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Processes of hybrid knowledge creation in pastoralist development

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Statement

I hereby declare that this thesis has not been and will not be,

submitted in whole or in part to another University for the award of

any other degree.

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Abstract

This thesis addresses an under-researched disjunction surrounding knowledge creation between, and within, development and pastoralist groups. Many academics increasingly recognise pastoralist populations as creative and adaptable, yet these populations often lack the resources to develop innovations beyond the local context. Despite often being better resourced than pastoralist communities, development interventions in the Horn of Africa have achieved limited successes; an observation often linked in academic literature with a failure to rethink inappropriate established practices drawn from settled agriculture.

The need to explore new ways of understanding hybrid knowledge creation in pastoralist settings emerged from the international community's limited understanding of informal innovation processes and unique contexts of pastoralist regions, due in part to the unsuitability of current frameworks and research tools for conceptualising informal innovation in marginal settings. This study makes an original research contribution by exploring the factors that shape processes of knowledge creation between development and pastoralist groups to answer the question *what factors influence innovation in pastoralist areas*?

An interconnected, mixed-methods research strategy was developed and applied to study the role of knowledge networks and framings in processes of knowledge creation amongst pastoralist and development actors innovating in North Horr, Kenya. The empirical data gathered throughout the research informed the development of an internally-valid analytical framework with which to explore innovation in this setting.

The key findings of this study highlight the importance of the contextual and often asymmetric nature of relationships in processes of emergent knowledge creation within pastoralist development. The observations collected throughout the research process provide an empirical basis from which to discuss networks, framings, and knowledge creation in pastoralist settings; contributing to wider debates surrounding informal innovation processes and narratives of pastoralist development.

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Glossary

Network terminology

1-mode	A network that contains *nodes* of the same class, e.g. people
2-mode	A network that contains mixed classes of *nodes*, e.g. people and organisations
Alter	A *node* connected to an *ego*
Betweenness centrality	The number of shortest paths passing through a *node*
Centrality	Measures of position within the network
Degree	The number of connections to a *node*
Directed edge	An *edge* with an origin and end
Dyad	Two connected *nodes*
Diversity	The breadth of knowledge exchanged, ranging from *wide* to *narrow*
Dynamic	The nature of the speed and reciprocity of knowledge exchanged, ranges from *active* to *static*
Edge	A link between *nodes*
Ego	A focal *node*
Modularity class	A measure of strength of cohesion of sub-networks
Node	An actor within a network
Node attribute	A property of a *node*, e.g. age or gender
Plurality	A description of the diversity of knowledge types exchanged
Strength	A property of an *edge*
Sub-network	A collection of *nodes* and *edges* within a larger network

Common Oromo Gabra terminology

Barazza   Large community meeting assembled for a purpose

Chilres   Holder of traditional livestock knowledge

Da'abela   Cultural position of seniority

Daimtu   Lit. 'knowledge', also 'news'

Fora   The deep bush

Harambee   Fundraising for charitable purposes

Dyad Analysis terminology

Dyadic empathy   The similarity of the *ego's meta-perspective* to the alter's *direct perspective*

Dyadic framing   The characteristics of the two *direct perspectives* in the *dyad*

Dyadic harmony   The similarity of *direct perspectives* within the *dyad*

Dyadic plurality   The number of knowledge exchange channels in a *dyad*

Dyadic projection   The similarity of the ego's *direct perspective* and *meta-perspective*

Dyadic strength   The subjective strength of a *dyad's* connection

Dyadic structure   The relationship characteristics of the dyad's *edges*

Framing terminology

Direct perspective   An *ego's framing spectrum*

Factor   A set of beliefs expressed as a *factor* derived from Q-methodology

Framing   A subjective understanding of an issue

Framing spectrum   A weighted collection of *framings*

Meta-perspective   An *alter's framing spectrum* of an *ego*

Global Theme   The macro-level unit in Thematic Analysis

List of abbreviations

AHA	Government-employed Animal Health Assistant		*MALF*	Ministry of Agriculture, Livestock, and Fisheries
APA	APA Insurance		*MUB*	Multi-Urea Block or Molasses-Urea Block
AV	Agroveterinarian		*NH*	North Horr
CAHW	Community Animal Health Worker		*PDS*	Participatory Disease Surveillance
CDR	Community Disease Reporter		*PFS*	Pastoral Field Schools
CMDRR	Community-Managed Disaster Risk Reduction		*PS*	Project Supervisor
CVO	County Veterinary Officer		*SCVO*	Subcounty Veterinary Officer
DCD	Deputy Country Director		*SI*	Solidarités international
DfID	United Kingdom Department for International Development		*SNA*	Social Network Analysis
DVO	District Veterinary Officer		*STS*	Science and Technology Studies
ECHO	European Civil Protection and Humanitarian Aid Operations		*TI*	Transparency International
FSC	Food Security Coordinator		*USAID*	United States Agency for International Development
GoK	Government of Kenya		*VSF-G*	Vétérinaires Sans Frontières Germany
IBLI	Index-Based Livestock Insurance		*WA*	WhatsApp
IBLIT	Index-Based Livestock Insurance Takaful		*WA AGF*	WhatsApp All-Gabra Forum
ILRI	International Livestock Research Institute		*WA GPA*	WhatsApp Gabra Professional Association
KALRO	Kenya Agriculture and Livestock Research Organisation		*WA GYA*	WhatsApp Gabra Youth Association
KEFRI	Kenya Forestry Research Institute		*WA NHW*	WhatsApp North Horr Ward Group

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Chapter 1:

Overview

Picture 1: Same soil, different shoes

Local project beneficiaries construct a roadway under the watchful eyes of NGO staff. The relationship between indigenous communities and external actors can often involve contestation and conflict.

1.1 Introduction

"In the first age of the Gabra our clothes were from the animals, our food was

from the animals. Then came the Colonial times; we would take animals and

swap them for clothes, for food. Our fathers would trade animals for things they

had not had before. This was the second age. We are now in the third age of the

Gabra, and it is called many things - the age of the Black Government, the age of

carti (ID cards). But the Algaanna know the true name of the third age of the

Gabra.

What is this name?

It is 'the age of the NGO'"

Da'abela Yarra, speaking to the researcher as Abba Dibbe ('Father of the Drum') of Ya'a Algaanna

"National governments often see pastoralists as a problem, and it is hard not to

be influenced by this discourse, especially when writing reports. If it is national

policy to sedentarize pastoralists, the failure of projects or initiatives to settle

them transmutes into a problem"

Roger Blench, writing for the United Nations Food and Agriculture Organisation (FAO) in 2001[1]

This study uses innovation as a lens to explore hidden narratives of conflict and creativity surrounding pastoralism and development in the Horn of Africa. The pastoralist communities of the East African Arid and Semi-Arid Lands (ASALs) have developed adaptive and creative strategies in response to shifting, multidimensional pressures for over 7,000 years (McPeak et al., 2012). The relatively recent birth of East African nation states and the subsequent introduction of development organisations have brought both new opportunities and threats to pastoralist ways of life (Fratkin and Roth, 2005). This research explores how communities shape and are shaped by emergent innovations at points of contact between indigenous networks and the architecture of industrialised development.

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[1] BLENCH, R. 2001. Pastoralism in the New Millennium. *Animal Health and Production.* Rome, Italy: UNFAO.

1.2 Setting the scene

Pastoral groups are common targets for development interventions due to their perceived environmental, socio-cultural, economic, and ultimately political marginalisation (Galaty and Bonte, 1991, Azarya, 1996, Lesorogol, 1998). Suggested as a core group of the rural poor (Jazairy et al., 1992) pastoralist communities often attract criticisms from external actors of a resistance to development and unwillingness to adapt to NGO programming (Ellis, 1987). External narratives portray pastoralist communities as passive, homogenised masses; a view that that overlooks the range and diversity of attitudes, livelihoods, and adaptability contained within these groups (Barrett et al., 2001). This blind spot on behalf of agencies has led to notable failures in development programming, undermining indigenous coping mechanisms (Lind, 2014, Markakis, 2003, Unruh, 2005) and reshaping traditional socio-cultural systems (Clapham, 1996).

Tensions between the powers of 'modernity' and incumbent traditional structures form the basis of a conflict that compounds the marginalisation of the region. Development and Government groups speak with an implicit irrefutability that can deny local voices a place in shaping possible futures (Scott-Villiers, 2011). The closing-down of indigenous perspectives is a common feature of discussions on pastoralist development; policy dialogues often reject challenges through the addition of "*a kind of gloss on events: typically a position that claims to be exemplary in some way is presented in language chosen mainly to attract and persuade one of this... its hallmark is non-refutability*" (Gasper and Apthorpe, 1996). These are not theoretical concerns; national policy has been shown to inhibit pastoral development (Morton and Meadows, 2000) unrecognised by governments (Morton, 2005), sometimes to the extent of enabling direct state demonization of marginalised populations (Galaty and Bonte, 1991, Fratkin, 1997).

New conceptualisations of pastoralism highlight the contested and evolving nature of pastoralist development, challenging simplified pastoralists-versus-development narratives (Krätli et al., 2016). The exploration of the creativity and complexity of innovation in pastoralist regions requires researchers to set aside common assumptions of homogeneity within pastoralist and development institutions and choose instead to 'keep it complex' (Stirling, 2010). The creative milieus permeating pastoralist areas evolve from the variety of individuals that exit within these systems. The heterogeneity of pastoralist and development groups is well recorded; orthodox broad-brush categorisations may serve to hide internally-marginalised (Anderson and Broch-Due, 1999), self-reinforcing (Tache, 2008), and structurally different (Baxter, 1991) populations. Recognising diversity and complexity as key features of development and pastoralist communities informs how this study positions itself in terms of conceptual foundations and scale of research.

This inherent variety and dynamism within systems of pastoralist development is hypothesised as one possible driver for the creation of new ways of thinking. Sites of contact between established institutions suggest the possibility of micro-level maelstroms of knowledge development potential, driven by creative and resourceful actors. As Galaty and Bonte (1991) suggest, "*pastoral populations have been and remain both subject to larger forces of influence, and agents of their own histories, shapers of their own futures*"; the search for these future-shapers, these creative agents, frames the aims and construction of this study.

1.3 The need for an exploration of pastoralist innovation

1.3.1 A record of misassumptions, misunderstandings, and missed opportunities

Points of contact between different cultures and communities provides potential for both collaboration and conflict. These sites of interaction exist across geographical, political, and conceptual domains; the notion of innovation itself provides a useful illustration of conflict between ideological positions. Multiple disciplines employ the term 'innovation' rooted in different understandings and applications, leading to contestation and debate when venturing from one discipline into another. The open and evolving nature of innovation as a concept allows groups to compete in promoting their understandings of what innovation 'is', and in doing so close down alternative visions that may empower other actors.

The contest to define narratives of innovation in pastoralist development can be seen across the Horn of Africa; where herders innovate to shift trade across border crossings, law enforcement agencies see illegality (Mahmoud, 2013). Pastoralist producers adapt and exploit market changes through mass herd movements, yet governments consider their actions to be undermining state and disease control mechanisms (Aklilu and Catley, 2009).

The recasting of pastoralist creativity as non-innovative is further reflected in the tools available to study of the phenomenon itself. Conventional innovation studies methods often rely on formalised, industrialised conceptualisations of innovation that may struggle to accurately reflect pastoralist contexts. The unsuitability of these tools can be suggested as contributing to the under-exploration of the creative potential of marginalised communities, and the persistence of orthodox development approaches.

1.3.2 The research gap

This study addresses the disjunction between pastoralist creativity and development programming through an exploration of the characters and contexts of innovation occurring in pastoralist development. Framing innovation as an ongoing process of knowledge creation between actors, this study explores ways in which individuals can be capable of shaping process of knowledge co-creation. Using an actor-level lens to create an internally-relevant framework for understanding processes of knowledge creation, this study suggests a novel alternative to existing industrialised innovation studies methodologies for exploring pastoralist innovation.

1.4 The central question

Synthesising these elements this study asks *what factors influence innovation in pastoralist areas?* The framing of innovation as processes of individual level, interlinked knowledge creation allows this research to focus on two key factors; firstly, understanding the importance of knowledge transfer between actors, and secondly, to explore how individual perceptions may shape the knowledge creation processes.

1.5 Three considerations when researching pastoralist innovation

The lack of existing studies and suitable methodological tools provides both a challenge and opportunity to the study of pastoralist innovation. This is specifically true for network and perception-based research in pastoralist studies; existing literature often draws heavily from industrialised and Western-based schools that may struggle to capture the informal complexity of these pastoralist systems. A novel mixed-methods approach is suggested to address these issues, the design of which is informed by three central observations.

1.5.1 Empirical considerations

Whilst innovation remains a current development 'buzz word', little empirical evidence exists that explores the nature and application of innovation in pastoralist settings. This study engages empirically with innovation at a conceptual level, recording evidence of different understandings throughout the study population. These conceptualisations are designed to add to the emerging body of work surrounding innovation in international development by including the voices of alternative development actors in ongoing debates.

1.5.2 Methodological considerations

The study of pastoralist innovation addresses questions of culture and identity, requiring the selection and combination of suitable tools for cross-cultural assessment and analysis of complexity. No single established technique can be suggested as suitable for use in studying pastoralist innovation, suggesting the need to develop a novel methodological approach to guide data collection and analysis.

1.5.3 The theoretical context

The connections and perceptions of actors lay at the heart of this study. The influence of these factors on knowledge sharing requires this research to locate and synthesise theories from a wide range of disciplines drawing on literature from framings, perceptions, network analysis, and relationship studies. The data collected during this research will provide an opportunity to examine the suitability of these theories in pastoralist settings, contributing to debates within and between disciplines.

1.6 The potential value of researching pastoralist innovation processes

1.6.1 Possible new approaches for researching pastoralist innovation

This study suggests that development and academic communities may benefit from a better understanding of the creativity and adaptability of actors involved in pastoralist development. Researching innovative processes in pastoralist settings may require new perspectives and tools. Many of the methodologies for researching pastoralism (Krätli, 2016) and innovation (Klerkx et al., 2012) are rooted in orthodox theories; theories that may struggle to represent the complex and informal nature of innovation occurring outside of mainstream development.

The study of innovations in industrial contexts often makes use of data on observable outputs such as patenting or product development. It can be suggested that these measures may be less relevant for studying innovations in pastoralists societies. Rather than evaluating the outputs of innovation as with conventional innovation studies, this research will focus instead on the exploration of processes of knowledge construction and evolution. This approach hypothesizes that rather than being discrete events, innovations may also occur as interrelated links in a chain of individual-level acts of knowledge creation. This interlinked knowledge creation process focuses on the contexts in which

these links may be forged; contexts that are explored in this research in relation to networks of knowledge flows and actor perspectives and attitudes.

1.6.2 How the research was structured

The chapters of this thesis have been sequenced to guide readers through what is at times a complex research process. Many aspects of the research involve iterative feedback loops; where possible, schematic diagrams have been included to provide figurative representations of the process. The chapter that follows this provides an in-depth review of the empirical and theoretical landscape in which the study is based, setting the history of development in pastoralist areas against the need to look for new conceptualisations of innovation to address persistent failures in development. The chapter develops these themes to propose a knowledge-based lens through which to explore pastoralist innovation, using an approach that combines network and framing theories. The chapter closes by drawing attention to questions of complexity and interrelations between knowledge creation and cultural change.

Having highlighted the limitations of existing conceptualisations and proposing the use of a network and framing techniques, chapter three sets out the research approach. A methodological and analytical schematic is included that highlights interconnections between the network and framing tools used to develop an internally-relevant framework for evaluating acts of knowledge co-creation. The chapter reviews the potential suitability of network methodological and analytical techniques, selecting and describing the tools to be used in identifying case studies and key actors, and tracing knowledge flows. The next section outlines the tools for the empirical framings-based research, suggesting intersubjectivity and frame effects as two bodies of research with which to guide methodological and analytical choices. Lastly, the chapter details the selection of case study relationships, or dyads, and reviews the relevant aspects of theory underpinning the development of an analytical framework.

After establishing the context of the research, and outlining the methodological and analytical choices, chapter four provides detail on the study location. Focusing on locating sites of knowledge encounters and the emergence of new pathways and forms of knowledge sharing, the chapter introduces the key actors and institutions that feature in the data chapters. The following three chapters set out the results and analyses of each of the specific areas of study. Chapter five introduces data relating to knowledge connections, setting out the macro- and case-study networks, and proposing an analytical framework for later dyadic analysis. Chapter six compares data on perspectives and the construction of a series of framings used in later chapters; this data is used to develop analytical categories relating to the framework from chapter five.

Chapter seven locates, introduces, and analyses a series of twelve individual case-study dyads that illustrate the diversity of knowledge creation occurring within the study. Chapter eight comparatively analyses these twelve dyads using the framework from chapter five, and the categories from chapter six. Chapter eight closes with a discussion of processes of hybrid knowledge creation as seen through the analytical framework.

Chapters nine and ten develop the findings from the previous chapters to both answer the central research question and situate the findings in wider academic and policy discussions. Chapter nine focuses on the specific findings as they relate to the literature employed in this study, chapter ten develops these themes further to bring in wider debates and to identify both limitations and opportunities relating to the use of study findings.

Picture 2: Market opportunities

This study aims to capture the adaptability and creativity of pastoralist communities. Here, a tin shack in the centre of North Horr offers telecommunication services, opening new markets and channels of communication between pastoralist communities and the world at large

Chapter 2:

Research foundations

2.1 Introduction

This chapter sets out the empirical and theoretical positions underpinning this study and proposes the need for greater inclusion of pastoralist innovation in development programming. Highlighting the chequered history of external interventions to pastoralist communities in the Horn of Africa the chapter identifies literature on the adaptability and flexibility of dryland communities as a possible foundation for a new alternative to orthodox development approaches.

The chapter develops this theme by reviewing recent advances in understandings of pastoralism, linking these emergent debates with calls to rethink pastoralist research methodologies. Building on these foundations this chapter locates an evolutionary and relational definition of innovation suitable for use in non-industrialised pastoralist contexts. This model of informal, emergent innovation is contrasted with established innovation studies and indigenous knowledge literature in pastoralist settings; a review which supports the suitability of a knowledge-based model of innovation in pastoralist development.

Recognising the centrality of knowledge creation, the following section sets out the epistemological and theoretical perspectives used in this study. This leads to the research question being recast in more analytical terms that focus on knowledge creation through knowledge flows and perspectives, highlighting the interrelated nature of cultures and innovation in these complex situations.

2.2 A harsh and fruitful landscape:

Pastoralist innovation as a development disjunction

The Horn of Africa can be an unforgiving place to call home. From climate change to environmental degradation, overpopulation to local- and geo-political interference, many of the inhabitants of the Horn live under conditions of constant livelihood uncertainty (Catley et al., 2013). The combination of shifting human-led and natural pressures can disrupt traditional coping mechanisms (Lind, 2014, Markakis, 2003, Unruh, 2005) and reshape complex indigenous social and economic systems (Clapham, 1996).

For many years external groups have supported indigenous populations that they consider to be in dire peril with limited records of success. From drought to conflict, alongside successful programming development agencies continue to make mistakes first committed decades before. Unlearnt lessons and wasted resources can be seen in artefacts across the East African region (Anderson and Broch-Due, 1999, Baxter, 1991, Hogg, 1987); the weathered husks of abandoned dip-

tanks and dry boreholes, marked by crumbling donor signs, are reminders of the need for development communities to do better in rethinking business as usual.

