Our research tells us this is not simply a case of codifying explicit knowledge and making it available to others. Our research implies that what is most required is a person-centred system where tacit knowledge (practical knowledge, intuition and experience) is shared and self-organised based on trust.

But, surprisingly little is known about how people share information and knowledge in the public health sector, who they are, what they do and how they do it. Equally there is a dearth of knowledge

about how collaborative Web 2.0 digital tools can be used to this effect in an interorganisational community context.

Therefore, we have developed such a collaborative digital tool that we hope can not only facilitate better collaboration and information sharing in this sector, but more importantly, provide us with a contextual understanding of the potential impact these new technologies will have on information sharing processes in the public health/community sector. We hope that this will provide guidance for the implementation and future development of knowledge-sharing and collaborative Web 2.0 technologies.

Some of the questions that require answers are as follows:

- How do practising public health workers conceptualise collaboration and understand their role in sharing information and knowledge for the purposes of collective impact?
- How do contemporary organisational and cross-organisational networks affect interorganisational information sharing and collaboration, and how do these networks serve to build links between individual public health organisations and workers with similar interests in public health issues (address the complex problems of the sector)?
- How do public health workers make use of communications technology in the information sharing process, what is their impression of current technology on collaboration and information sharing and how do they view future developments impacting on collaboration?
- How will public health workers perceive SALUS to help frame both the intention to collaborate and actual collaboration?

How are we going to go about this study?

As stated, we have already developed the prototype of a proposed digital tool that will help us to understand the requirements and complexities of sharing information in this sector. This tool is now ready for trailing in a pilot project. In this second stage we are now conducting, our primary concerns relate to user perceptions of the usability and value of the tool and the potential for interorganisational collaboration. In order for the digital tool to impact on cross-organisational collaboration, a certain critical mass must be achieved.

To create a person-centred digital collaborative tool, the collaborative principles of social media were studied and adapted for use in SALUS. Participants involved in the second phase of research will be asked to develop a profile on SALUS. The time required to establish a profile is less than that of LinkedIn as the profile required is not so comprehensive. Participants will be automatically asked to ensure their profile is up to date every 6 months.

Participants will also be asked to report back on their experience (in the form of a 45-min. interview at a time and place of your choosing) of SALUS. One of the design objectives of SALUS was to minimise the work required to enter and manage one's participation, in other words, to ensure the time and work required to use SALUS was both minimised and far-outweighed by the benefits of participation. Our approach to the design and development of this tool has been participatory, asking practitioners to comment and advise from the beginning. This continues with the pilot project. Not only will this process ensure a greater understanding of the needs and constraints of interorganisational information sharing but any outcome in the form of a collaborative tool will be of greater value.

Participation in this project is entirely voluntary. Participants can withdraw from the project without comment at any time. If a participant withdraws, on request any identifiable information already obtained from the participant will be destroyed.

Of course, participants are free to refuse to answer any question asked.

EXPECTED BENEFITS

Expected benefits can be perceived across individual, organisational and inter-organisation levels.

Expected benefits can be seen in terms of the following:

- Access to information about individuals, networks and projects in any geographical area in any public health issue of interest.
- Assistance with public health issue mapping exercises.
- Contact with, and access to other's practical knowledge about who is doing what, where and with what strength in a public health issue area.
- An overview of activities and projects being conducted around any particular public health issue.
- Developing and enhancing networks around public health issues.
- Facilitating collaborative responses that reduce wasted effort and increase efficiencies.
-

RISKS

No risks greater than the risks of everyday life to participants, researchers, or other organisations have been identified.

PRIVACY AND CONFIDENTIALITY

All participant comments and responses will be treated confidentially. Participants will not be identified by name in any of the research documentation. Based on consent any interviews will be audio-recorded for note taking purposes. All recordings will be destroyed at the conclusion of the project. Only members of the research team will have access to the recordings. Participants can still participate in an interview that is not recorded if that is your wish.

OUTCOMES ARISING FROM THIS RESEARCH

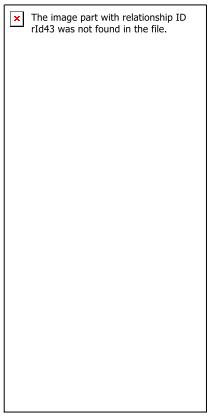
The results of this research may be used for development of reports, conference presentations and Journal publications.

No names of individuals will appear in any research publication.

The study has been approved by the Human Research Ethics committee of Swinburne University of Technology (HREC No. 2015/037)

If, at any stage, participants have any concerns about the conduct of this research they can contact the Research Ethics Officer, Swinburne Research (H68), Swinburne University of Technology, P O Box 218, HAWTHORN VIC 3122. Tel (03) 9214 5218 or +61 3 9214 5218 or resethics@swin.edu.