2.2.1 Contestation and collaboration

These failures represent one face of the history of pastoralist development. If we shift our gaze from the Horn to centres of power around the world, we uncover explanations and excuses for why these approaches don't work. Narratives from the international community commonly link failures of development with notions of marginal areas as wildlands, arid zones in which destitute populations scrape precarious livings from infertile soil (Scott, 1998). If we contrast conversations had in London, Nairobi, or Addis Ababa with those in the streets and houses of Moyale, Marsabit, or Mandera conflicting perspectives emerge. Where development groups see risk, pastoralists may see opportunity (Barrett et al., 2001, Cashdan, 1990). Where governments see subsistence and destitution, pastoralists may see culture and livelihood (McGahey et al., 2014, Rass, 2006). Long-incumbent development narratives suggest pastoralists resist change (Herskovits, 1926), yet herders shift species (Al-Najim, 1991) and markets (Herren, 1990) to exploit new opportunities.

These narratives illustrate the disjunction at the centre of this study. On one hand are pastoralist populations living in challenging conditions, with capacities for problem-solving but limited resources. On the other, a set of development organisations with significant resources but limited capacity to solve problems. This study aims to explore the potential for creative collaboration between different actors involved in pastoralist development in the Horn. This research proposes to explore the bridging of worlds to understand how co-creation of new knowledges can occur between, and within, pastoralist and development groups. These creative and adaptive processes can take multiple forms, but are embodied in the key concepts of innovation (Bacon et al., 2008, World Bank, 2006).

2.3 Knowledge creation at the margins:

Researching pastoralism and innovation

The section above suggests understanding knowledge co-creation between cultures could contribute to current debates on pastoralist development. Studying collaborative innovation and pastoralist communities poses significant theoretical and methodological challenges to researchers; the following sections outline key considerations for contemporary investigations of pastoralism and innovation that may shape the construction of the research question and approach.

2.3.1 Rethinking pastoralist research

The previous section set out the poor record of success of development communities in pastoralist development. These failures are suggested as both symptom and cause of limited understandings of 21st century pastoralism. Looking beyond pastoralist research, contemporary research has seen a widespread refocusing of conceptual thinking from mechanistic processes towards an appreciation of complexity within systems (Chapman, 2015, Mingers, 2006). This philosophical shift is relevant for pastoralist innovation research as it highlights links between emergent theory and established methodology (see, for example, Fine and Elsbach, 2000, George and Bennett, 2005, Shah and Corley, 2006). Pastoralism is undergoing a studied re-conceptualisation involving the development of new theoretical positions that can introduce disconnects between evolving theoretical perspectives and orthodox methodological tools (Krätli, 2016). Existing pastoralist research methodologies often continue to reflect evaluations of settled agriculture that can blind researchers to pastoralist practices (Pica-Ciamarra et al., 2014), distorting and misrepresenting many aspects of pastoralist systems (Krätli and Swift, 2014).

A response to these disconnects can be to develop new methodologies that better reflect new thinking surrounding pastoralism. Recent work on pastoralist communities has challenged established conceptualisations of pastoralists' engagement with ecology (e.g. Homewood, 2008), resilience (e.g. Berkes et al., 2000), and risk (e.g. Bollig, 2010, Roe et al., 1998). These developments acknowledge the inherently relational nature of pastoralism, more so than of settled agriculture in which farmers may pursue a command and control approach to maintaining production. A new counter position is emerging of pastoralists' use of strategic flexibility and adaptability (African Union, 2013), relational techniques that rely on nuanced links with the wider environmental and political systems (Mortimore and Adams, 1999, Scott, 1998). Understanding the flexibility of these relationships requires the rethinking of common assumptions of pastoralism, and new research techniques with which to capture this potential.

Rethinking pastoralism is not a solely conceptual debate; empirical evidence to support new relational narratives is not hard to find. Once considered isolated from all outside contact, motorbikes and mobile phones enable greater interconnection with the outside world than ever before (Krätli, 2016). Understandings of pastoralism as 'simple' subsistence herding are giving way narratives that reflect complex systems of plural livelihoods and interconnected animal ownership (Baxter, 1991, Khazanov and Schlee, 2012). Traditional definitions of pastoralism based on a 'failure' to pursue settled crop-based agriculture are being overturned; increasingly pastoralist groups are being recognised by what they do, rather than what they do not. Pastoralist livelihoods are slowly

being recast from being subsistence producers to specialists in engaging with environmental variability (Krätli and Swift, 2014). Perhaps most relevant for this study are the ways in which the international community is beginning to understand pastoralist experimentation and learning. Göbel (1997) reports that Andean pastoralists "*test luck*", seeking out opportunities to explore new ideas and practices. Similarly Roe et al. (1998) discusses how dryland pastoralists often reject options to limit variability and instead actively engaging in risk-taking, a far cry from the destitute risk-adverse populations seen in the media.

Bringing these themes together, a new understanding of pastoralism begins to emerge. Rather than an outdated, failing, subsistence existence we begin to see a picture of a dynamic and adaptable pastoralist system. The roots of established research methodologies for understanding both settled agriculture or innovation are by inception linked to theoretical foundations that may be challenged by this new pastoralist narrative. Discussing this topic in specific regard to pastoralism, Krätli (2016) suggests that "*the infrastructure beneath the process of appraisal, i.e. tools such as definitions and indicators, and the methods used to operationalise them, with their assumptions about what is what, and what needs to be measured, will determine how pastoral systems will be represented*" (Krätli, 2016, p.490). It is the aim of this study to develop and adopt a research methodology that represents processes of hybrid knowledge creation as faithfully as possible, a position that acknowledges shifting conceptualisations of both pastoralism and innovation.

2.3.2 Innovation for, or with, pastoralists

The section above identifies the emergence of new ways of thinking about pastoralism, highlighting the importance of selecting methodologies that can capture these new perspectives. These new ways of looking at established topics are forged through ongoing debate and conflict; topics of pastoralism and innovation are contested by both practitioners and academics. Specific debates surrounding the conceptualisations and definitions of innovation relate to the control of resources that accompany 'innovation' in international development. The lack of a clear definition opens space around innovation practice for flexibility and abuse by various actors; incumbent powers often reserve the term for creations they deem as positive or 'worthy' rather than the 'undesirable' adaptations of local groups. Examples of this abound in pastoralist areas; for example, increasing commercialisation in the Kenyan-Ethiopian cross border zones results in pastoralist livelihood flexibility portrayed as adaptive criminality and conflict by government and police (Mahmoud 2009). Similarly, the movement of vast numbers of animals across borders from pastoralist producers to markets can be considered innovative, yet is described as damaging from a state and disease control perspective (Aklilu and Catley, 2009).

These examples illustrate how contested definitions provide opportunities for the use and abuse of power. This study aims to engage with a diverse range of actors involved in pastoralist development, it is therefore imperative to select a robust and non-partisan definition of innovation that acknowledges the presence of competing, subjective conceptualisations. This study addresses this core issue by reviewing key literature and selecting the most suitable definition for use in exploring emergent creativity from within a heterogeneous population, without preferencing one groups' interpretation over another. The first step in this process is to identify and evaluate the most common points of confusion and contestation surrounding innovation.

2.3.2.1 Defining innovation

A common cause of confusion in innovation literature surrounds the terms *invention* and *innovation.* Often employed synonymously, cross-disciplinary literature suggests *invention* refers to the production or design of an artefact that has not existed before, whereas an *innovation* can be the introduction and adoption of new ideas, objects, or practices. The innovation scholar Everett Rogers develops this notion of innovation as "*an idea, practice or object that is perceived as new by an individual or other unit of adoption*" (Rogers, 2003, p. 11). This definition provides both challenges and opportunities for innovation researchers which are discussed below.

The principal challenges to the use of a broad definition relate to identification and measurement of innovations themselves. More mainstream definitions of innovation most commonly relate to either measurable outputs (such as patent applications or product creation), or to changes in practices. By including ideas in this definition study opens itself to the possibility of innovation as a novel thought or new perspective – aspects that are much harder to capture in research than directly observable phenomena. This study aims to directly engage with this challenge as an integral part of the research process. Part of the focus of this study is the exploration and identification of possible understandings and interpretations of innovation found within a complex system of multiple interacting cultures. This exploratory approach requires a sensitivity to acts of knowledge creation that may be hidden from view – including the formulation and creation of new ideas and attitudes that may drive innovation. Whilst these are difficult to capture and harder still to measure, the value of including internal and subjective products of innovation may help provide vital context to understanding how larger (more measurable) acts of innovation are developed in the form they take. The processes by which this study aims to capture these more internalised types of innovation are considered below and outlined in more detail in chapter 3.

The challenges of identification and measurement resulting from the use of Rogers' broad definition relate to two further potential opportunities for the analysis of innovation specifically in pastoralist

settings. The conditions for innovation are primarily the *perception* of newness; by removing the requirement for innovation to be 'new to the world' the scales may be rebalanced away from high technology discoveries, allowing marginal communities to innovate in self-defined terms rather than supporting or rejecting orthodox definitions (see later section on hybrid knowledges). Secondly, innovation is located within the adopter (or creator) who may be an individual *or other unit*; this enables the application of an innovation lens to the development of ideas and practices within cultures and organisations along with individuals.

Rogers' definition is by no means exhaustive; the focus on an innovator may fail to capture the relational aspects of pastoralism discussed in the section above. Scholars such as Lundvall (2010) and Edquist (1997) provide a complementary conceptualisation of innovation as overlapping, emergent pathways present within individuals and systems. These systemic perspectives stress the involvement of multiple actors in *innovation processes*, rooted in learning and adaptation (Lundvall, 2016). This view locates knowledge, and specifically knowledge transfer and creation at the centre of innovation.

The portrayal of innovation as interlinked acts of knowledge creation helps this study to explore the flexibility and diversity within pastoralist development. This model suggests innovation be seen as the novel combination of existing knowledges to form new hybrid forms (Fleming, 2001, Nelson and Winter, 1982), recognising knowledge creation processes do not occur in isolation. Novel combinations of knowledge often form interrelated chains of innovations and innovators (Metcalfe, 2000). These chains act as self-promoting cores around which a "*larger number of further cumulative improvements and complimentary innovations*" may be built (Rosenberg, 1982, p.59). This model of innovation as a chain of events highlights the plurality of interrelated innovative outcomes through emergent and dynamic processes; an approach that is potentially suited to researching innovation occurring in marginal settings (see, for example, Hall et al., 2014, Robinson et al., 2013).

This view of innovation as non-linear processes articulates well with the previous discussion of Rogers' definition. Where innovation is defined as practice change or product development, there exist the potential to overlook aspects of the multiple steps leading to, and impacts from, these measurable outputs have. Instead by including 'ideas' in any potential definition, any study can in increase the chance of capturing the influences of other more silent actors who form stages in innovation processes. These actors may not observably alter their own practices, or create new products, but may have a role in shaping the way knowledge is reworked within chains of innovation.

2.3.3 The central research question

As described above few empirical, theoretical, and methodological studies exist that specifically explore questions of innovation in pastoralist settings. To address this gap this study proposes to examine the activities of individuals and organisations involved in pastoralist development through a knowledge-based innovation lens. The identification of suitable theories and methodologies, and the use of these to explore the landscape of pastoralist innovation, constitutes a novel contribution to the fields of international development and innovation studies by asking the question:

What factors influence innovation in pastoralist areas?

2.4 Pathways to the present day:

Engagement with innovation in pastoralist development

The section above proposes the value of understanding innovation processes in pastoralist innovation, highlighting the need to carefully consider conceptualisations and tools used for studying these phenomena. To guide new research on innovation in pastoralist areas this section examines the history of pastoralist development, followed by a review of the contexts and current frameworks of pastoralist and innovation development policies.

2.4.1 The evolution of pastoralist development

The birth of nascent East African nations saw the imposition of national boundaries on a landscape of fluctuating inter-ethnic domains. Processes of formal demarcation restricted indigenous travel, trade, and exchanges that limited communities' movements in the emerging border regions (Abbink, 1997, Lewis, 1983, Schlee, 2003). The marginalisation of newly-peripheral communities by nation-makers was supported by narratives of progress that described a need to tame the wild borderlands (Herbst, 2014, Young, 1994). Aspirational East-African states often saw their unordered edges as simultaneously threats – origins of famine and poverty, and as threatening – rebellious service-demanders that contributed little to the nation (Catley et al., 2013). All the tools of statecraft – economic, bureaucratic, and military – were deployed by governments to impose 'order' upon these unruly, marginal areas (Hagmann and Péclard, 2010) in an act that reaffirmed the 'outsider status' of remote populations (Scott, 1998).

In dryland regions, pastoralist communities were a common target for these framings by remote governments. Administrative centres often used narrative power to undermine pastoralists' political legitimacy in national and international dialogues; the East Africa researcher Peter Little suggests

that "*perhaps no other livelihood system has suffered more from biased language and narratives than pastoralism*" (Little, 2013 p. 244). Little details a wide range of misrepresentations directed at pastoralist groups from portraying pastoralist ways of life as a violent, illegal, and inefficient systems that trap participants in a state of poverty, to an aid-dependent, environment-degrading livelihood that exists in 'vacant' wastelands. Many of these narratives are still deployed to further political and personal agendas through 'benign' interventions such as the prioritising of agrarian areas for development investment since colonial times (Sandford, 1983, Baxter, 1991). The centrality of settled agriculture as a development trajectory in the Horn of Africa continues to undermine pastoralist livelihoods to this day; interventions designed for farmed agriculture are, at best, of little use to transhumant pastoralist herders. At worst these approaches can be damaging to pastoralist economies, societies, and cultures. The failure of some development organisations to understand the variation in livelihood strategies has contributed to the continued repetition of mistakes from the 1970s (Sandford, 1983).

Development failures in pastoralist programming are by no means universal. When development actors have taken account of local circumstances, and where pastoralists are involved, projects can make significant differences to indigenous populations. From community-led animal health interventions (Admassu, 2002) to rinderpest eradication (Catley and Leyland, 2001), community participation in the development process can markedly increase the chances of project success. The process of participation is often not straightforward; many authors have highlighted key differences between meaningful participation and meaningless 'involvement' (Arnstein, 1969, Pretty et al., 1995, Robinson, 2002, Stewart and Sinclair, 2007). Participatory approaches may overlook normative aspects of power (e.g. Cleaver, 1999, Mansuri and Rao, 2004, Mohan and Stokke, 2000), and ostensibly 'depoliticized' processes can damage communities through reinforcement of the vested interests of local elites (Cooke and Kothari, 2001, Corbridge and Kumar, 2002, Mosse, 2001). What these studies suggest for this research is the importance of effective and affective relationships for including a wide range of actors in the development of new ideas and practices, a central feature of the relational knowledge-creation model of innovation proposed above.

From the resistance to externally-defined development trajectories to the contested ground of participatory techniques, challenges to the 'business as usual' of pastoralist development continue to emerge. An evolving body of literature calls for a radical rethinking of development orthodoxy and advocates challenging existing pastoralist development practice (Catley et al., 2013, Krätli and Schareika, 2010). This challenge does not advocate a search for new techniques or technologies but looks instead for new ways to conceptualise the capacities and potential of pastoralist communities. These alternative development pathways aim to address head-on the received practices of

development agencies, specifically the pernicious assumptions enabling elite priorities. Catley et al. (2013) proposed the term 'development at the margins' to describe this new way of thinking, a position that explicitly recognises the creative and adaptable processes that are able to cross social and ecological boarders.

The suggestion that marginal communities can hold key lessons for development groups opens the possibility of multiple pathways for building relationships between development groups and communities for shaping their own futures (Tsing, 1993). Rather than engaging pastoralist groups in orthodox development processes, development at the margins suggests the relocation of power and agency into the pastoralist communities themselves. By placing these marginal areas at the centre of development dialogues researchers, practitioners, and community members can begin to recast debates surrounding the capacities and abilities of pastoralist communities.

Picture 3: A silent market

Many development interventions stand idle after initial flurry of activity. Here, the USAID-Food for the Hungry (FH) sponsored livestock market stands unused alongside the traditional livestock migration routes between Northern Kenya and Ethiopia.

2.4.2 Innovation for pastoralist development

The previous section supported a reconsideration of pastoralist development by placing these communities at the centre of the research. This does leave a question of what development 'is'

under these new conditions; rather than being something that international and national actors 'do' to local populations, it is necessary to challenge and explain what development could mean in this new model. It is important to expose how the norms of development can, and have, influenced the use of innovation as a development tool.

Development is, and continues to be a 'big business' (Hobart, 2002); a situation perpetuated by the belief that current local techniques are somehow inadequate (Goulet, 1980, Shepard, 2005). The development sector's attempts to improve upon pastoralists' assumed deficiencies mirrors much of the macro-economic development thinking that assumes countries pass through similar development stages *en route* to 'developed-ness' (Gerschenkron, 1962, Rostow, 1962). This progression is commonly conceived as driven by technological adoption rates (Kaldor, 1957) leading to the establishment an idea of a technological 'gap' between developing and developed states. The identification of this gap led to a surge in interventionist policies (Cornwall, 1977, Gomulka, 1971, Maddison, 1982) that focused on developing states 'catching up' developed countries through technological investment (Fagerberg, 1987).

The 'gap' model cemented the role of technology and innovation in development as a "*cumulative unidirectional process*" that permeated interventions of this era (Perez and Soete, 1988 p. 476). A global analogy arose of a technological train progressing ever forwards along a single track, supported by investment in science and technology. The promotion of a technological pathway to national development led to many notable publications, such as the Sussex Manifesto, that highlighted the role of government in setting the speed, direction, and nature of the change (Singer et al., 1970). Under this banner governmental support of research and development (R&D) and scientific publications was seen as the route to 'better innovations', economic growth, and eventual development (Erika and Watu, 2010). Through application of these ideas, governments and development agents realised that many of the world's poorest had limited access to these wondrous new technologies (Roling, 2008) who responded by the provision of 'appropriate technologies', that led to the emergence of the 'technology transfer' narratives that dominate pastoralist development to this day (Garnett et al., 2009, Todd, 1995).

Technology transfer approaches promised increases in development investment efficiency and effectiveness through planned research activities (Cleaver, 1999). Formal R&D structures were linked with farmers, herders, and agriculturalists in a linear fashion – a 'pipeline' model that often overlooked the local context in which new knowledge was designed to operate (Biggs, 2007). This oversight often led to technological solutions falling short of users' needs, particularly under high-risk conditions with variable production and limited market access such as pastoralist regions

(Chambers and Jiggins, 1987). Despite these shortcomings, technology transfer remains part of the wider Agricultural Research and Development (ARD) sector in marginal areas, most commonly found within macro-level frameworks such as the National Agricultural Research Systems (NARS) (Assefa et al., 2009).

The mechanistic 'pipeline' nature of ARD and NARS are typical of wider conceptualisations of innovation that focus on technical solutions to complex problems. Attempts to introduce counter-narratives through locally-sensitive ARD have led to the development of frameworks such as the Actor Innovation System Model (AISM) (Biggs, 2007) which suggest a mechanistic nature for local innovation processes. This model of innovation mirrors macro-level thinking that emerged in the decades after the Sussex Manifesto, positions that crystallised as the innovation systems (IS) approach (Edquist, 2001). IS was developed in part to understand evolutionary technical change where technological innovation is seen as responsible for driving development (Dosi et al., 1988). Led by the work of Nelson and Winter (1982), Rosenberg (1982), and Freeman (1987) amongst others, IS approaches centres on the flow and utilisation of knowledge mediated through a complex series of actor relationships. Within IS, actor and institutional contexts are key to understanding the shaping of technology and innovation trajectories. IS approaches have been widely adopted in international development despite limited theoretical foundations (Lundvall et al., 2002), due in part to the limited empirical evidence on actor relationships, and a tendency to 'black box' innovation processes (Edquist, 2010).

Policymakers in particular have engaged with IS-approaches to drive the direction and nature of development (Lall and Teubal, 1998, Nelson and Pack, 1999). Agriculture was no different; in 2006 the World Bank commissioned research into using IS approaches to explore the mechanisms of the agricultural sector that led to the formation of the Agricultural Innovation System (AIS). AIS approaches focus on promoting institutional and organisational linkages throughout agricultural production and marketing chains, visualising agriculture as a complex interconnected system (World Bank, 2006). AIS has swiftly became the dominant framework for understanding innovation in pastoralist settings (Chema and Roseboom, 2003, Hall et al., 2003, Hall, 2007, Spielman, 2005, Spielman et al., 2009, Sumberg, 2005). Whilst providing a useful tool for engaging with multi-agency innovation development AIS has been shown to struggle when the focus shifts to poverty alleviation (Dorward et al., 2003). Pastoralist societies in particular may include sub-populations of varied wealth and vulnerability; evidence suggests that the poorest individuals may be displaced by more market-integrated members of the community (Von Braun et al., 1989). The relevance of this for pastoralist communities is clear when considering that these communities contain a diverse range of

market and non-market based livelihood strategies (Smith et al., 2000, Barrett et al., 2001, Butt et al., 2009).

The ability of AIS-type approaches to highlight the importance of interconnections in driving innovation is of great use in moving debates around pastoralist innovation forwards, however this study suggests that the formality of the IS model may limit its usefulness for understanding individual, emergent, and informal knowledge creation in pastoralist settings. An alternative to these macro-systems approaches is to focus on local-level community engagement, examples of which are reviewed next.

2.4.3 Community-level innovation programming

Macro-level systemic approaches to agricultural development were not the only options available to development practitioners, but many of the alternatives continued to overlook or homogenise pastoralist populations in favour of settled agriculture. Locally-focused innovation models for pastoralist areas include the use of Farming Systems Research (FSR) that aims to improve the appropriateness of technological developments through inclusion of producers (Chambers, 1983, Chambers and Ghildyal, 1985, Scoones and Thompson, 1994). These approaches were refined for use in transhumant communities through models such as Pastoralist Field Schools which aim to use local knowledge to guide research processes by defining research questions or performing in-situ trials. Opinions have been divided as to the outcomes; Conroy (2008) highlights the use of FSR to legitimise external technological answers, whereas Collinson (2000) suggests farmers can play a valuable role in the innovation process.

Taken as a whole, these approaches are often considered unsuccessful due to a troika of mistakes: failing to understand the socio-cultural context of the producer, the use of 'expert' agronomists requiring levels of statistical proof and pre-defined research designs, and the homogenisation of pastoralist populations with other agriculturalists (Gardner and Lewis, 1996, Sillitoe et al., 2006). But despite falling short of their promised potential (Karunanayake and Abhayaratna, 2002) their deficits, in combination with macro-level attempts at trade liberalisation and market development have driven a refocusing of interest onto innovation as a tool for agricultural development.

The models and systems discussed above provide an insight into the ways in which the development community has attempted to use innovation in pastoralist areas. Rather than review or refine an alternative model of formalised innovation delivery, this study aims to contribute to new understandings of the role of co-created knowledge as part of the innovation process. The history of industrial-focused innovation approaches in pastoralist areas has yielded limited successes,

prompting the formulation of a research question to look at alternative ways of engaging with local creativity. This research adds to a growing body of literature that call for greater local engagement in innovation processes developed in the following sections through an exploration of the ways in which development groups have engaged with external and indigenous knowledge creation.

2.5 Green shoots, grown in shade:

Innovation and informality

As suggested above, innovation in non-industrialised settings often remains a challenge to mainstream innovation thinking in general (Erika and Watu, 2010). Despite their widespread use this study proposes to explore alternative conceptualisations to IS-based models which may struggle to represent more informal[2] innovations. These informal and emergent innovations may be particularly relevant in pastoralist contexts as they highlight aspects of the political, economic, and geographical marginalisation of rural communities in wider innovation dialogues. This section therefore reviews ways in which the development community has engaged with endogenous pastoralist knowledge to inform the construction of a framework to understand pastoralist knowledge creation.

Traditional knowledges such as those found within pastoralist communities are often portrayed by development and government actors as something historic, sacred, and frozen (Scott, 1998). The alien 'untouchability' of indigenous knowledge has led to a lack of engagement between formal and non-formal knowledges in remote settings that result in a dependence upon non-formal scientific knowledge in local innovation (Bell, 2006). So-called 'informal knowledge' is often associated in wider development literature with a lack of articulation between 'modern', formalised knowledge stocks and indigenous knowledge (IK) networks (Bell, 2007). This disconnect, through accident or design, has historically led many development practitioners to overlook the presence of indigenous knowledge (IK) and capacities within communities (Sillitoe, 1998a). The lack of inclusion of local expertise, experience, and knowledge in development planning has spurred on the creation of IK movements that aim to increase local voice and action in development debates (Antweiler, 1998, Brokensha et al., 1980, Kloppenburg, 1991, Purcell, 1998, Sillitoe, 1998b).

2.5.1 Indigenous knowledge and pastoralist development

After two decades, some authors argue IK approaches have yet to realise their promised potential (Sillitoe, 2016). This is attributed in part to the perceived emergence of IK from the participatory

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[2] The term 'informal' is used here to engage with wider debates in innovation studies literature; it is important to note that as employed here, informal systems can be highly formalised from an endogenous perspective.

movement (Cooke and Kothari, 2001, Mosse, 2005), associated with criticisms of elite capture and manipulation by interested parties. These accusations may hamstring IK practitioners' attempts to use IK to expose and confront the dominance and power of development agencies. The marginalisation of IK has left proponents with two options. Firstly, IK could support 'classical' development approaches by injecting local voices and concerns into business-as-usual debates on market integration and technical interventions. Notable contributions to development debates have been made by IK this way in food security and health programming (Bentley and Baker, 2005, Shepard, 2005), though most progress to date has been methodological rather than practical (Emery, 2000, Grenier, 1998, Sillitoe et al., 2006). Secondly, IK could be employed to challenge development orthodoxy by confronting assumptions and stipulations surrounding programming and beginning to undo the capitalist-development hegemony of development that *"amounts to technical fixes, market integration, and good governance"* (Sillitoe, 2016 p. 130).

Through whichever model researchers or practitioners employ IK, IK itself is an evolutionary process subject to innovation processes of its own. The emergence of these new forms of IK are not disconnected from mainstream science and formal innovation programmes; contacts and influences between IK and more formal knowledge stocks speak directly to notions of hybrid knowledge creation that may prove important for this study. The section below discusses ways in which interactions between IK and formal knowledge stocks have been conceptualised to review their suitability for use in this study.

2.5.2 Engaging with informal innovation

Many of the innovation models above suggest a linear stepwise model. Whilst this provides an attractive heuristic for understanding industrialised innovation, it may struggle to accurately reflect the messy complexity of informal and emergent forms of knowledge found in pastoralist settings. Alternative conceptualisations of innovation exist that engage with these interconnected, adaptive knowledge flows and creation. Movements such as grassroots innovation promote differing visions of innovation practice and technical change based on social inclusion (Illich, 1973). Evolving from the appropriate technology and People's Science-type movements of the 1970s and 80s (Seyfang and Smith, 2007), grassroots innovation movements are characterised by the collaborative shaping of innovation pathways by local communities and external agents (Smith et al., 2014). Rather than the deliberate, planned model of traditional IS, grassroots innovations are suggested as rising out of contestation such as the perceived environmental challenges and social exclusion that can accompany IS-type policies (Abrol, 2005, Gupta et al., 2003).

Whilst providing a framework for understanding local innovation processes, and promoting debate around local voice in development policy, the grassroots movement may not be a suitable lens through which to view pastoralist knowledge creation. The formal collaborative innovations that characterise grassroots projects may fail to capture the informal, illegal, and endogenous aspects of innovations in pastoralist settings. By adopting a formal collaborative view of grassroots innovation to engage in system-level debates on innovation, this study could risk obscuring the granularity and plurality of the individual actors that comprise knowledge hybridisation processes.

2.5.3 Systems and movements for the study of pastoralist innovation

Reviewing the methods of innovation engagement mentioned above, no single method or conceptualisation is uniquely suitable for exploring hybrid knowledge processes in pastoralist contexts. IS approaches provide a useful framework for understanding formal innovation processes but may struggle to reflect the informal emergent knowledge hybridisation processes in marginal settlings. Grassroots innovation models expose non-mainstream innovation dynamics, but may lack engagement with individual-level acts of knowledge creation. IK and indigenous problem solving, recognise the dynamic processes of knowledge evolution but can overlook system-wide contexts (Ingold, 2000).

Despite individual barriers to use in pastoralist innovation research, knowledge remains a central theme to these three methods of engagement. The following section sets out how this study conceptualises knowledge and builds on this epistemological position to suggest the importance of knowledge hybridisation for this research. Having made clear the lens through which knowledge will be viewed, a suitable theory for understanding knowledge creation is identified that provides a framework within which to discuss pastoralist innovation. The section closes by recasting the original research question in terms of knowledge perspectives and flows, providing a more rigorous analytical position from which to explore this complex topic.

2.6 Developing the question:

The natures of knowledge

The section above highlights the importance of knowledge in innovation research. To engage rigorously engage with knowledge creation it is important to establish clear foundations in which theoretical frameworks can located to guide the analysis and discussion of knowledge creation in pastoralist development.

2.6.1 Establishing an epistemological position

The substances and concept of knowledge are complex issues. This study aims to engage with diverse cultures and communities which require a suitably flexible epistemic position; this study selected a 'wide angle' epistemological lens proposed by Peter Meusburger (2015) that recognises the plurality of possible knowledge types within the pastoralist system. Building on discussion of IK from the previous section, Meusburger's categorisations highlight IK as both an epistemic and development studies term in which the *indigenous* nature of IK is key; IK is a *situated knowledge* contained within a specific context.

The bounding of knowledge to a specific context provides a useful tool for exploring hybrid knowledge creation between different groups. The delimitation of knowledge renders IK a simultaneously political and an analytical tool (Nüsser and Baghel, 2016); the political aspect of IK is unsurprising as many authors argue that much knowledge is inherently political (see amongst others Unger, 1976, Foucault, 1972). This is particularly true of IK; assumptions by development groups that *local*, *situated*, or *IK* are only applicable to pre-industrialised communities highlights the political nature of knowledge classifications (Roba and Oba, 2008). Rather than romanticising a traditional knowledge stock, this study starts from the assumption that each cultural group within the study may possess its own situated IK; a position supported by academics who identify active and evolving milieus of local knowledge within 'advanced' societies and academia (Crang, 1998).

Tensions between knowledge types suggest two key points for researching knowledge creation. Firstly, the act of learning and innovation is rooted both in the circumstances and the perceptions of individuals (Grossberg, 2010) that link knowledge creation to specific physical and cultural contexts (Meusburger et al., 2016). In pastoralist contexts these locations may include sites of interaction between knowledge flows from different cultures that from the backdrop for the knowledge creation events explored in this study.

The second feature relates to tensions between 'universal' and situated knowledges. Throughout history groups have sought to establish specific knowledge forms as universal through the formal or informal apparatuses of statehood. These mechanisms act in Latourian terms as 'centres of calculation' (Latour, 1987), declaring and promoting their own epistemic agendas often associated with the negative recasting of opponent's positions. For innovation in pastoralist development narratives in development literature often differentiate modern, technologically progressive innovations of the development community from the outmoded, backward traditions of pastoralist groups. This study aims to uncover community-based counter-narratives to incumbent descriptions

to understand how these attitudes may contribute to the shaping of knowledge hybridisation processes between varied cultures.

2.6.2 Hybrid knowledge

The importance of context and tension suggest sites of interaction as a focus for this research. In marginal settings these sites are represented as points of articulation between individual knowledge networks providing access to a wide range of knowledges from highly technical 'expert' consultancy to silos of indigenous wisdom. Recent research surrounding mixed-knowledge networks highlights the potential importance of the creation of hybrid knowledges from the synthesis of heterogeneous knowledge stocks; examples from marginal settings include the use of NGO vehicles by pastoralists to deliver *miraa* (Tasker, 2012), *jugaad*-type vehicle innovations in India (Birtchnell, 2011, Singh et al., 2012), and *Mingjian chuangxin* and *Shanzhai* counterfeit movements in China (Goxe, 2012).

Despite the attraction of 'hybrid knowledge' as a topic of study, closer examination of relevant literature reveals hybridity to be a '*risky notion*' (Kraidy, 2017, p.vi) that has been used to refer simultaneously to both contradictory and mutually supporting ideas, concepts, and themes (ibid.). Despite these differences, scholars from a range of disciplines have agreed on the relational nature of hybridity; this study therefore chooses to focus on hybridity in relationships from a pragmatic perspective (as opposed to the rhetorical or philosophical angles also found in literature). The use of a pragmatic, relational approach to knowledge hybridity prompts the question 'relationship of what or whom?' Using the examples above as an illustration, hybrid knowledge is used in this research to refer to emergent, cross-cultural knowledge creation, to inform this study of innovation in marginal populations. A cross-cultural lens opens the orthodox local-universal model of knowledge hybridity to include acts of creation in informal situations, to try to capture innovations between and within local groups that draw on external and/or internal knowledge networks. The definition of hybridity used is intended to link overt and covert communities and groups; this study therefore proposes to view knowledge hybridisation as *processes of knowledge creation between individuals from the combination of differing knowledge stocks.*

Having located a suitable definition of knowledge hybridity, it is important to suggest how it may articulate with other concepts used in this research. Hybridity as defined above arises from relational interactions, however this definition does not engage with the conditions, contexts, and influences of those relationships. Rejecting the simplified premise that a relationship alone is sufficient to drive knowledge hybridisation, this study suggests that the nature and circumstances of the bond may facilitate or inhibit acts of knowledge co-creation. Within this study those conditions are gathered together under the banner of relational *a/symmetries*; within relationships there exist

real or perceived inequalities or imbalances that can influence the ways in which knowledge passes and is utilised. There are multiple philosophical foundations and methodological angles from which these asymmetries may be investigated, including the highly relevant theories of Social Capital (of which more later), but many of these schools of thought may struggle to engage with informal social structures. This study therefore proposes instead to follow the work of Richardson et al. (1969) whose work traces the ways in which communication is influenced by imbalances within relationships – '*asymmetries of power*' (Richardson et al., 1969, p.265). Put simply, for this study *hybridity* refers to the act of creation of knowledge across a relationship, *asymmetry* describes one way in which the nature of the relationship may influence the act of creation.

The hybridisation of local and external knowledges is a relatively recent conceptual addition to international development literature. Hybrid knowledge may prove valuable to the study of innovation in marginal populations as it recognises interactions between informal and formal networks; instead of "…*counterpoising what have become termed 'industrial' and 'grassroots' innovation approaches, we are increasingly witnessing the emergence of dynamic, hybrid combinations of both*" (Ely et al., 2013, p. 1064). These hybridisation processes are not limited to the creation of new artefacts, knowledge hybridisation has been studied in political structures, actors, mechanisms, and knowledges (Ely et al., 2013). The hybridisation process is both dynamic and evolutionary; knowledge theories suggested by Scoones and Thompson (1994), Arun Agrawal (1995) and Tim Ingold (2000) identify continuous processes of co-transformation between indigenous and 'Western' knowledges. Increased understanding of these co-created, hybrid knowledges could be significant for this study considering the diversity of actors involved in pastoralist development; collaborations between different actors can increase the value and quality of knowledge generated (Singh and Fleming, 2010) yet explicit recognition of these forms of co-created innovations remain uncommon in pastoralist development.

The importance of context in knowledge creation informed the choice of a wide-angle epistemic lens and the value of hybrid knowledge. Building on these suggestions the following section develops the research foundations of this study by setting out the theoretical framework that will be uses to provide explanatory power and recasts the central research question in light of these features.

2.6.3 Mechanisms of knowledge creation

The previous section described processes of knowledge hybridisation that cross cultural and community divides to shape new forms of knowledge. To move beyond descriptive measures and explain processes of creation this study requires a theoretical basis from which to analyse and interpret observations.

Many scholars root theories of knowledge creation in economic or organisational science literatures that may struggle to represent pastoralists' variable market engagement and complex cultural systems (Spender and Grant, 1996). This study proposes to employ a different body of literature to explore knowledge creation; a paradigm that conceptualises creation as a dynamic process of knowledge synthesis between individuals suggested by Nonaka and Toyama (2002). This approach recognises and centralises the opposing positions that permeate pastoralist and development settings such as tacit and explicit knowledge, self and other, deduction and induction, order and chaos amongst others (Nonaka and Toyama, 2003, p.2). The importance of these dualities for this study is a relational view of knowledge creation that recognises the synthesis of these seemingly opposing positions through processes of iterative dialogic integration rather than compromise. These processes recognise the shaping of the individuals involved, creating 'new individuals' alongside new knowledge. This view holds great promise for research that examines innovation between established cultures by supporting an exploration of innovations and innovators that break from incumbent systems.

This conceptualisation recognises the key role of relationships between actors and contexts of creation. Context here relates to both the physical, institutional, social, cultural, and historical surrounds perceived by individuals; perceptions that can shape individual and collaborative creation (Vygotskiĭ, 1986). Whilst shared contexts may promote creativity, a failure to build links with the perspectives of others risks falling prey to "*ontological ills and fallacies*" (Nonaka and Toyama, 2003, p.3) that may contribute to the creation and persistence of inappropriate narratives like those seen in pastoralist development.

2.6.3.1 Context and contestation

The section above suggests the role of context and collaboration in developing new knowledge, but the influence of contradiction and conflict in the creative process should not be overlooked. Traditional theories of knowledge creation tend to underplay differences in the goals, attitudes, and beliefs of individuals. Add to this conflict between individual and institutional aims, and it is possible to suggest how tensions may close collaborative opportunities. Nonaka and colleagues propose an alternative position in which the synthesis of conflicting and contradictory positions may enable, not inhibit, processes of knowledge creation. This overcoming of difference as a positive force links to the definition of knowledge hybridity proposed in section 2.6.2 by recasting the orthodox dichotomies of hybridity as opportunities for a novel perspective from which to consider the shifting and contested contexts of pastoralist development. Nonaka suggests syntheses occur through a process of socialisation, externalisation, combination, and internalisation of knowledge (SECI); the

relevance of this model for explaining hybrid knowledge creation in pastoralist settings is discussed briefly in the next section.

2.6.3.2 SECI for pastoralist development

The SECI model provides a structured way to visualise processes of knowledge creation in pastoralist settings. *Socialisation* recognises the importance of co-experiencing a context for sharing more complex knowledges and understandings. This can be hypothesised as a useful lens with which to explore zones of interaction between pastoralist and development groups. *Externalisation* is a process of rationalisation and discussion (Lawson, 1998) that this study links to ideas of community evaluation and discussion, and formal and informal learning processes. *Creation* is the subject of this study, involving the overcoming of contradictions and the synthesis of differences inherent in pastoralist development. Lastly in the SECI model is *internalisation*, whereby created knowledge becomes 'owned' by individuals. Internalisation is often suggested as synonymous with praxis; for this study it is most likely to represent empirical events that will form the basis of data collection.

Whilst it may seem appropriate to focus upon *creation*, this study's research question explores the complex conditions of innovation in pastoralist development. By employing Nonaka's conceptualisation this study must engage with all part of the SECI process to explain, not describe, processes of pastoralist innovation.

2.6.4 Recasting the research question

This chapter suggests the exploration of informal innovation through processes of knowledge creation, conceptualised as acts of knowledge hybridisation occurring at sites of interaction between knowledge networks. Nonaka and Toyama (2003) suggest that the context surrounding creation, and the bridging of differences between actors and situations could be central to understanding the resulting trajectories of these processes.