Appendix D: SALUS: Expression of interest



Expression of Interest

PROJECT TITLE: SALUS-A web-based digital tool for sharing information in public health sector

Investigators

Dr Andrew Joyce, A/Prof Helana Scheepers, Stuart McLoughlin and Dr Emma Bruce

Project overview

The overall aim of this study is to be understanding how technology can assist in facilitating information and collaboration between organisations and between groups and individuals across organisations in the public health sector. Public health organisations are being increasingly confronted with complex public health problems. These problems require a response that draws upon the coordinated input of multiple actors across the public, private and community sectors of public health. Any such coordinated response will require the sharing of information and knowledge. However, knowing who to share and collaborate with, what knowledge is required to be shared, when such knowledge and information sharing, and collaboration will be advantageous and how to realise the intention to collaborate and share knowledge are all challenges collaboration–seeking organisations, groups and individuals must grapple with.

Your participation

A participant in this project will have access to the information that is stored into SALUS. Expected benefits in participation are:

- Access to information in SALUS about individuals, networks and projects in any geographical area in any public health issue of interest.
- Contact with, and access to other's practical knowledge about who is doing what, where and with what strength in a public health issue area.
- Developing and enhancing networks around public health issues.

As a participant, you will be asked to:

i. Create a profile in SALUS.
ii. Update your profile on a 6-monthly basis
iii. Provide us feedback on SALUS in the form of a questionnaire and 30/45-minute interview.

I understand that:

(a) My participation is voluntary and that I am free to withdraw from the project at any time without explanation;

By signing this document I express my willingness to participate in this project. A consent form will be sent to you to confirm that you are still willing to take part. In addition, a link to SALUS will be sent to you.

Name of Participant: ……

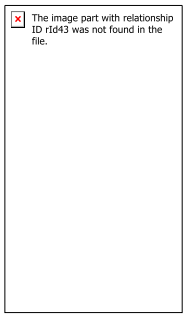
Contact details: email address:…….

Mobile phone number (optional): …….

Signature & Date: ……

If you have any questions regarding the project, please contact the investigator: A/Prof. Helana Scheepers, Faculty of Business and Law, Swinburne University of Technology, on (03) 92145422 or at hscheepers@swin.edu.au. Or Stuart McLoughlin Faculty of Business and Law, Swinburne University of Technology at smcloughlin@swin.edu.au.

Appendix E: Informed consent document



Consent Form.

PROJECT TITLE: SALUS

PRINCIPAL INVESTIGATORS

Dr Andrew Joyce, (Department of Business Technology and Entrepreneurship, Faculty of Business and Law)

Stuart McLoughlin (Department of Business Technology and Entrepreneurship, Faculty of Business and Law)

SWINBURNE ETHICS APPROVAL NUMBER: SHR Project 2015/037 Building Information Systems Capacity for Public Health Collaboration

CONDITIONS TO CONSENT:

1. I consent to participate in the project named above. I have been provided a copy of the project information statement to which this consent form relates and any questions I have asked to have been answered to my satisfaction.

2. ***In relation to this project, please circle your response to the following:***

I agree to participate in an interview **Yes No**

I agree to allow the discussions to be recorded by electronic device **Yes No**

3. I acknowledge that:

(a) My participation is voluntary and that I am free to withdraw from the project at any time without explanation;
(b) The study is for the purpose of research and not-for-profit;
(c) Any identifiable information about me which is gathered in the course of and as the result of my participating in this project will be (i) collected and retained for the purpose of this project and (ii) accessed and analysed by the researcher(s) for the purpose of conducting this project;
(d) I will not be identified in publications or otherwise without my express written consent.

By signing this document, I agree to participate in this project.

Name of Participant: ……

Signature & Date: ……

Appendix F: Focus group protocol

Building Information Systems Capacity for PHC Collaboration

Theme 1: Mapping the landscape

In order to adapt the framework, i.e. the information needed, and to develop an IT tool that promotes cooperation we need to develop a greater understanding of the healthcare landscape you operate in, which is a really complex mix of public/private, and profit/not-for-profit organizations operating within a dynamic policy environment. So the first question asks if you could describe your role and your organisations role within that primary care system.

PROCESS	TIME	QUESTIONS
Opening	5m	Introductions, small talk.
Formal Introduction	5m	Permissions/ethics/ confidentiality/purpose of the interview
Warm-up questions about Agency history/role in primary health care	15m	**Structuring question:** Can you tell us something about your agency/department and the role it plays in primary health care in the region? (Targeted towards organisations function and role in primary care system) **Follow-up:** Projects involved in? Are you involved in any coordinated projects with other organisations? What is the nature of the cooperation? How do you communicate with these organisations? How do you communicate between agencies at this time? What do you communicate about and for what purpose? What information is shared? Is there any structured form of information sharing between agencies?, between agencies and department?
		Reaction Interview notes

Theme 2: Current challenges.
Fragmentation of health care services is seen as the primary cause of the ineffectiveness of the health care system in Australia. Integration of services, especially Primary Care, is seen as an effective way to improve the delivery of services and patients outcomes. Partnerships and collaboration are seen as core tools in the effort to integrate health care delivery. It is important for us to get an impression of how you are constrained (if at all), the challenges you face in terms of delivering on your objectives by limited coordination, cooperation, the current landscape you work in.