Building on these themes, the initial research question can be recast with a more analytical slant as:

"*How are how are knowledge hybridisation processes shaped in pastoralist development*"?

2.7 From the theoretical to the empirical:

Locating the subjects of study

This recast question focuses on innovation as processes of hybrid knowledge creation occurring between actors who possess unique characteristics and network memberships. This diversity is a challenging topic of study; rather than adopting an existing characterisations and risk inappropriate homogenisations, this study reviews the ways in which actors have been defined to suggest internally-relevant groupings that guide the identification of major protagonists.

2.7.1 Defining development

This thesis opened with a portrayal of complex, interconnected, and often contested relationships between pastoralist communities and development groups. The previous sections of this chapter suggested the term 'pastoralist' is commonly a broad catch-all that contains multiple sub-populations. The heterogeneity of development groups has received less rigorous attention, but assumptions of homogeneity should likewise be challenged as biased narratives based on unrepresentative homogenisations can act to reinforce incumbent power. To provide analytical rigor this study must be explicit about processes of group identification; this section sets out how common conceptualisations of development may influence this research and introduces cultural heterogeneity as a possible solution.

The term 'development' occurs throughout pastoralist literature. A "*contested… complex and ambiguous*" concept (Thomas, 2000), development includes both deliberate and unintentional consequences (Cowen and Shenton, 1998). As a noun, 'development' commonly describes the 'progress' of one actor by another (Straussfogel, 1997), as a verb it may include theoretical, ethical and practical approaches (Simon, 1997). 'Development work' has been defined in terms of intent, such as "*activities of development agencies, especially aimed at reducing poverty and the Millennium Development Goals*" (Thomas, 2000). These intentions should be set against observations of development as "*an immanent* (sic) *and unintentional process… …and an imminent or intentional activity*" (Cowen and Shenton, 1998). The intended and unintended nature of development conflicts with the purposeful agendas promoted of development agencies; defining development by outcome rather than intent can challenge these positions, e.g. Chambers' "*good change*" (Chambers, 2004). Many authors suggest there may be "*no uniform or unique answer*" to 'what is good change' (Kanbur, 2007); add to these emergent, subjective definitions that based on targets (e.g. 'poverty alleviation') or philosophies (e.g. 'postmodern') (Simon, 1997, Sumner and Tribe, 2008) and the need for clarity in defining 'development' becomes clear.

Development is clearly a complexity entity. This study aims to identify and represent the variety and breadth of actors found within the pastoralist development system and requires a definition that reflects this heterogeneity. The previous section described unsubstantiated or inappropriately vague ways in which non-indigenous actors have defined pastoralism (Little et al., 2008) and should be cautious of repeating these mistakes for development groups. At the heart of this study are the ways in which individuals, groups, or communities can act to shape knowledge through shared connections, norms, and practices. Rather than using established categorisations and characterisations and alternative approach could be to gather norms, practices, attitudes, and identities under the concept of a *development* or *pastoralist culture*. The use of culture to relate to development actors commonly escapes rigorous attention in pastoralist development literature; the role of culture in shaping behaviours holds potential for the study of cross-community knowledge creation. The next section sets of how cultures may contribute to shaping knowledge creation.

Picture 4: The uniform of development

Development culture, and a culture of development, can be seen across the drylands of East Africa; the obvious differences in technology and resources are hard to miss from outside of the 4x4.

2.7.2 Culture and knowledge creation

Multiple authors have wrestled with the definition of culture; many of the resulting positions lend themselves to the study of innovation and knowledge creation. The following section sets out the importance of culture in processes of hybrid knowledge creation, linking the meeting of cultures to notions of context discussed previously in this chapter.

The cultural scholar Geertz (1973) promoted the exploration of aberrance, difference, and division for locating cultures which provides a useful starting point for examining innovators who break from established norms. Ideas of non-conformity are useful for this research for exposing incumbent cultural systems, but Geertz's view often overlooks the role of individual action in processes of knowledge creation. Anthropologists such as Goodenough (1970) examine the use and sharing of cultural knowledge by individuals, a view that places the social actor at the centre of analysis. This individualistic approach aids the examination of actor-actor knowledge hybridisations but may limit exploration of the influences of wider cultural membership. Instead of these opposing viewpoints this study chooses to adopt the position of contemporary authors such as Swidler (1986) and Reid et al. (2006) who suggest culture as a 'tool kit' of rituals, stories, and world views employed by individuals to decide upon actions. From a knowledge creation perspective this idea is supports authors who consider innovation to be an intimate act, occurring between individual actors who exist as members of groups and communities (Reid et al., 2006). Reid suggests that cultural membership uniquely influences acts of knowledge creation, hence the importance of understanding the different cultures present in this study. Expanding upon this idea, Briggs (2005) suggests that the interconnection of culture and innovation be viewed as a point of knowledge combination itself, occurring at "*a site for the social production of knowledge and the reworking of human-nature boundaries. It is always within a field of power. It is always in place. It is always embodied. And it is above all else, relational*".

The relational nature of culture and the importance of cultural diversity for knowledge creation form the analytical basis from which this study will explore processes of hybrid knowledge creation in pastoralist development. The following two sections develop these positions further; firstly, section 2.8 set out the use of knowledge networks to explore the relational nature of creation. Secondly, section 2.9 highlights links between culture and perspectives that will be used as lens through which to explore contexts of innovation using theories of framing and intersubjectivity. These sections are synthesised to discuss the ways in which networks, framings, and knowledge creation shape, and are shaped by cultures and contexts.

2.8 Streams and rivers:

Knowledge flows and hybridisation

The previous sections suggested the importance of relationships and perceptions for shaping hybrid knowledge creation; this section sets out how this study will engage with knowledge flows. The construction of new knowledge requires individuals to explore "*a network of possibilities*" (Carlson, 2000, p.155); scholars have recognised for many years that these processes of exploration may influence abilities to create further knowledge (Galunic and Rodan, 1998, Nahapiet and Ghoshal, 1998, Phelps et al., 2012). This position is supported by that showing how an individual's knowledge network may have significant impacts on both individual creativity (Burt, 2004, Perry-Smith, 2006) and the sharing and adoption of new knowledge (Becker, 1970, Bothner, 2003). The following section firstly sets out the theoretical origins of Social Network Analysis, including a review of the use of theories of Social Capital for exploring pastoralist development. Secondly, this section reviews measures of Social Network Analysis (SNA) for exploring Carlson's 'complex webs of possibilities', focusing specifically on the roles of actor position and the nature of relationships in shaping knowledge creation.

2.8.1 Social Networks and Social Capital

The previous section suggested that knowledge links between actors may offer insight into the shaping of hybrid knowledges. These exchanges can be visualised as networks of interconnections that allow or inhibit access to alternative silos of knowledge, mediated through interpersonal relationships. These processes of mediation and the resulting access are complex issues that have been the subject of much research over the last century, often linked to theories of Social Capital (Lin, 1999). This study suggests that Social Capital holds many potential advantages for use in this study, but also faces some significant challenges for exploring knowledge creation in pastoralist contexts. To explore these, the origins and uses of Social Capital are briefly reviewed below.

The notion of Capital at the heart of Social Capital can be traced to (Marx, 1995), developing the concept as a tool to describe the relationship between surplus production and investment that form the Classical Theory of Capital. From the classical theory scholars have derived further refinements, arguably most relevant for this study are theories of Human Capital (Johnson, 1960) surrounding the investment of knowledge and skills, and Cultural Capital (Bourdieu, 1990) describing the dynamics of the perpetuation of cultural values through signs and meanings. These two theories diverge from the Classical Theory most notably by recognising the ability of the labourer to invest and acquire Capitals of their own, moving the debate on from a dichotomised struggle to a series of interrelated

discourses. A third form of this negotiated capital – Social Capital – has been developed based on the work of authors such as Burt (1992), Coleman (1988), Flap (1991), Lin (1982), and Marsden (1987) to explore how resources that are embedded in social networks may be accessed and exchanged at both individual and group levels. The most common premise behind Social Capital, reflected in the work all of the contributing scholars above relates to "*an investment in social relations with expected returns"* (Bourdieu, 1986, Bourdieu, 1990, Burt, 1992, Coleman, 1988, Erickson, 1995, Erickson, 1996, Flap, 1991, Flap, 1995, Lin, 1982, Portes, 1998, Putnam, 1995). That phrase neatly summarises individuals' engagements in networked interactions to facilitate the flow of information, to influence agents, to certify social credentials, and/or reinforce identities that through instrumental and performative mechanisms not recognised by theories of Economic and Human Capital.

This approach has prompted some debate as to the scale at which Social Capital should be conceived. At the individual level, Social Capital engages with questions of investment in social relations and the capture of resources. At the group level Social Capital can engage with issues of the collective nature of group capital, and how these group assets may influence individual outcomes (Bourdieu, 1986, Coleman, 1988, Coleman, 1990). Tensions between the macro- and individual-level of goods recognised in theories of Social Capital underline difficulties in researching individual action versus group trust, norms, and 'collective' actions (Portes, 1998). These issues are further compounded by often assumed links between closure in social networks and the collectives in question (Putnam, 1995); this is especially relevant in cases where one group is suggested as having dominance over another. Even where researchers have considered Social Capital at an individual level there exist tautologies; for example Coleman suggests that Social Capital may be simultaneously the result of social action, and the action itself (Coleman, 1990, p.302).

One response to these criticisms has been to root Social Capital as a concept in the networks and relationships that form the network itself, (re)defining Social Capital as "*resources embedded in a social structure which are accessed and/or mobilised in purposive actions"*. This view links structurally-embedded resources with notions of individual access and deliberate action. These aspects have been developed further to explore how the positions of actors and the nature of network structures can influence the mobilisation of Social Capital, and by the nature of individual relationships that form these structures. Detailing the importance of actor location within a network authors such as Burt (1992) suggest how the proximity of individual nodes to strategic locations could influence the diversity of information; authors including Granovetter (1973, 1983) outline the role of tie strength as a property of knowledge sharing.

An alternative to network location measures can be to focus on the embeddedness of resources within a network. At the heart of this approach is the suggestion that valued resources in most societies are represented by wealth, power, and status (Lin, 1982); Social Capital is therefore given as the amount and variety of these characteristics via direct or indirect ties. These resources can be further disaggregated into network (directly accessed) and contact (agent-mobilised) resources; network resources are far more easily assessed than the more remote contact resources. This difficulty of assessment underlines the challenges for using embedded resources in this study. Notions of wealth, power, and status are rooted in individual subjective assessments, and in cultural norms and values. This study explicitly deals with points of contact between widely differing cultures and emergent communities arising from knowledge creation. This dynamism and heterogeneity is a challenge to the identification and assessment of embedded resources with networks, stemming from the potential existence of widely differing value judgements.

These considerations highlight both the advantages and challenges offered by Social Capital to this study, where the individuals and collectives in question may occupy very different cultural spaces. Both structural social network and Social Capital theories have great potential to provide some explanatory power for the mobilisation of knowledge and resources across networks. They allow insight into how individuals may access unique and diverse knowledge stocks, and how actors may act as gatekeepers and bridging agents for these flows. Whilst attractive as theoretical and methodological tools, the specific circumstances around this study call into question the suitability of these techniques. At the group level it may be unrealistic to assume shared norms and behaviours, and to consider that each community exists in a bounded form. On the contrary; existing literature suggests the potential presence of multiple heterogenous intersecting and overlapping cultures within the study population that would make the community-level application of Social Capital difficult to identify. Similarly, at the individual level, one aspect of interest is the potential for actors to mobilise and create knowledge across cultural boundaries; an aspect of knowledge creation that may promote the dynamic shaping and reshaping of relationships, networks, and resources between individuals that would challenge the use of Social Capital here. For these reasons this study will set aside Social Capital as a central theory, choosing instead to follow a more exploratory approach and subsequent search for emergent explanations. This is not to say that Social Capital may not have much to offer the interpretation of the results; the study will reserve the use of these theories as an additional analytical lens for the discussion section and in future work once the network landscape has begun to be mapped.

2.8.2 Knowledge networks

Many authors recognise that individuals, existing as part of greater collectives, necessarily share knowledge. Knowledge sharing within a group requires individuals to engage with networks of interlinked actors; historically researchers have explored this phenomena through combinations of basic intuition, patterns of individual characteristics, and visual or computational division of these characteristics (Freeman, 2004). These approaches derive from a belief that improved refinement of actor characterisations would better explain knowledge sharing, a view that explicitly rejects the role of the network itself in shaping knowledge flows. A key challenge to this assumption came from researchers who wished to account for the influence of a social dimension, who advocated for the "*priority of relations over categories*" (Emirbayer and Goodwin, 1994, p.1414). The focus on the importance of relationships in knowledge sharing, and not just the actor, led to the development of SNA approaches that have enjoyed widespread use across multiple disciplines (Snášel et al., 2008).

SNA may be more readily considered a paradigm than a theory (Burt, 1980), rather than offering deductive lessons SNA provides a systematic approach to exploring and evaluating connections between individuals, organisations, and individuals to organisations (Hummon and Carley, 1993). This openness is reflected in the range of levels at which analyses have been performed; studies have variously focused on individual actor-level networks (Burt, 2004, Perry-Smith, 2006), exchanges within parts of organisations (Reagans and McEvily, 2003), and between organisations (Lane and Lubatkin, 1998); by setting aside assumed group and institutional memberships this study will focus on individual actors as the central unit of analysis.

The two most common analytical perspectives used in actor-level SNA relate to the position (*topography*) of actors (*nodes*) within the network, and the nature of relationships (*edges*) that tie them together (Wasserman and Faust, 1994). This research suggests that both features may be of use in exploring processes of hybrid knowledge creation in pastoralist settings; the key features of network structure and relationship characteristics research are discussed below.

2.8.2.1 Network topography and actor position

SNA suggests that individuals exist within wider networks of linkages. These linkages may reflect various affiliations, memberships, group ties, and collectives, all of which may be represented by clusters of nodes and edges within broader systems. Direct ties between actors in these systems increase the frequency and fidelity of knowledge transfer (Singh, 2005); specifically relating to innovations, the more ties an actor has to an innovation the more likely they are to adopt (Strang and Tuma, 1993) and share (Morrison, 2002) the new idea. Many authors suggest that increased numbers of ties promote individual innovativeness (Audia and Goncalo, 2007, Ebadi and Utterback,

1984) whereas others note that the costs of maintaining ties can ultimately outweigh the benefits (McFadyen and Cannella, 2004). The presence of different clusters within a network raises two points for exploring knowledge creation in marginal settings; firstly, how clusters are defined. Secondly, how knowledge flows between clusters.

Defining clusters and communities

Social structures, and sub-communities within them, are represented in SAN as collections of relationships (Wellman and Berkowitz, 1988). Despite a long period of academic interest in SNA only a small number of studies have focused on the identification of cluster boundaries (Doreian and Woodard, 1994) which is surprising as early authors such as Wellman cautioned that "*attempts to impose improper boundaries may often lead to analytic confusion*" (Wellman, 1988, p.26). Rather than risk Wellman's 'improper imposition', many authors follow a single or combined normative, realist, or algorithmic approach to identifying clusters (Burt and Minor, 1983). Dealing with the non-computational methods first, realist approaches centre on actor-led group memberships, whereas normative approaches use researcher defined attributions (recognising Wellman's warnings). Gillespie and Murty (1991) developed this two-category model further to consider realist and normative approaches in terms of the focus, either attributional (the character of nodes) or relational (the character of edges). This granularity generates four possible perspectives on identifying populations using actor- and relationship-defined categories of edges and nodes, all of which may contribute to researching marginal knowledge creation processes. The importance of rigor in identifying clusters is of particular importance for this study as it is well understood that pastoralist societies contain multiple livelihood strategies and sub-communities (Barrett et al., 2001), but are rarely the subject of systematic SNA analysis. Combining the lack of empirical SNA data with suggestions by authors that individuals may simultaneously be members of multiple groups (Breiger, 1974), the need to unpack the complexity of group identification and membership becomes clear.

To tackle these concerns this study chooses to use a triangulated, exploratory approach to generate internally-relevant actor-defined (realist) alongside researcher-induced (normative) categorisations of both actors and relationships. These approaches involved differing degrees of subjective definition; to address the possible introduction of improper boundaries through positionality and bias this research proposes to triangulate these results with calculated metrics. Multiple algorithms exist for mathematically exploring and defining cluster boundaries (see, for example, Doreian and Woodard, 1994). Many of these approaches focus on the interrelated topics of the theoretical stability of the network (level of interconnectedness), or on divisions between sub groups (ability to partition), often termed metastability versus modularity (Sarich et al., 2014). This study wishes to draw out hidden and emerging clusters from within networks of assumed partitions, hence will use a

modularity class algorithm (Muff et al., 2005) that provides the flexibility to seek out groups to compare with the realist and normative groupings suggested above.

Actor position

Mapping networks of connections and identifying clusters within the system are key descriptive process involved in SNA. Central to the explanatory power of SNA is the search to understand how these structures relate to knowledge sharing and creation, in particular sharing and creation within, and between, clusters (Wasserman and Faust, 1994). To explore knowledge transfer between sub-networks this study focuses on two network features, *centrality* and *bridging*.

Centrality is a measure of the extent to which the actor is connected directly and indirectly to others within the network. More central actors have access to more diverse knowledge that provides increased opportunities for knowledge creation (Burt, 2004, Ebadi and Utterback, 1984) and diffusion due to reduced adopter uncertainty (Nerkar and Paruchuri, 2005). When considering pastoralist innovation, it is worthwhile noting that these high-centrality individuals often have greater powers of influence (Burt, 1982) that can motivate others to adopt new ideas (Ibarra, 1993) that could be important in the transfer of co-created knowledge.

Bridging most commonly refers to *triadic closure*, or the linking of two actors connected by a third. Triadic closure was developed around the idea of a *structural hole* – the 'missing third link' (Burt, 1992). Bridging actors, and their sub-forms that include brokers, boundary spanners, and gatekeepers[3], are common topics of study due to their ability to span two communities. For the bridger, cross-community relationships provide increased knowledge diversity (Perry-Smith, 2006) which can increase knowledge creation (Burt, 2004, Fleming et al., 2007, McFadyen et al., 2009). A counter position suggests the linked concepts of relationship density and strength (Granovetter, 1983) mean that well-connected groups (with few structural holes) rapidly distribute knowledge (Abrahamson and Rosenkopf, 1997) that may increase member innovativeness (Ebadi and Utterback, 1984). These observations have generated debates on the 'ideal' network form for promoting knowledge creation; considering pastoralist innovation this study follows the work of Adler and Kwon (2002) who suggest that there is no 'universally beneficial' structure. This echoes work by Morrison (2002) who proposes that structural holes may be beneficial for some tasks, and increased density for others. The exploratory SNA approach proposed in this study remains open to considering each network form on its own merit.

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[3] For a list of fifteen possible terms see Long et. al (2013)

2.8.2.2 Relationship nature

The section above suggests how the topography of a network may shape knowledge access and creation. Whilst the relative position of actors provides insight into macro-level knowledge flows, it is also necessary to consider the nature and role of links between actors in shaping knowledge. This may be important for networks such as pastoralist development systems which possess little assumed common ground between actors and have poorly understood channels of knowledge transfer. This is especially relevant when considering tie strength across communities; strong ties are more effective for the transmission of complex, privileged, or tacit knowledges (Centola and Macy, 2007, Reagans and McEvily, 2003, Uzzi and Lancaster, 2003), whereas weak ties may improve the ability to search for diverse new ideas and opportunities (Granovetter, 1983). This can be further complicated by the suggestion that bonds of either strength may carry multiple knowledge types (Bright et al., 2012), observations that highlight the importance of relationship nature and strength in this research. Pragmatically, explicit relationships found in knowledge networks are more easily measured whereas implicit linkages of power and hierarchy also shape knowledge creation but may go unrecorded. The next section considers the social aspects of linkages as they relate to innovation in pastoralist settings.

Networks and social influence

Social relationships often operate under implicit rules or dynamics alongside more explicit linkages such as expertise, status, or personality. Actors with similar expertise have been shown to communicate more effectively and with a reduced transfer cost (Black et al., 2004) that can be hypothesised as relevant to siloed expertise within development groups and pastoralist community leaders. The presence of formal and informal social hierarchies can motivate lower-status persons to share with higher-status (Thomas-Hunt et al., 2003); advances that are commonly rejected (Black et al., 2004, Thomas-Hunt et al., 2003). Similar status exchanges can increase the desire to receive knowledge (Black et al., 2004) linked to issues of trust and respect (Allen and Eby, 2003). It is unclear how these dynamics relate to crossing cultures and ethnicities, however experience of collaboration (Reagans and McEvily, 2003) and the ability to adapt communication strategies (Wang et al., 2009) have both been shown to increase the chances of knowledge transfer, and may prove useful lenses for exploring hybrid knowledge creation.

These social connections also influence relationship strength. Affective, high frequency, long duration, 'strong' ties (Marsden and Campbell, 1984) enhance knowledge communication (Bouty, 2000, Levin and Cross, 2004, Uzzi and Lancaster, 2003), particularly of complex (Centola and Macy, 2007) and private knowledges (Uzzi and Lancaster, 2003). Many authors link these observations to

notions of trust and reciprocity through an increased awareness of the types of information and transaction costs involved (Appleyard, 1996, Kachra and White, 2008). Given the existence of established, and often derogatory narratives surrounding pastoralist development it is interesting to both work that suggests *distrust* may increase the efficiency of an actor's search for information elsewhere (Jarvenpaa and Majchrzak, 2008).

Setting aside philosophical and conceptual arguments, it is necessary for this study to select a pragmatic approach to begin investigating relationships within the system. Multiple scales exist for classifying and analysing connections in terms of strength and nature; this study chooses to start the exploration of relationships using a taxonomic approach to guide internal validity. The taxonomy suggested by Ian McCulloh et al. (2013) considers relationships in the following ways:

- Individual evaluations (such as friendship, trust, or respect)
- Transactional (exchange of material resources such as wealth or livestock)
- Transfer (exchange of non-material resources such as knowledge or diseases)
- Affiliation (to a place or group)
- Formal ('chain of command')
- Kinship (family, sibling, tribal)

(adapted from McCulloh et al., 2013, p.191-192)

Whilst not assuming direct applicability, these classifications provide a framework to begin the exploration of connection types and knowledge sharing. Many SNA studies consider one, if not two, of these relationships when constructing a network; this study suggests that exchanges between individuals are rarely so unidimensional. Drawing on the author's previous work in Northern Kenya, the example of two pastoralist herders discussing how to stop flies biting their feet provides a useful illustration. These two people know one another, and this may have resulted in friendship, feuds, or fealty (*individual evaluations*). They would commonly share *miraa* roots or milk (a *transaction*), we observe them sharing knowledge (a *transfer*), they share an ethnicity and location (*affiliations*). Whilst they may not be *formally* connected (though not impossible), herders will commonly share either a phratry, age set, or familial connection somewhere (*kinship*). This example highlights how arbitrary it can be to assume relationships operate solely based on ethnicity, organisation, or location; this study will use the categorisations above as a starting point to explore the importance of relationship diversity on knowledge transfer.

2.8.2.3 Networks for researching pastoralist knowledge creation

The sections above outlined how SNA can be used to represent networks of individual actors operating in a social space. Within this web, clusters of more- and less-connected individuals represent communities that this study will identify in an emergent, exploratory way; communities that exchange knowledge within and between themselves via bridging actors, connected by links of varying strength. Many texts provide insights into how actors may shape processes of knowledge creation but the limited empirical SNA data relating to pastoralist innovation makes anything more than conjecture difficult.

2.9 Shaping knowledge flows:

Cultures and attitudes in knowledge exchange

The previous sections suggested that the contexts of knowledge exchange and creation may be key to understanding processes of knowledge hybridisation. Researchers are offered two, non-exclusive perspectives for studying these contexts; attempt to define and observe real phenomena[4], or consider the context as mediated through actor perceptions.

Due the variety and complexity of possible sites of knowledge exchange, this study proposes to explore actor perceptions to provide greater insight into processes of creation than objective contextual data. The study of perceptions is complex, particularly when considering locations involving different communities and cultures. Perception research often draws on attitudinal research tools from established (typically Western) methodologies that can lack cultural relevance, the main alternative, an open-ended exploratory attitudinal study, can make internal comparisons between actors challenging.

This study requires a theoretical and methodological foundation that provides both cultural validity and internal comparability; a conceptual approach that unifies these aspects is a *framing* perspective. Frames are a means of constructing and organising everyday realities (Tuchman, 1973); framing research is of particular use for this study through its emphasis on social processes and emergence that mirrors the conceptualisation given in section 2.3. Framing approaches can capture emergent aspects of perceptions by exploring individual creativity in a 'collective arena' (Snow and Benford, 1992). Current framing research is able to consider dynamic relationships between frames and how these interactions can construct meanings (Johnston and Klandermans, 1995). Whilst

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[4] For a discussion of the nature of reality and truth pertaining to research, see for example Cutcliffe and McKenna (2002)

conceptually attractive for this study, limited evidence exits on cross-cultural frame construction (Sniderman and Theriault, 2004).

This study hypothesises that frames may be used to understand the co-creation of perspectives between different actors through co-experience of common contexts. These framings may allow exploration of differences that reflect the contexts surrounding knowledge hybridisation outcomes.; whilst novel to the pastoralist context, frames and framing research have progressed considerably since inception, and now represent a well-established (if still evolving) field that has been tested in international development contexts (Alsop and Heinsohn, 2005).

The use of framings research provides this study with an established literature with which to explore perceptions. Whilst framings provide the cornerstone of this study's understanding the contextual shaping of knowledge creation processes, framing research allows further discussion of links between perceptions, attitudes, and behaviours (Eagly and Chaiken, 1998). Using frames to explore both attitude and behaviours builds on work by Entman (1993) that suggests frames are relational conduits of power. This relational view of frames fits well with notions of perception and the conceptualisation of innovation as an interconnected processes of individual knowledge creation. The mechanisms by which framings shape these processes, and interactions between actor framings may influence knowledge sharing are discussed below.

2.9.1 Frame effects as individual knowledge drivers

Understanding the role of frames and framing is a first step to exploring the how these perspectives influence processes of knowledge creation. This study draws on frame effect literature to provide a theoretical basis to explain observed behaviours. Frame effects attribute conscious (Eagly and Chaiken, 1998) or unconscious (Higgins, 1996) behaviour alterations to the possession of a frame, influenced by *mediating* and *moderating* factors. For knowledge creation in pastoralist development *mediation* can be linked to the use of memory and learning to alter behaviours may be complicated by the presence of disconnected cultures with diverse norms and rituals*.* At the individual level *moderators* are commonly characterised as the influence of personal values and predispositions on actions (see, for example, Barker, 2005, Druckman, 2001a, Shen and Edwards, 2005). Some authors suggest that traditional values (Gamson and Modigliani, 1987) and source credibility (Druckman, 2001b) can have significant impacts as moderators; this study suggests that a wide understanding of moderator effects is preferable as pastoralist communities have been shown to contain a wide variety of backgrounds and attitudes (Barrett et al., 2001).

2.9.2 Relationships and intersubjectivity in shaping knowledge creation

Theories of frame effects, moderators, and mediators can describe the shaping of individual behaviours. The concept of frames discussed in the previous section frames are relational; to explore notions of hybrid knowledge creation between individuals it is necessary to acknowledge the interactions of framings within relationships. This research elected draws on psychological literature to explain how beliefs, and the perceptions of others may shape knowledge interactions, specifically using *intersubjectivity* from the field of micro-sociology.

Intersubjectivity is commonly suggested as the variety of relationships between perspectives (Gillespie and Cornish, 2010). Often used interchangeably with terms such as interpersonal perception, empathy, insight, and social sensitivity (Gage and Cronbach, 1955), the field of intersubjectivity provides this study with theoretical basis to engage with the nuances of actor-actor perceptions and a set of existing terminology to engage with complex themes such as the nature of 'I' and 'you', abstract self-awareness (or *self-identities*) and what 'I believe you to think of me' (or *meta-identities*) (Laing et al., 1966).

Many interpretations of Intersubjectivity exist with specific definitions and methodologies. This study chooses to set aside scholars who suggested Intersubjectivity as a shared definition of a common object (see, for example, Mori and Hayashi, 2006) as this view risks obscuring the possibility of contestation and disagreement. This research adopts instead the definition proposed by Laing et al. (1966) which explicitly recognises agreement and disagreement between actor (*ego*) and partner (*alter*) and gives space for understanding and misunderstanding. This definition retains wider aspects of intersubjectivity such as the situated, performative, and interactional nature (Goffman, 1959, Schegloff, 1992) but retains the capacity to highlight discord and inequality in actor-actor dyads.

2.9.3 Knowledge creation and cultural change

The section above suggests the use of framing as an analytical device to explore the context of the 'intimate act' of knowledge sharing and creation. By combining framing and intersubjectivity theories, this study aims to create a conceptual framework that can recognise how perceptions shape individual action and influence hybrid knowledge creation. Both framing and intersubjectivity speak to the overlapping, conflicting, inhibiting, and enabling nature of cultures that can create boundaries to knowledge flows between actors.

Processes of knowledge sharing and creation occurring in sites of cultural contestation have been shown to change cultures themselves. The following section discusses the framework selected by this study to explore the complex interlinked nature of knowledge and culture, bringing together the previous sections of this chapter to explain how knowledge hybridisation processes are shaped in pastoralist development.

2.10 Innovating cultures and cultural innovation: Interrelations between culture and knowledge

The previous sections of this chapter suggest the importance of knowledge flows, cultures, and attitudes in researching innovation for pastoralist development. These relationships do not simply co-exist but form complex systems of mutual influence. This section outlines how this study explores the influence of dynamic co-creation on processes of knowledge hybridisation.

The entanglement of knowledge and culture can exceeds the research capacities of conventional methods in sociology, economics, and political science (Jasanoff, 2004). Anthropologist have fared better at explaining and sense-making, but often descend into non-generalised localism (though not always, see Gingrich and Fox, 2002). Complex philosophical questions exist surrounding the interplays between knowledge, culture, science, and technology, specifically around feedback that could influence beliefs on the features that enabled the original creation. (Foucault, 1972, Hacking, 1999). These questions are not solely academic; the dryland communities of this study have seen a whirlwind of technological change in recent years including the emergence and uptake of mobile telecommunications in pastoralist areas (Rutten and Mwangi, 2012). This case is highlighted as mobile devices are suggested as the most rapidly diffusing technology in the history of Sub-Saharan Africa, capable of significant impacts upon pastoralist social networks and community structures (Shrum et al., 2011).

2.10.1 Hybridity and knowledge-culture co-production

Broad questions surrounding the interrelatedness of knowledge and culture are central to the study of innovation for pastoralist development as they engage with processes of co-construction that continually shape contemporary societies. A limited number of approaches addressed this complexity; one field that brings together theoretical and methodological perspectives is Science and Technology Studies (STS) (Jasanoff, 1995). The STS canon has developed a concept of *co-production,* a "*shorthand for the proposition that the ways we know and represent the world (both nature and society) are inseparable from the ways in which we chose to live in it*" (Jasanoff, 2004 p.

2). The importance of co-production for this study is the recognition of knowledge as both embedding, and embedded in social practice, discourse, institutions, and instruments. The research approaches selected by this study challenge assumptions of shared cultures within the wider system; the use of a co-productionist perspective enables the identification and exploration of emergent cultures of innovation (and innovators) that may span established communities. Beyond this STS literature engages with the transportation of knowledge between cultures, addressing issues of production, interpretation, and credibility (Bowker and Star, 1999, Latour, 1987, Jasanoff, 1995). This study therefore uses STS co-productionist thinking as an interpretive framework, integrating key concepts into the analysis and discussion. The power of co-production for exploring innovation in pastoralist development lays, to borrow a phrase from the anthropologist Lévi-Strauss, "*not in the reduction of the complex to the simple. Rather, in a substitution of a complexity more intelligible for one which is less*" (Lévi-Strauss, 1962, taken from Geertz, 1973).

2.11 Conclusion

Bringing these threads together, a picture begins to emerge of the conceptual landscape in which this study is rooted. Knowledge is a dynamic entity, passing between actors through networks of relationships. Actors' shape knowledge flows and dynamics influenced by their framings and beliefs in the framings of others; framings that are constructed from the multiple cultures in which they may reside. These cultures may be either explicit or implicit, identified as attitudinal collectives that overlap with community memberships.

These two features – knowledge flows and framings – are synergistically interrelated, both shaping one another. By using this conceptualisation to inductively explore innovation outside of formalised frameworks such as IS and grassroots approaches, this study aims to uncover the breadth and complexity occurring within pastoralist settings. More specifically, the question *how knowledge hybridisation processes are shaped in pastoralist development* can be recast as a series of research objectives. These are:

1. What knowledge networks exist within the system?
2. What framings exist within the system?
3. How do framings and network characteristics shape processes of knowledge hybridisation in pastoralist development?

Answering each of these requires a different set of methodological tools, rooted in a range of academic disciplines. The following chapter discusses the process used to select the methodological tools for this study and sets out the ways in which individual techniques articulate with one another as part of a larger research approach.

Chapter 3:

Methods and Methodologies

Picture 5: Voices and visions

Researching pastoralism requires careful consideration of the methodological tools and techniques to be used. Here, a Participatory Frame Building exercise has prompted animated exchanges amongst male members of an Algaanna-phratry group that provide insight into complex cultural institutions.

3.1 Introduction

The previous chapters suggested the use of a combined framings-network perspective for studying complex, dynamic, emergent, and informal innovations in pastoralist settings. This chapter builds on these foundations to outline how methodological and analytical tools were selected to gather data on the features that make up the conceptual framework.

Researching innovation is a complex undertaking, and the methodologies (plural, as there are many) used in this study are no different. This chapter construction tries to guide readers through the choices that were made during the study design process; many of the methods are drawn from different disciplines and were deployed in an interrelated, recursive fashion that requires greater explanation than a mono-method study.

The chapter is comprised of four sections. Firstly, the research approach is set out; this includes a brief discussion of literature relating to the choice of a mixed-methods approach and an overview schematic of the methodological framework. The following three sections deal with each research question in turn. For each question, the section frames the background literature, discusses key decisions, and describes the methods used to obtain the data. These reassembled at the end of the chapter to suggest how each methodological and analytical stage of the research process contributes to understanding the creation of innovation pathways in pastoralist development.

3.2 Research Approach

As described before, innovation is a complex phenomenon. Contested definitions and evolving methodologies conspire to challenge would-be researchers of pastoralist innovation. At the heart of this study lies a desire to contribute to "*a more encompassing and valid understanding of the phenomenon*" (Wald, 2014, p.66), and to suggest a possible explanation for the shaped of hybrid knowledge creation processes in pastoralist development.

These two features – understanding and explanation – are methodologically closely linked. To develop understanding in the case of a culturally heterogeneous system such as pastoralist development requires a sympathetic and open ear to the various realities that people experience; these realities may be best explored through the use of multiple conceptual and methodological lenses (Bryman, 2007). This suggestion is supported by the observation that a narrow methodological focus can systematically exclude research-relevant insights, significantly limiting explanatory power (Hesse-Biber and Leavy, 2010). To engage with the range and vibrancy of individual perspectives in the pastoralist setting, the ability to capture a wide range of positions is vital for providing data depth and context.

The use of combined research methods and methodologies is a well-established practice (see, for example, Browne-Nuñez and Jonker, 2008, Creswell, 2013, Domínguez and Hollstein, 2014, Greene and Caracelli, 1997, Teddlie and Tashakkori, 2003). One of the central concepts of mixed-methods design is triangulation. Originally designed to improve the validity of data (Campbell and Fiske, 1959), recent work by authors such as Denzin (2007) demonstrates triangulation's contribution to the development of methods and theory and by Flick (2004) who suggests triangulation as a potential validation strategy, as an aid to generalisation, and as an alternative route to additional knowledge. In this study triangulation is primarily employed as an aid to validation, but contributions from both other modes are considered in the concluding chapter.

Triangulation for validation is most commonly conducted in a combination of four forms; the triangulation of data, of investigators, of theories, and methodological triangulation (which is often further differentiated into within- and between-method triangulation) (Denzin, 1978). The presence of a single investigator makes multi-investigator triangulation difficult (leaving aside issues such as interpreter subjectivity discussed in section 3.2.2) so will be omitted for this study. Data triangulation, or the drawing of data from different sources, places, peoples, or times will be used extensively throughout the study, for example the use of network measures and semi-structured interviews to locate Key Actors. Similarly, between-method triangulation will be used to provide two

perspectives on a single data set such as through the use of a matrix-building procedure and semi-structured interviews to provide insight into Case Study networks. Theoretical triangulation is often a more complex process that can uncover new facets of the data arising from the juxtaposition of theoretical perspectives. This study draws on multiple research techniques such as Q-methodology and Thematic Analysis, but in many cases, there exists a common theoretical root that unifies this approach (in this case Discourse Analysis). For this reason and to facilitate clarity of interpretation the contribution of theoretical triangulation will be considered at each stage of individual analyses rather than separately as a unique analytical perspective.