Theme 3: Expectations

PROCESS	TIME	QUESTIONS
Theme 2	**15m**	**Current challenges**
		Structuring question: What are the current challenges you face with reference to coordination and collaboration in your work? **Follow-up:** How is the current situation structured in terms of partnerships and collaboration? What are the major constraints to greater planning coordination and collaboration? What do you think is currently putting a brake on greater collaboration? How can the system be improved What benefits do/would you see/you think would accrue from greater coordination in planning? In your experience what are the positives about the existing health care structure in terms of promoting collaboration? What works?
		Reaction Interview Notes:

Information technologies can facilitate collaboration and coordination. Partnerships and collaboration are seen as core tools in the effort to integrate health care delivery. Information technologies are a key factor in influencing the success of service coordination outcomes. The adoption of technologies that

improve information collection and sharing are seen to support an enhanced evidence base for primary care as well as promoting a more effective relationship with other care services.

PROCESS	TIME	QUESTIONS
Theme 3	**15m**	**Current challenges**
		Structuring question: What is your interest in the classification system being proposed? **Follow-up:** How do you see it contributing to your planning processes? How do you think it will benefit collaboration in healthcare in the region? How do you think it might influence current programs and practice? What are the possible barriers or challenges can you think of, currently and in the immediate future, that would hinder or impede the implementation of this classification system/sharing of information? What data do you think should be included from your perspective?
		Reaction Interview Notes:

Appendix G: Semistructured evaluation interview protocol

Realising the value proposition of SALUS

In order to confirm the value proposition of SALUS (or not) for the purposes of formally consolidating the project outcomes, we need to gain a greater understanding how you engaged with SALUS, and whether or not you were able to realise any value you might have seen in terms of the benefits we originally conceptualised in the value propositions. You will recall there were 5 value propositions and we will go through each individually.

PROCESS	TIME	QUESTIONS
Opening	5m	Introductions, small talk.
Formal Introduction and warm-up questions about experience with the SALUS tool etc.	5m	Permissions/ethics/ confidentiality/purpose of the interview Can you tell us something about your agency/department and your role in primary health care in the region? (Targeted towards individual/organisations function and role in primary care system)
	10m	Value (Design) proposition 1: More efficient access to, and therefore better utilisation of planning and program information will enable the PHC sector to better manage information dissemination and utilisation, generate heightened visibility and interaction. **Structuring question 1:** From your experience of SALUS, did you feel you would be able to use SALUS to gain a broader appreciation of actors, networks, organisations and interventions in PHC? **Follow-up:** Can you give an example? How did you use SALUS to this effect? What was the result? If not, can give reasons as to why you were not able to ?
	10m	Value (Design) Proposition 2: The provision of a digitally searchable information structure across PHC activities and actors would enable PHC actors greater ease of access to resources relevant to their service delivery needs promoting more efficient access to resources and thereby increasing the potential for service value co-creation. **Structuring question 2:** From your experience of SALUS, did you feel the tool allowed you to search efficiently and effectively and access the resources you wanted to? **Follow-up:** Can you give an example? How did you use SALUS to this effect? What was the result? If not, can give reasons as to why you were not able to ?

	10m	Value (Design) Proposition 3: Systemising and categorising available resources according to a common framework and language of PHC resources will promote ease of interaction and resource integration thereby improving connectivity, information sharing and coordination. **Structuring question 3:** From your experience of SALUS, did you feel that the PHC classification used, effectively presented data in a manner you could easily absorb and apply? **Follow-up:** Did you feel you could effectively enter your data into the classification? Can you give an example? How did you use SALUS to this effect? What was the result? If not, can give reasons as to why you were not able to ?
	10m	Value (Design) Proposition 4: Developing a database based on actor profiles that lists and connects actors, their networks and will serve to trigger trust in the information, helping to generate interaction and facilitating the processes of coordination and collaboration thereby improving the efficiency and coordination service value co-creation. **Structuring question 4:** From your experience of SALUS, did you feel you could trust the data presented? **Follow-up:** Would you feel confident in using and/or following up on the data presented? Can you give an example? If not, can give reasons as to why you were not able to ?

	10m	Value (Design) proposition 5: Practising practitioner involvement and contribution to the design and development of the technology will facilitate greater trust and acceptance, thereby promoting greater engagement and improving connectivity, information sharing and coordination, which are sector priorities. **Structuring question 5:** In being an integral part of the design and testing of SALUS, do you have confidence SALUS will achieve its objectives and generate collective value for the sector? **Follow-up:** Why? If not, can give reasons as to why you think it will not?