Given the range and variety of methods used in this study, a diagrammatic representation of the individual steps involved in triangulation is given in section 3.2; however, to introduce the methodological structure a (non-triangulatory) overview methods schematic of the specific research framework designed to address each of the research questions is given in diagrammatic form below in figure 2 on page 61:
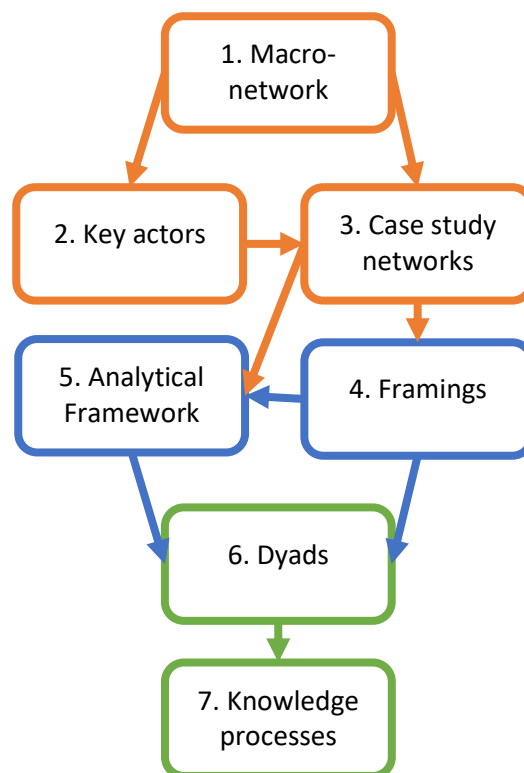
Figure 1: Overview methodology schematic

Key:

1. What knowledge networks exist within the system? (shown in **red**)
2. What framings exist within the system? (shown in **blue**)

3. How do framings and network characteristics shape processes of knowledge hybridisation in pastoralist development? (shown in **green**)

Each research question was approached in multiple stages. The methodologies and methods used in each stage were selected from a range of existing literatures. The specific steps within each group are given in figure 2 on page 61 below and are discussed in the relevant sections of this chapter.
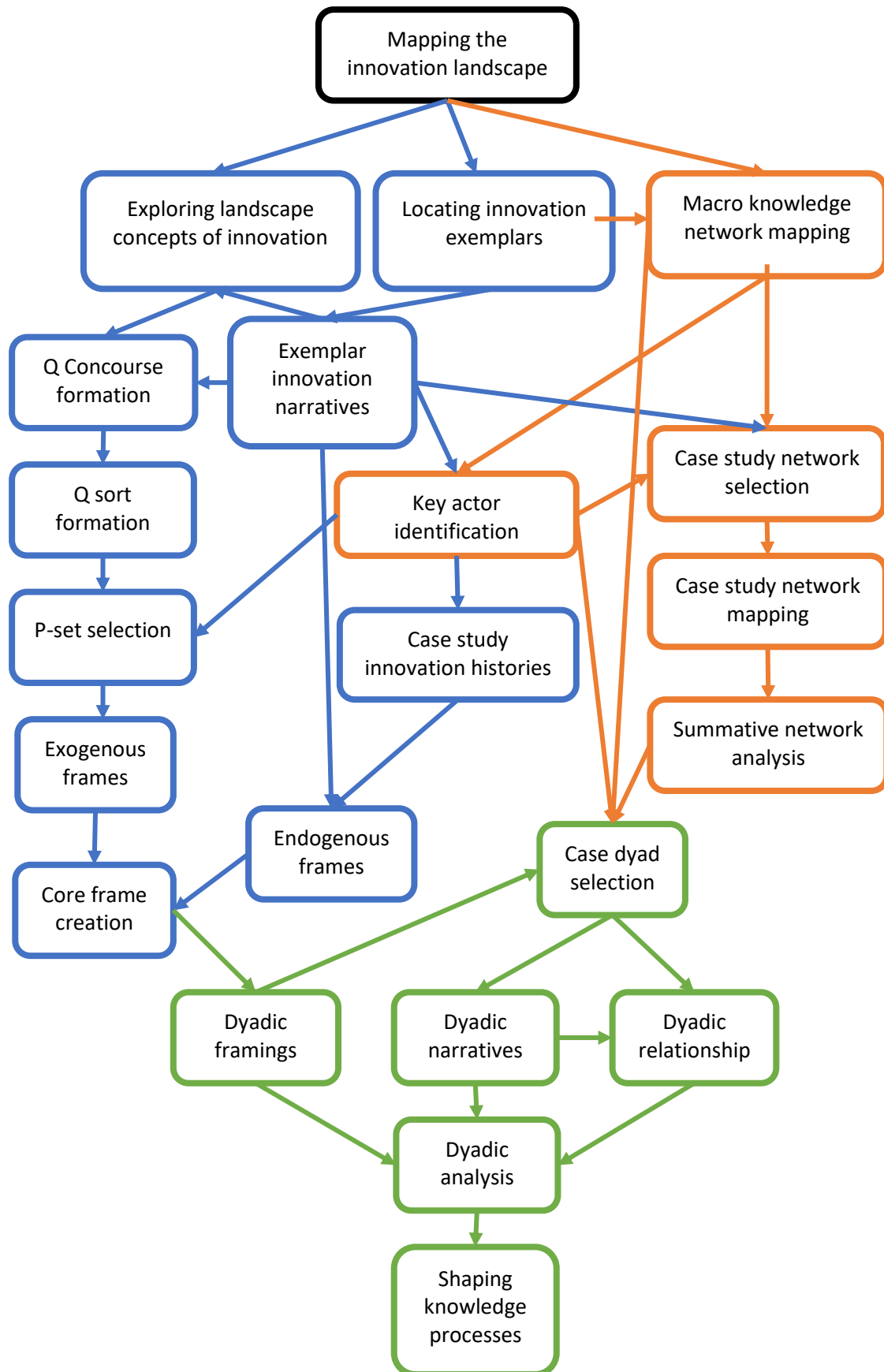
Figure 2: Detailed methods schematic

3.2.1 Design, collection, and triangulation

This schematic groups and links the research methodologies used in each stage of the project; this is developed further in figure 3 below to show how research methods (in **blue**) are used on different data sources (shown in **yellow**) to create outputs (in **green**). The linking arrows show examples of where multiple sources of data are triangulated to provide an output (such as network analytics and key actors in developing innovation exemplars), and where multiple analytical methods are used on the same data source (as with the use of innovation histories and semi-structured interviews on key actors).

Figure 3: Triangulation schematic

3.2.2 Translation and data collection

Conducting interviews and data collection in a foreign tongue presents significant challenges for would-be researchers, particularly when considering abstract issues and conceptual topics. This is not a simple academic conceit; 'speak for' others can incur political consequences (Alcoff, 1991, Back and Solomos, 1993, Wilkinson and Kitzinger, 1996). One method to engage with local language speakers is to employ local-language translators (used in this study), however this raises further issues around the subjectivities that may accompany translation from one language to another. Translation as a topic of research itself has a long history, and particular attention has recently been focussed on influences in qualitative research (Birbili, 2000, Edwards, 1998). Much of this work acknowledges that there is no 'true' translation, often acknowledging that translators select a subjectively 'best' combination of words in the second language to represent the discourse in the first (Bassnet, 1994). Choices of terminology and understanding made by the translator may be influenced by their personal perspectives and beliefs, just as are those of the interviewee and researcher (Berger and Luckmann, 1991). These differences in worlds views are negotiated through dialogue; this dialogic process is both a means and subject of study for this research. Those individual subjectivities are further complicated by the use of terms that may have no direct counterpart in another language (Hantrais and Mangen, 1999, Révauger and Wilson, 2001). Simon (1996, p.139) suggested that "*Translators must constantly make decisions about the cultural meanings which language carries, and evaluate the degree to which the two different worlds they inhibit are "the same." These are not technical difficulties, they are not the domain of specialists in obscure or quaint vocabularies. They demand the exercise of a wide range of intelligences. In fact, the process of meaning transfer has less to do with finding the cultural inscription of a term than in reconstructing its value"*. The search to understand this 'cultural value' informs the recruitment and training of translators for this study in the process given below.

3.2.2.1 Translation for researching pastoralist innovation

Many of the decisions surrounding the recruitment and training of translators for this study were informed by previous experience of working within the community. The NGO actors involved in this study were universally English speaking; the Gabra respondents had various levels of English, Swahili, Sheng (Swahili-English hybrid), Somali Arabic, and Boranaa–Arsii–Gujii Oromo (Cushitic indigenous language). Translators were therefore selected who were able to engage in local dialogues, and whose English was enough to explore more complex, abstract terms. In addition to language skills, translators of both genders were required to maximise the data collection in a culturally-appropriate manner; in Gabra culture women will often respond less completely to male

interviewers. Using these criteria, five translators were approached on recommendation from NGO and past local researchers. A group discussion around innovation was conducted with all five, followed by a cross-translation exercise. From these five, the three most suitable translators were selected; one younger male, one older male, one younger female. For the following three days the translators were introduced to and gained familiarity with the research tools (semi-structured interviews, network maps, and Q-methodology). Each translator was asked to translate and present the views of the two others to emphasise the plurality or perspectives, and to drive discussion of how best to engage with different issues and themes around innovation and knowledge creation. Any differences/disagreements in translation were highlighted and discussed not to create a uniform vocabulary, but to make all translators aware of the conceptual possibilities. During the data collection process each interview was recorded, and twice per week translators were asked to cross-translate to highlight any key differences in interpretations. This process also provided an opportunity to explore new insights and emergent themes in the research. Whilst not perfect, I believe this approach does minimise opportunity for errors, and allow multiple perspectives on the key areas to be explored. Additionally, translators are engaged as active members of the research team, helping to drive the research direction by volunteering areas that they felt were new or of specific value.

3.2.3 Influences of resources and time

Undertaking this doctoral research project involved near-constant choice-making; loops of interrelated intellectual and pragmatic choices to couple together the research aims and logistical constraints. In the case of this research, several external factors informed the final shape of the research.

The exploratory nature of the research.
Chapter 2 outlined the open, exploratory approaches used in this study to map conflicting narratives within the study population. This means that rather than a traditional hypothetical-deductive approach the research required an iterative review process, whereby data gathered in the early stages can be interpreted and used to explore emergent themes in the later portions.

Resource limitations.
This research was funded by the ESRC, providing both living stipend and limited research expenses. To maximise the amount of data that could be gathered many of the larger costs were offset through partnerships with in-country organisations, but the budget did not allow for significant extra expenditure. In total, accommodation and translation costs were available for approximately 8 weeks of research and two return trips to the field area.

Remote location.

North Horr is not an easily accessible or affordable study location. Other more 'resource-friendly' pastoralist locations were considered in developing the study, however prior experience of working within the community and local contacts meant that the limited budget could be more fully applied to project expenses, rather than requiring contingencies against the unknown.

Personal circumstances.

Over the period of this research several personal factors influenced some research decisions. A complex family hospitalisation and bereavement, the birth of my two children, and the sale and purchase of homes influenced all the above aspects and had consequences for the research plan.

These factors, through conversation with supervisors, led to a shift from the ethnographic-type 'deep study' originally envisaged to refocus the research onto points of articulation between development and indigenous knowledge networks. The research design was adapted to include two field sessions with a period of analysis and review in-between. These sessions were planned to achieve the intended research goal, fit in with budget constraints, and react to childcare and family support requirements.

3.3 Mapping knowledge networks

Chapter two set out the importance for this study of considering the channels through which knowledge flows; in the diagram above, five steps in red relate to the question "*what knowledge networks exist within the system*"? This study proposed to draw on Social Network Analysis (SNA) theory to inform the selection of methodological and analytical techniques designed to explore formal and informal flows of knowledge.

3.3.0.1 Social Network Analysis (SNA)

SNA was selected for its ability to address the complexity and heterogeneity within pastoralist development whilst limiting the possibilities for researcher positionality bias. The analytical process employed in SNA (more so than other network techniques such as Actor-Network Theory) relies slightly less on researcher-led interpretations, instead looking to comparative spatial representations of distributions and relationship characteristics to provide insight into the characteristics of networks. This study elected to follow four common core concepts of SNA; (a) that a network be considered to be made of *nodes* (actors) and *edges* (relationships) between nodes (Wasserman and Faust, 1994), (b) networks can be analysed through examination of relationships and structural forms (Borgatti and Cross, 2003, Granovetter, 1983), (c) that knowledge flows between *nodes* can be

explored in terms of *knowledge processes* (Argote et al., 2003), and that (d) that node-node *dyads* may be analysed within a network setting (Rivera et al., 2010).

The topography of the network was therefore characterised in terms of *nodes* (actors), *edges* (the presence and nature of relationships), *structures* (the relative positions of nodes) and *knowledges* (the type of knowledge flowing between nodes). This conceptual position provided the foundations for selecting more specific methodological tools. A common tension in SNA research is a focus on either actor positions with a wider topography (*structural* network data) or examine overlaps between network position and actor characteristic data (*compositional* network data). Following an initial scoping study, a broad set of interconnected networks were identified which could have been suitable for further exploration. Due to resource limitations it was necessary to allocate specific time to macro-level *structural* network mapping, and in-depth (more qualitative) *compositional* network mapping. Focusing solely upon an exploration of macro-level structures would provide detail on the extent and dynamics of knowledge exchanges at the expense of actor-level depth. A narrow but deep focus on individual relationships between actors would likely yield much more information on how particular contexts could shape knowledge creation but may fail to capture the overall pathway structure.

The structural characteristics that were examined included the presence and nature of relationships between actors, using these to explore how structural features - specifically bridging, brokering, clustering, and centrality – can be used to describe and analyse the network as defined and detailed in section 2.8.

Within this topographical structure it was possible to trace knowledge flows; descriptions of flows were adapted from Phelps et al. (2012) to give *stasis* (knowledge is neither transferred, adopted or adapted), *transference* (passed to other actors), *adoption* (knowledge is utilised by the node) and *hybridisation* (the combining of new knowledge with existing knowledge stocks). Phelps' work combines all acts of creation and co-creation under the banner of 'hybridisation'. This study aimed to unpack and explore this categorisation further by combining data from networks with framings to understand what this means for knowledge creation in pastoralist contexts.

It was decided to start with the collection of broad *macro-level knowledge networks* that would capture the range and types of innovations occurring and inform the selection of qualitative respondents. From this map a series of *case study knowledge networks* would be selected for further in-depth analysis to provide contextual depth. Both knowledge network maps would be used to (a) inform the exploration of framings, (b) help locate possible types of hybridisation occurring, and (c) develop a working theory that would help guide final stage of research looking at individual-level

knowledge creation. To achieve these three aims it was necessary to consider the networks in terms of their *exploratory* and *explanatory* power, and as to the scale of the network data collection (either *individual* or *complete*).

3.3.0.2 Exploring and explaining through networks

Many networks are used in an exploratory manner (Scott, 2017); it is however possible to derive exploratory power through data visualisation. This process is most commonly described as the "*conversion of quantitative information to qualitative*" (Molina et al., 2014, p.306). Exploratory models assist reflexively in questioning prior assumptions, evaluating research models, and developing *post-hoc* analyses (Freeman, 2005). Beyond the need for analytical rigor, this study wished to engage with respondents as active participants in the study. This meant selecting methodological tools that provided room for dissenting voices and allowing respondents to shape the research process. Given the diversity of respondents in the study, visualisations (as part of the research process) could provide actors with an alternative route with which to engage with the topic, contest and refute interpretations, and recognise their unique contributions (Borgatti and Cross, 2003).

Specifically for network data in marginal settings, graphic visualisations could help respondents develop discussions around biographical information, and identify informal groups and cliques that are meaningful to them (McCarty, 2002). Identifying actor-generated personal groups could also help participants explore wider notions of community and community-membership, concepts that underpin many parts of this research (Cachia and Maya Jariego, 2010). Researchers have often demonstrated that temporal considerations are indispensable for identifying and analysing accounts of change and evolution (Lubbers et al., 2010); whilst this study did not have the resources to collect longitudinal data, limited temporal effects were captured by exploring recollections of network changes with innovation histories.

3.3.0.3 Networks as collectives of individuals

The centrality of individuals' perceptions and interpretations in this study informed the choice to focus on an *individual* (as opposed to a *complete* or 'whole network') approach (Wasserman and Faust, 1994). Individual (sometimes referred to as *ego-networks*) explore the personal connections of a single actor, (the *ego*), volunteering connections to other actors (*alters*). The aggregation of individual networks to form a larger, combined network is an uncommon but established technique (Lerner and Brandes, 2007, Lerner et al., 2008); the rationale for doing so in this study is rooted in both academic theory and practical utility.

From an academic perspective, the study was informed by two key requirements. Firstly, networks were required to capture and explore individual perspectives on a topic that attracts contested definitions ('innovation') involving heterogeneous groups of actors, requiring sensitivity to individual conceptualisations and beliefs. Secondly, the definition and discussion of innovation in 2.3.2.1 suggests the possible importance of innovation as ideas and perspectives. The use of aggregated ego-networks provides opportunity to explore the granular detail within individual relationships and to qualitatively capture changes in thinking that may contribute to the shaping of knowledge creation processes. The contribution to and impacts of individual innovations were explored using open-ended questions to try and locate steps in the chains of knowledge creation.

From a pragmatic perspective, a significant challenge to Social Network Research is establishing network boundaries (Wasserman and Faust, 1994, Laumann et al., 1989). By using a series of interconnected ego-networks, this study aspired to use a self-defined, self-limiting population to construct the wider network (see 'population selection' below).

These stages may be mapped onto the overall methodological approach given below in figure 4 on page 71 where the steps relating to network analysis are shown in **orange**.
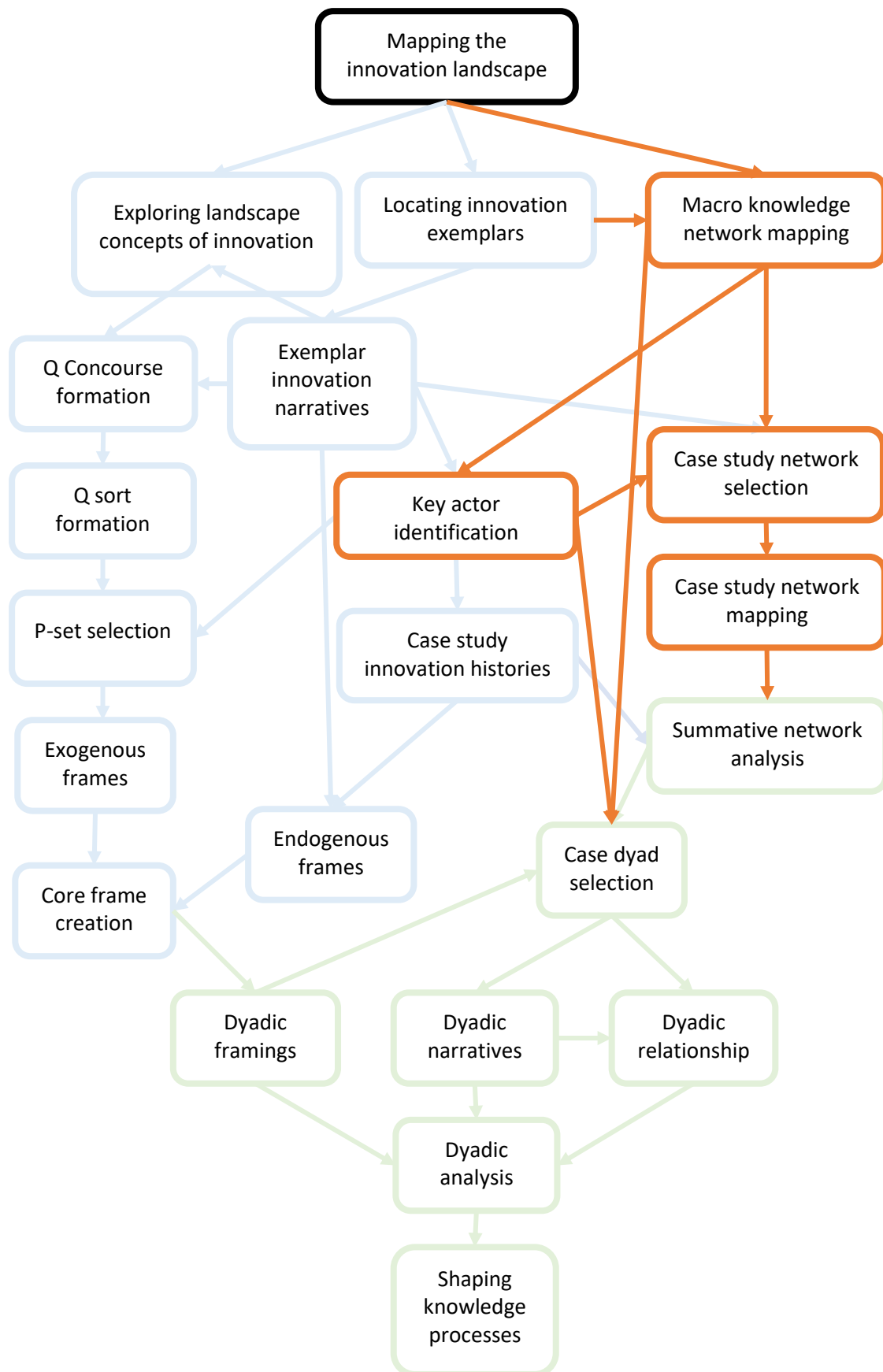
Figure 4: Network methodology schematic

3.3.1 Macro Network Mapping

The macro-level network mapping of pastoralist innovation aimed to provide a broad overview of the diversity and reach of actors within the system. Constructing an *exploratory ego-network* required three distinct data sets; *ego* data, *alter* data, and *relationship* data (see appendix 1 for interview guide).

Ego

Ego data related to the characteristics and connections of individual actors. Data were collected on personal roles, group memberships, brief personal histories, and a brief semi-structured series of questions concerning innovation that fed into the 'framing data' section below. In this process respondents were asked to suggest examples of innovation that they knew of and/or were involved in, later used as the basis for the creation of *innovation exemplars*. Exemplars can act as Boundary Objects (Carlile, 2002); Boundary Objects provide actors' with a 'real' (to them) event, experienced in common with other people, which they can describe. These descriptions allow the researcher to compare responses across cultures and communities, which has two key benefits for this study. Firstly, it provides a comparative data set to identify similarities and differences in farming. Secondly, many network techniques ask respondents to 'list all the people at the time', a process that is prone to underreporting errors due to so-called free-recall bias (Grimes and Schulz, 2002). The use of a discrete event to focus respondents has been shown to limit issues seen with network collection of abstract or historical events (Anderson and Bower, 1972).

Alter

As mentioned previously, part of this study aims to explore knowledge creation between actors. The *ego* selected above was connected to a series of *alters*, the links between which form the basis of the ego network. The ego was asked to list the other actors involved in the innovation exemplars, and to describe the actors and roles involved. At this stage contact details and introductions were also sought to aid the data collection process.

Relationships

The nature of relationships between ego and alter is suggested as key to shaping processes of knowledge hybridisation. At this stage of the research the aim was to provide an exploratory map, meaning that there was insufficient time to gather complete data on the depth and nature of each linkage. This meant that for each nominated alter, the ego was asked to describe their relationship and provide as much or as little detail as they wished. At that stage no quantifiable data were

collected on relationships (*edge weights*) – this information was collected at a later stage of the research process for a specifically selected populations (see section 3.5).

3.3.1.1 Building the macro network

As described above, the exploratory macro-network was constructed from a series of overlapping and interlinked ego-networks. The primary respondents involved in these networks were selected through key-informant suggestions and transect walks with local contacts to identify points of interests. The combination of these methods aimed to capture readily observable innovative activity alongside adaptations at the household or individual level that may have been more hidden from external actors.

Using innovation exemplar networks as a starting point, respondent-driven sampling was used to further develop membership of exemplar networks (Goodman, 1961, Salganik and Heckathorn, 2004). This 'snowball' method of recruitment explored the alters to each ego, until no new respondents were forthcoming or available for participation. Whilst this method of participant sampling was not exhaustive, it was as comprehensive as practicable.

3.3.1.2 Analysing the macro-network

The primary analysis for this section was performed using Gephi (Bastian et al., 2009), a Windows-based analytical and visualisation software. The network analysis involved the creation of graphical representations to assist participant involvement and data collection, and the calculation of basic network characteristics. Gephi v.0.9.2[5] is an open-source network analysis and visualisation programme that offers supplementary functions through additional open-source add-on modules (Bastian et al., 2009). The primary calculations performed by Gephi in this study are power measurements, sub-network identification, and visualisations. Power calculations are of the *degree* (the number of *edges* for each *node*) and *betweenness* (the total number of paths between all possible sets of *nodes* that the *target node* is included within) of specific nodes; the selection of specific parameters is not required for these calculations. This study proposes to use a *modularity class algorithm* (Muff et al., 2005) to assist in bounding sub-networks; this algorithm uses a Louvain method to identify densely-connected sub-networks within the macro network structure, separated by sparser inter-cluster spaces (Blondel et al., 2008). The algorithm used here requires a research-defined *resolution* value to guide the size of classes considered (Lambiotte et al., 2008); in this case a resolution of 1.2 was selected through experimentation to provide cluster bounding informed by, and coherent with, the qualitative data on the various individual ego-networks.

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[5] Downloadable from https://gephi.org/

The graphical representation of the network was plotted using a Fruchterman-Reingold algorithm (Fruchterman and Reingold, 1991). Fruchterman-Reingold, a form of force-directed distribution plots, performs a calculation that seeks a minimum-energy state if each node was repulsive, and each edge attractive. The result of this process is a clustering of nodes into tightly-connected communities with spaces of lower-connected intercommunity space. For this study this provides a rapid means of locating groups of closely connected actors, however it is important to cross-reference the existence of clusters with data on node characteristics to explain groupings.

Whole-network values were calculated for Average Degree (average number of connections per node), Network Diameter (shortest number of relationship steps between two most distant actors), and Graph Density (proportion of possible edges divided by possible edges). Node-specific values are discussed in the relevant sections below. Node-specific values for *degree* (number of *edges*), and *betweenness* (the number of network paths on which the actor is included) were calculated in Key Actor identification (see next section).

3.3.1.3 Macro-network contribution

The primary output from this stage was the whole-network visualisation and data set that was used to inform the stages that follow on from the exploratory process. Additionally, the calculated values were used for comparative description between case studies, and node-specific values for key actor identification.

3.3.2 Key Actors

The study of innovation often considers individuals and circumstances that breaks from the norm. For pastoralist innovation, this meant engaging with actors who were able to provide insights into dynamics occurring outside of established institutions. Rather than pursing an opportunistic approach based on a researcher-led definition of deviation from the mainstream, this study adopted an anthropological position to more rigorously explore the identification of valuable respondents. The Key Informant technique was described by the anthropologist Marc-Adelard Tremblay (1957), who suggested that Key Informants were more than just well-placed or privileged individuals, but instead were "*natural observers*" (Tremblay, 1957, p.693). These persons were capable of providing informed comments on the world around them. Sjoberg and Nett (1968) further differentiated these observers into those who represented a culture or community, and those that articulated more extreme attitudes or views – so-called "*marginal men*" (see also Sjoberg (1957)).

The Key Informant technique offers this study the possibility of a structured methodology for selecting interviewees who provide perspectives from across heterogeneous actor populations.

Tremblay suggests that the 'ideal' Key Informant should have knowledge, communicability, impartiality, willingness, and a role in the community (Tremblay, 1957, p.692), of which only the role may be possible to tell in advance (Marshall, 1996). For this study, knowledge and perspectival framings are the focus of the research, communicability and willingness are issues for the researcher to overcome through research tool selection, role and position both benefit from robust study design.

3.3.2.1 Identifying Key Actors

The diversity of actors involved in pastoralist development mean that three techniques were used to locate and engage with Key Actors; respondent suggestion, data visualisation, and network analytics. With every interview, respondents were asked to suggest actors whom they felt could provide insight for the study. Secondly, a Fruchterman and Reingold (1991) algorithm provided a data visualisation that clustered closely connected actors that assisted the identification of actors bridging sub-networks. Thirdly, as the exploratory nature of the macro-network meant that no single respondent had full knowledge of the networks' topography, calculated measures of *centrality* were used to locate actors at positions of importance within the network.

Node centrality is calculated through use of an algorithm to identify positions equated with popularity and leading behaviour change (Becker, 1970, Rogers, 2003, Valente et al., 2008). The centrality calculations used in this stage of the study were *degree* (number of *edges*), and *betweenness* (the number of network paths on which the actor is included); both of these measures relate to nodes in key positions of brokerage and connectivity between different sub-networks.

3.3.2.2 Analysing Key Actors

The way in which this research was designed meant that many Key Actors were either locally valued, or occupied positions of influence or brokerage. As such, these individuals were able to speak to central issues surrounding knowledge flows and creation. In-depth interviews were conducted with these individuals; the primary analysis of interview data were conducted using NVivo 11 for Windows software (QSR International Pty Ltd., 2017), and network visualisation and analysis with Gephi (Bastian et al., 2009). The output of these analyses provided qualitative detail that guided multiple aspects of the research process.

3.3.3 Identifying Case Study Networks

The previous two methodological sections describe how this study mapped the macro-scale network and began to locate key actors. These techniques provided both exploratory oversight and actor-specific insight, however for explanatory power it was necessary to develop a deeper and more contextual understanding of knowledge creation processes, completed in a systematic manner. To capture the complexity and diversity inherent in systems of pastoralist innovation, a series of case studies were selected and analysed to provide this richer, more granular detail.

There are multiple ways to identify and select potential case studies (Ritchie et al., 2013). For this research potential case studies were firstly evaluated as to their ability to reflect one or more aspects of the core research question. To make sure this was completed in a rigorous and systematic manner, a three-stage screening process was developed.

1. *Qualitative Review*. Discourse Analysis (see section 3.4) was used to identify key themes, informed by case notes taken throughout the field data collection period. These were cross-referenced with innovation exemplars from the previous section. This resulted in a short list of innovations that included these themes.

2. *Spatial Visualisation*. A Force Atlas algorithm (Jacomy et al., 2014) was used to separates sub-groups, providing an alternative visualisation to the previous Fruchterman and Reingold plot. This was used as an 'eyeball' tool to discuss possible case study networks with Key Informants (Hogan et al., 2007), cross-referenced with parallel qualitative data.

3. *Modularity Class calculation and plot*. A Modularity Class algorithm detects and displays communities of connected nodes within a macro-level network. These classes have been shown to have real-world relevance (Blondel et al., 2008), providing an objective bounding tool when identifying Case Study networks. Modularity Class defined case studies were also used as the basis for Key Informant discussion and qualitative cross-referencing.

The qualitative data analysis was conducted using NVivo 11 (QSR International Pty Ltd., 2017); network calculations, Force Atlas, and Modularity Class plots were completed with Gephi (Bastian et al., 2009).

3.3.3.1 Selecting Case study networks

To identify the case studies to be mapped and analysed, a range of qualitative and quantitative criteria were used to guide the selection process (Hanneman and Riddle, 2005). The case study networks identified above were firstly assessed for data collection practicalities, resource efficiency, and likely data quality and utility using key actor interviews.

Calculated network metrics were then reviewed to select networks with specific topographical characteristics that represented aspects drawn from qualitative interview data (i.e. tight versus loose, formalised versus informal). The calculated measures described the average *centrality* of nodes (average degree), and topographical measures (network diameter, density, and average path length) in terms of the size, number, and interconnectedness of the case study networks.

- Average degree describes the average number of connections of each node within the system.
- Network diameter describes the shortest edge path length between the two least connected nodes.
- Network density describes the number of edges as a proportion of the number of possible edges.
- The average path length describes the mean number of edges between any two nodes in the network.

3.3.4 Mapping Case Study Networks

The section above outlines the process by which case study networks were selected for inclusion. Once located, these specific networks were investigated in more detail, reflecting a shift in focus from the macro-network *exploratory* role to seeking *explanatory* power. At the heart of the explanatory process was an exploration of relationships between actors that is discussed in more detail in later sections.

Case study networks were designed to add depth and context to data collected in the initial mapping phase. Respondents were shown draft versions of the case study network diagrams and were asked to describe their relationship with each alter in as much detail as possible. Actors were prompted to give examples of exchanges and suggest how these may have shaped knowledge sharing; the aim of this collection phase was to capture the richness and variety of exchanges occurring within the case study network. Much of this section of the research was developed by previous work on the classifications of relationship types; leading to the creation of six relationship archetypes that formed the basis for exploring endogenously derived classifications and characterisations. These six were:

- Individual evaluations (such as friendship, trust, or respect)

- Transactional links (exchange of material resources such as wealth or livestock)

- Transfer links (exchange of non-material resources such as knowledge or diseases)

- Affiliations (to a place or group)

- Formal links ('chain of command')

- Kinship links (family, sibling, tribal)

(adapted from McCulloh et al., 2013, p.191-192)

The combination of these categorisations with richer network diagrams were used as the basis to further explore sub-networks, focusing on an examination of how different types of exchanges may contribute to different knowledge sharing outcomes. Qualitative analysis of relationships and knowledge types was completed using NVivo 11 (QSR International Pty Ltd., 2017), based on the relationship typologies suggested above as a position from which to develop endogenous classifications. Once gathered, these data were used to suggest the presence of further case study sub-networks; potential sub-networks identified in this way were then cross-referenced with discourse analysis themes. These sub-networks and themes form the basis for the later Summative Network Analysis (see figure 3 on page 60).

3.4 Exploring framings

Chapter two suggested the value of a framings-based perspective for exploring processes of hybrid knowledge creation in a pastoralist context. The study of subjective topics such as framings highlights several considerations for any potential researcher, particularly research conducted in culturally unfamiliar terrain. Most significant of these methodological concerns is the use of language and context to accurately represent the breadth of framings surrounding innovation.

Language is a complex cultural construct. More than a 'set of symbols', non-fluency immediately places any non-native speaker at a disadvantage when trying to unpack complexity. In this case the researcher had limited spoken Swahili and Arabic, and a scattering of Oromo (the broad indigenous language, of which the Gabra speak a specific dialect). These three languages, in addition to English, are all found within the study population. The lack of researcher fluency can be considered to limit the ability of the study to collect non-filtered (i.e. untranslated) data. As many of the actors in this study were illiterate, opportunities to engage with secondary written or recorded data were further limited. With English-speaking actors and resources, many respondents used dialects or technical language specific to their discipline or field area, such as NGO-speak (e.g. "*operationalise*" rather

than "*use*") or acronyms (e.g. "*I'll talk to the ECHO WASH CO about the OCHA RNA*")[6]. These linguistic differences provide fertile ground for analysis but make comparative claims more difficult through contested understandings and meanings.

Secondly, interview methods often provide a rich series of descriptive accounts that can create identities and shape understandings. These features of responses can provide excellent background to the research context, however for this study the integration of narrative-type results into network analysis could have been challenging.

Lastly, whilst seemingly obvious, conventional interview approaches focus on what the respondent articulates, not what they do not say. This raises two specific concerns surrounding comparability in cross-cultural and innovation-focused research. In both cases it may be necessary to understand how actors conceptualise and engage with unfamiliar or abstract concepts – ones they may not volunteer in discussion. For example, how a pastoralist herder understands funding for NGO innovation may influence beliefs around technology. Or, on the other hand, how an NGO sees cultural norms shaping community-level experimentation, may guide participatory programming. Careful thought was required to structure the research in such a way that sympathetically identified aspects of what was unsaid, and what was unknown.

Considering all three of these factors, this research selected a suite of methods to identify and evaluate framings. This approach integrated three primary methodologies that reinforced one another through the design, data collection, and analysis phases. These themes were Discourse Analysis, Thematic Network Analysis, and Q-methodology. These three themes are not independent of one another, instead they were designed to feed back into, and build upon one another to explore the systems inherent complexity. These three approaches provided a solid methodological base, but in two specific cases they were insufficient for the purposes of the research. In these cases, a further two methods were developed for use in the study; Participatory Frame Building, and Frame Attribution.

The place of framing methodologies in the overview research schematic are given below in figure 5 on page 80.

Key: Discourse analysis shown in **blue**, Thematic Analysis in **green**, Q-Methodology in **yellow**, and Participatory Frame Building in **grey**.

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[6] Translation: "I'll talk to the European Commissions' Humanitarian Aid Office's (ECHO) Water Sanitation and Hygiene (WASH) Country Office (CO) about the United National Office for the Coordination of Humanitarian Affairs' (OCHA) Rapid Needs Assessment (RNA)"
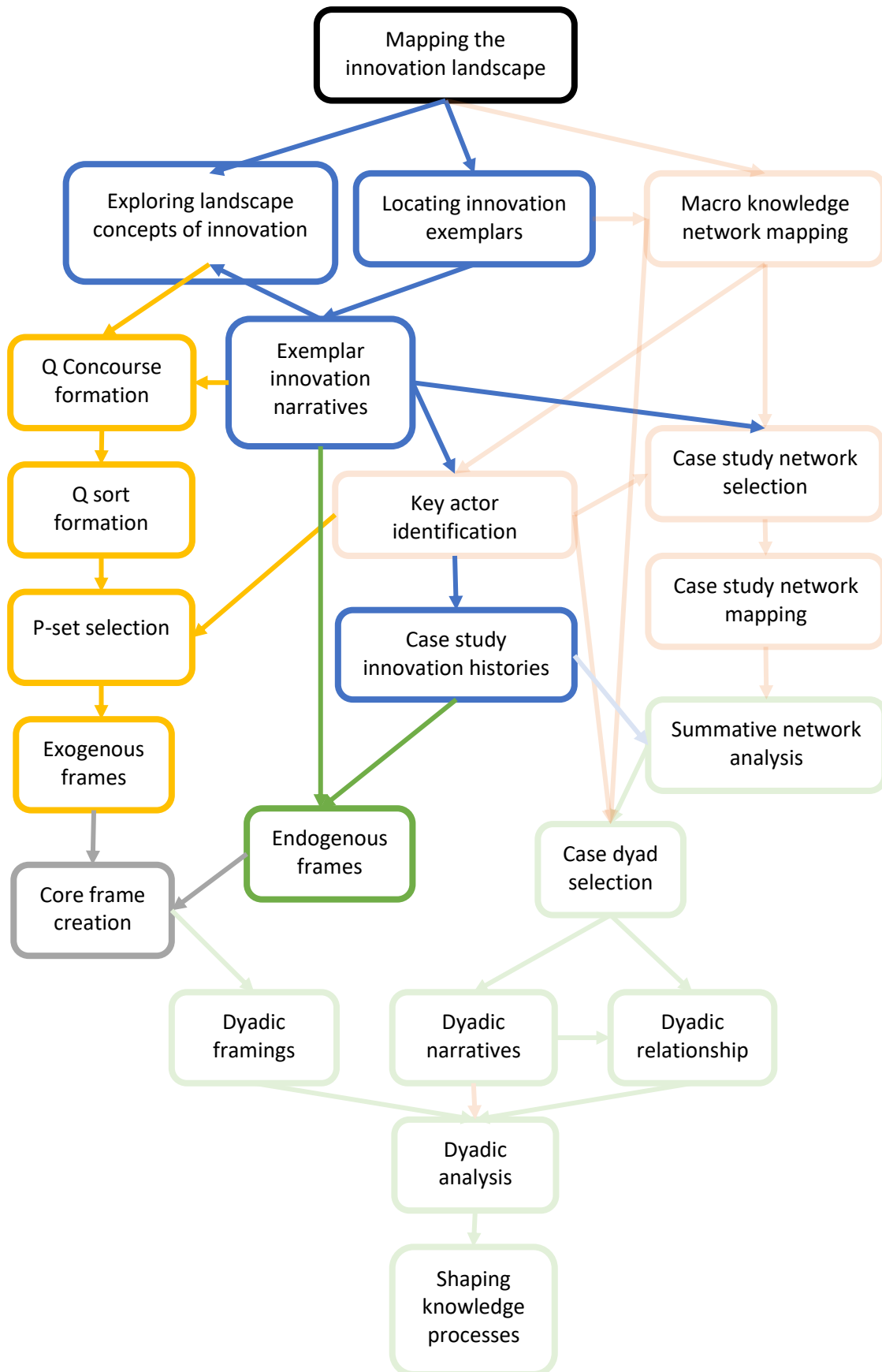
Figure 5: Framing methodology schematic

3.4.1 Discourse Analysis

Shown in **blue** in figure 5 on page 80.

In this study framings are used to capture a composite of actors' beliefs, perceptions, and attitudes. Multiple techniques exist to guide researchers in uncovering these subjective positions, many are based upon the rigorous and systematic analysis of communications surrounding a phenomenon of interest. One central approach selected for use in unpacking framings is Discourse Analysis.

Discourse Analysis is often considered by academics to be a broad canon of theories, philosophies, and techniques that examine how communications ('discourse') can form the basis of socially constructed identities and actions. Sub-themes of Discourse Analysis have been developed to address specific questions such as Gender-based, Political, Intercultural, and Computer-mediated Discourse Analysis amongst others. This study positions itself alongside the theoretical and methodological model proposed by Scollon and Scollon (2001), which they term 'Mediated Analysis'. Mediated Analysis originates from a school of Intercultural Communication, refocusing away from individual actors as the subject of study to examine instead shared actions as a form of social discourse. This model holds multiple advantages for this study; principally it avoids the use of arbitrary preconceived 'cultures' as units of analysis and can engage with innovation as an item of shared action that supports a model of hybrid creation.

3.4.1.1 Capturing discourses

Framing data collection requires respondents to feel able to refer to a broad range of topics and narratives; the inclusion of framings in network research necessarily means understanding this range of topics in a systematic way. This study used semi-structured interviews to collect data that would form the basis for comparative analysis. Respondents questioned on their current role, history, education, and experiences. Secondly, respondents were prompted to talk in abstract terms about innovation, moving on to providing specific examples. Following this, respondents were asked to provide short innovation history for a selected number of examples following the methodology in Douthwaite and Ashby (2005). This included identifying key actors and connections in the history of these innovations. Thirdly, respondents were provided with a series of small case studies describing varied levels of 'new ideas' and asked to comment on these from an innovation perspective. The interview guide can be found in appendix 2.

3.4.1.2 Locating voices

The macro network identified a broad range of actors and institutions, all of which had the potential to contribute to a greater understanding of knowledge hybridisation processes. There was insufficient time and access to properly evaluate all these voices, hence it was necessary to identify actors who were able to provide specific insights into the processes in question. Actors chosen for interview included respondents who were influential in innovation histories, held key positions within the macro- or case-study networks, held unique positions within groups, or could provide novel well-informed perspectives on the study topic.

As this study was based on endogenously-defined actor characteristics and avoided presumtions of shared cultures and world views, the population selection approach used in the Discourse Analysis section of the study was not designed to provide statistically representative sampling. The aim was instead to represent a cross section of attitudes and belief of actors within the system, hence respondents were selected on a combination of participant suggestion, network analysis, reflective analysis of results, opportunistic sampling, and snowball-based techniques.

3.4.1.3 Analysing discourses

Once conducted, interviews were transcribed and coded following the methods proposed by Schiffrin et al. (2001) using NVivo 11 (QSR International Pty Ltd., 2017). The coding process was informed by field notes taken during interviews, text analysis for key words, and background research including grey and academic literature (Bazeley and Jackson, 2013). Nodes and child nodes were identified and reviewed throughout the coding process; whilst time-intensive, this enabled new themes located in later interviews to be back-traced into earlier discourses.

3.4.1.4 Understanding knowledge creation through discourse analysis

The structured and systematic analysis of the collected discourses was used in four sections of the research relating to both abstract and specific notions of innovation:

Exploring landscape concepts of innovation

Discourses Analysis explored actors' abstract concepts of innovation to identify broad understandings and 'schools of thought' on innovation for pastoralist development. These results guided both Q-method and Thematic Analysis sections (see later) and provided interpretive assistance throughout the research process.

Locating innovation exemplars

Descriptions of exemplars and specific artefacts provided starting points for the creation of macro-level networks and the exploration of potential network case studies.

Exemplar innovation narratives

Following the identification of specific innovation exemplars, overview narratives and histories provided discourses that guided the identification and exploration of the final case studies and assisted in locating key actors through respondent suggestion and description. Discourse nodes and specific quotes from exemplar innovation narratives also contributed to the Q-methodology and Thematic Analysis sections (sections 3.4.2 and 3.4.3).

Case Study Innovation Histories

Following mapping of the three primary case study networks, discourses and innovation histories provided qualitative data to aid network analysis, and to guide the development of later dyadic analysis.

3.4.2 Thematic Analysis

Shown in **green** on figure 5 on page 80.

Discourse analysis provided broad and deep data on perceptions of innovation within the wider system. These rich data were not in suitable forms for direct integration within the network, or for later use in dyadic analysis. It was therefore necessary to locate an alternative analytical tool that could identify general attitudinal themes within the system that could be integrated into the network with relative ease.

As with Mediated Analysis', Thematic Analysis focuses on sites of negotiation rather than the actors. Thematic Networks, as used by Attride-Stirling (2001), bring together concepts from Grounded Theory (Corbin and Strauss, 2008, Glaser, 2017), Frameworks (Spencer et al., 2003), and Argumentation Theory (Toulmin, 2003) into a tested method for organising qualitative data. Thematic Analysis systematically identifies 'strata' of themes that this study suggests may reflect framings embedded in the discourse. Thematic Analysis proposes an identification of lowest-order premises (Basic Themes), contained in groups of more abstract, middle-order principals (Organising Themes), which fall under a super-ordinate '*principal metaphors'* (Attride-Stirling, 2001, p. 388) (also called 'Global Themes'). The attraction of this approach as an analytical tool for this study is the possibility that these macro-level, Global Themes can be used in the final dyadic analysis phase in much the same way as the Factors provided by the Q-sorting process (see 3.4.3 later).

3.4.2.1 Building themes

Part of the power of Thematic Analysis in this study is ability to combine abstract understandings with contextual examples. The data used in the Thematic Analysis was drawn from the exemplar and case study innovation histories, focused on knowledge transactions around specific shared events. Specific discourses were selected for their connection to innovation case studies or their ability to provide novel perspectives on specific aspects of innovations in question. Further key actors were interviewed following respondent suggestions and network analysis (see section on network methodology).

The specific analyses were conducted in line with the earlier discourse analysis, but child and parent nodes were used as the basis for Basic and Organising Themes. These themes were clustered and re-analysed using the responses of specific actors on order to locate the Global Themes most representative of those found in the wider network. These macro-level Global Themes were integrated and used to evaluate dyadic framings.

3.4.3 Q-methodology

Shown in **yellow** in figure 5 on page 80.

The previous two methodologies (Mediated and Thematic Analysis) identified emergent framings from within-network discourses. A possible limitation of this approach was that the unspoken remains invisible; wider issues and pressures that may shape the system may not be given voice. To account for these exogenous themes that may be relevant to the system, this study employed a Q-sort method as a complimentary means of identifying alternative framings.

Similarly rooted in discourse-analysis type approaches, Q-methodology draws on social psychology to provide in-depth analysis of framings and allowing comparison between actors (Stephenson, 1953). The first step in Q-method is the assembly of a *concourse* of statements that is reflective of all the possible framings and attitudes relating to the issue in hand. Subsequently, this *concourse* was reduced to a *Q-set* that was presented to respondents as part of the *Q-method* exercise.

3.4.3.1 Creating an endogenous-exogenous concourse

In order to capture both endogenous and exogenous framings relevant to the study, statements relating to pastoralist innovation were drawn from a range of academic and non-academic literatures. These included peer-reviewed journal publications, academic textbooks, NGO reports, government and donor policy documents, scientific and mainstream media publications and interviews, blog posts, and online commentaries (Webler et al., 2009).

These statements formed the basis of a Q-concourse; a functional Q-set was extracted from this wider concourse both inductively and deductively using a two-stage process (McKeown and Thomas 2013, Watts and Stenner 2012). Inductive coding and analysis was completed using NVivo 11 (QSR International Pty Ltd., 2017), followed by deductive re-analysis using existing innovation and knowledge theories. The statements that existed in both populations were used as the basis of a Q-set; this 'large Q-set' was then reviewed using a structured approach after Dryzek and Berejikian (1993) to ensure representation of all facets of the discursive landscape. The subsequent 'small Q-set' was piloted with peers and non-network actors to check statement comprehension, key theme omissions, and clarity of instruction. Two further statements were added and one removed at this stage to form the final Q-set.

3.4.3.2 Conducting Q research

The Q-research process centres on a ranking exercise that asks respondents to rank the statements from the Q-set in a forced-normal distribution grid-scale, from '*most like you think*' to '*least like you think*' (Brown, 1971, Burt, 1972, Barry and Proops, 1999). Respondents, or *P-set* in Q terminology, were selected to be representative of the diversity of perspectives (Setiawan and Cuppen 2013) rather than offer representativeness or quantity (Eden et. al 2005). Respondents were drawn from the case study network population, using interview transcripts to select on the basis of unique insight as described above.

Respondents were prompted to voice their reasons for statement placement during the exercise, and to explain the position of statements at the extremes. These discussions were recorded and transcribed for use in further analysis. Where possible interviews were conducted face-to-face; where not possible the online Q-Assessor software (http://q-assessor.com/) was used. The use of face-to-face and online Q-sorts in combination has precedents (Gruber, 2011, Cairns and Stirling, 2014), with empirical work suggesting that reliability and validity are not significantly different between face-to-face and remote (postal) Q-sorts (Van Tubergen and Olins, 1978). In line with good practice the sort was also used to identify researcher positionality (Robbins and Krueger, 2000, Swedeen, 2006).

3.4.3.3 Analysing Q-sorts

Once gathered, Q-sorts were collated and analysed using KenQ[7]. Ken-Q is an online, open-source software for the analysis of Q-method 'sorts'. The mathematical process of Q-analysis is well documented (see for example Ramlo and Newman, 2011, Watts and Stenner, 2012) however the

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[7] Accessible at https://shawnbanasick.github.io/ken-q-analysis/

process itself does require the active involvement of the researcher in selecting parameters. Central to the Q analytical process are calculations that relate individual preference rankings ('sorts') to one another in an attempt to locate a (mathematically) 'correct' series of archetypal sorts. The most common approaches used to perform these calculations are Centroid and Principal Component Analysis (PCA) (Ramlo, 2016), possibly combined with Varimax and/or 'hand rotation'. The decision to employ a Centroid or PCA approach primarily rests on epistemological assumptions about Q; Centroid analysis provides a theoretically infinite set of outcomes that require researcher interpretation whereas PCA lends itself to a 'right' answer; likewise, hand rotations are led by researcher perspectives on the data and Varimax by a logic-based process. Due to the relatively small dataset and ease of using Ken-Q both Centroid and PCA analyses were performed on the data to provide triangulation; both processes gave closely related results that lay within researcher-defined limits of acceptability.

Having located a series of calculated Factors, Q-method requires researchers to make decisions about the validity of each for use in interpretation. The variance in each Factor is represented by an Eigenvalue; convention (though not without challenge) suggests that those sorts with an Eigenvalue of less than 1 (the Kaiser-Guttman criterion) should be omitted as not interpretatively relevant (Watts and Stenner, 2005). In this research a single Factor from the PCA process returned an Eigenvalue of 1.0744 – close to the threshold – but was included for completeness at that stage of the analysis. When confounded sorts were removed (those that lay on two or more sorts), this sort ceased to be included. The principal confounded sort was from a donor respondent; it was felt that this perspective could be useful so a hand rotation with this respondent included was performed to explore this possibility.

Following the factor extraction and analytical review processes described above, archetype factor sorts were generated and interpreted using the data gathered during the data collection process (Watts and Stenner, 2012). The final archetypes were combined with Thematic Analysis using Participatory Frame Building (see below) to create a series of core frames that were used for dyadic analysis.

3.4.4 Participatory Frame Building

Shown in **grey** in figure 5 on page 80.

The methodologies detailed above provide structured analytical tools to engage with subjective themes surrounding perspectives and attitudes. The output of these techniques, Global Themes (from Thematic Analysis) and Factors (from Q-Method) provide different framing archetypes drawn

from within the same population. The difference between these two sets of findings was the identification of solely endogenous (Global Themes) or combined endogenous-exogenous (Factors) aspects of these perceptions. For inclusion in network and dyadic analyses, these Themes and Factors needed to be combined into a set of unified Framings. No specific, established methodology existed to guide this combination, hence this study chose to develop its own approach in line with the core principals of the project itself.

3.4.4.1 The mechanics of combining perception tools

The Global Themes and Factors developed above are considered by academics to be "unidimensional summary statements" (Thompson et al., 1995, p.362) reflecting "an evaluation of a particular entity with some degree of favour or disfavour" (Eagly and Chaiken, 1998, p.269). By combining these two sets of statements to create Core Framings, it was vital to limit introduced bias through researcher or participant positionality. This meant that a purely researcher-derived combination would have been inappropriate, instead this study constructed a methodology guided by participatory techniques aimed at reaching consensus.

The use of participatory, or 'bottom up' approaches allowed the establishment of culturally-specific reference frames (Willgerodt, 2003). Participatory techniques were employed in this stage of the study to identify common reference points for respondents within Global Themes and Factors; links between these features were developed further through social-level theories of Sense Making (Weick et al., 2005) and Collective Knowledge (Hecker, 2012).

3.4.4.2 The theatre of participation

Participatory methods may employ a variety of techniques from open-ended questions, vignettes, to qualitative observation (see, for example, King et al. (2004)) to provide "*supporting information for a deeper analysis*" (Infield and Namara, 2001, p.51). For the combination of Global Themes and Factors, this study used an iterative process of small-group activities. For this study, these groups were constructed from participants to represent different social, cultural, and gender groups, opportunistically selected to maximise potential diversity of attitudes. These groups were presented with the individual Theme and Factor statements and asked to describe a fictional character who typified this attitude. Having populated an imaginary *ollaa* (village) or organisation (depending on pastoralist or NGO respondent group), groups gave each attitude-character a name and role.

The researcher then presented three scenarios (fictionalised versions of the three case studies) that affected the *ollaa*. The group were then asked how each attitude-character would respond to these scenarios, and to identify any similarities or conflicts that would occur. In every situation this

triggered a series of intra-group debates that highlighted the central commonalities and differences between the Themes and Factors as viewed by the respondents. At this stage respondent groups were asked if there were any other attitudes that had been missed out ("people in the village who could not be seen"), to try and capture any positions that were not represented in the Themes or Factors. This stage of debate was either free-form or loosely guided and was recorded for further analysis.

Having focused the respondent group onto these factors, they were then asked to create a series of *ijolle* (lit. 'children') for pastoralist groups/character-archetypes for NGOs that represented attitude-characters, becoming 'people' who represented either commonalities or differences. This process was repeated until each of the *ijolle* had nothing in common with its brothers or sisters. Groups then were asked to describe these *intala-* or *ilma akkoo taatuuf* (lit. 'granddaughter/son') in the same manner as the original Themes and Factors to form the basis of the Core Frames.

This exercise was repeated with varied groups until the no significantly new *ilmoo* ('offspring') as viewed by the researcher were found. These *ilmoo* formed the Core Frames and replaced the Themes and Factors as the basis for two further rounds of interpretation to check applicability and relevance across different communities. It was positive to note that the process appeared universally well received, and the researcher felt that respondents actively understood and engaged with the methods.

In total six rounds were completed with groups of four to ten pastoralist respondents (two elite male, two non-elite male, two non-elite female), and three rounds with groups of two to four NGO respondents (two field and one Nairobi). Pastoralist respondents completed a second round with three groups of four to ten (one elite male, two non-elite male). A final cross-community applicability check using pastoralist responses to NGOs and vice versa. These had three NGO field actors in one group, and five non-elite pastoralist males in the other.

The central analysis focused on ensuring the wording of the *ilmoo* (as proxy core frames) accurately represented the attitudes and beliefs expressed through the process. This was done using field notes kept during the process, through translation and review of key sections of group debates, and by further questioning of selected individuals where necessary. The primary output of this process was the creation of three core frames that would be used in the dyad analysis section.

3.5 Beyond observation: Explaining hybrid knowledge processes

Section 3.3 set out the techniques used to map and explore networks of knowledge exchange, section 3.4 detailed the methods used to identify and capture framings from within the study population. Both sources provide insights into the complexity and creativity within pastoralist systems, but do not provide a coherent explanation of how knowledge hybridisation processes are shaped.

The section that follows outlines how this study moved beyond a collection of descriptive observations, or a "*loose federation of approaches*" (Burt, 1980, p.79), to search for an underlying framework that could provide explanatory power to understand processes of hybrid knowledge creation. The creation of this framework drew on data collected as part of the network and framing research components, brought together in a systematic manner, and applied to understanding a selected group of actor-actor dyads that represented specific features of the knowledge hybridisation process. This section is divided into three themes; firstly, discussion of how the analytical framework was developed, secondly, how dyads were selected for analysis, and lastly the process by which the analytical framework was used to explore and explain knowledge creation.

3.5.1 Constructing an analytical framework

The focus of this study on innovation as a process of hybrid knowledge creation places individual relationships at the centre of any analytical framework. (Nelson and Winter, 1982, Metcalfe, 2000, Sahal, 1981). Viewing acts of knowledge creation at the actor-level across varied populations requires any framework to be able to "*elaborate on different aspects of reality*" (Andreas Wald (2014, p.64), citing Alan Bryman (2007)). Both Wald and Bryman were addressing the challenges of integrating a range of data sets to provide both explanatory power and validity; two key aspects of developing an explanatory framework.

The first step in developing an analytical framework was the collation of empirical data and reflective appraisals. Throughout the data collection process, themes and thoughts emerging from discussions and experiences were recorded in a field journal. Unaware of any conventions, the researcher unknowingly followed the stream-of-consciousness style of the ethnographer John Van Maanen (1988) that separated observations from theoretical considerations. Over the period of research, these observations and theoretical reflections on began to coalesce into a firmer set of (at first) patterns, then a series of suggested links between concepts and observations. This process

mirrors that suggested by a number of academics who develop frameworks from mixed-methods research (Eisenhardt, 1989). This literature largely mirrors approaches from Grounded Theory (Glaser, 2017), Case Study (George and Bennett, 2005), and Social Network Analysis research (Brandes et al., 2006) that suggest the use of comparisons and triangulations to identify common themes across data sets; these comparisons are then used to provide insight into underlying dynamics (Strauss and Corbin, 1994, Corbin and Strauss, 2008, Ayres et al., 2003).

When refining the data to be used in structured comparisons, this study drew on the work of George and Bennett (2005). These authors suggested that specific comparative cases should be selected with a clear research objective in mind (in this instance to describe factors shaping hybrid knowledge processes), to be of one phenomena (the exchange of knowledge), and lastly that the case should contain elements of theoretical interest (in this research the starting point was the suitability of existing frameworks of analysis for use in pastoralist contexts).

3.5.1.1 Refining the framework

Interpretive analysis of this type is recognised by scholars as an iterative, inductive process that involves both the decontextualization and recontextualization of data (Morse and Field, 1995, Ayres et al., 2003). This study followed a recursive process throughout data collection and framework construction: data sources on innovation pathways were reviewed and compared to identify common themes. Outline theoretical concepts were developed through a reflective, iterative process in line with Grounded Theory (Charmaz and Belgrave, 2008). These concepts explored using emergent categorisations and characterisations of data; these themes were then re-interpreted as to their relationship to the observed innovation pathways.

Two key considerations emerged as relevant when refining the framework: when to stop adding cases and data, and when to stop iterating between theory and data (Eisenhardt, 1989). In this study time and other resources meant that it was impossible to reach 'theoretical saturation' – the point when no new phenomena are observed (Glaser et al., 1968). This suggests that any framework created would benefit from further exploration, but practical limits for case study inclusion are a common phenomenon (Gillham, 2000).

The second consideration – when to stop iterations – was more straightforward in this case. It was understood by the researcher that any framework generated would most likely be similar to a 'mid-range theory' (Boudon, 1991), an analytical framework rooted in a set of specific empirical examples rather than making claims to a grand- or meta-theory. This meant that data and concept exploration could continue until any changes resulted in negligible alterations. This finalised framework could

then be used to explore and explain hybrid knowledge creation within a series of selected dyads, as given in the following section (shown in **green** in figure 6 on page 91)
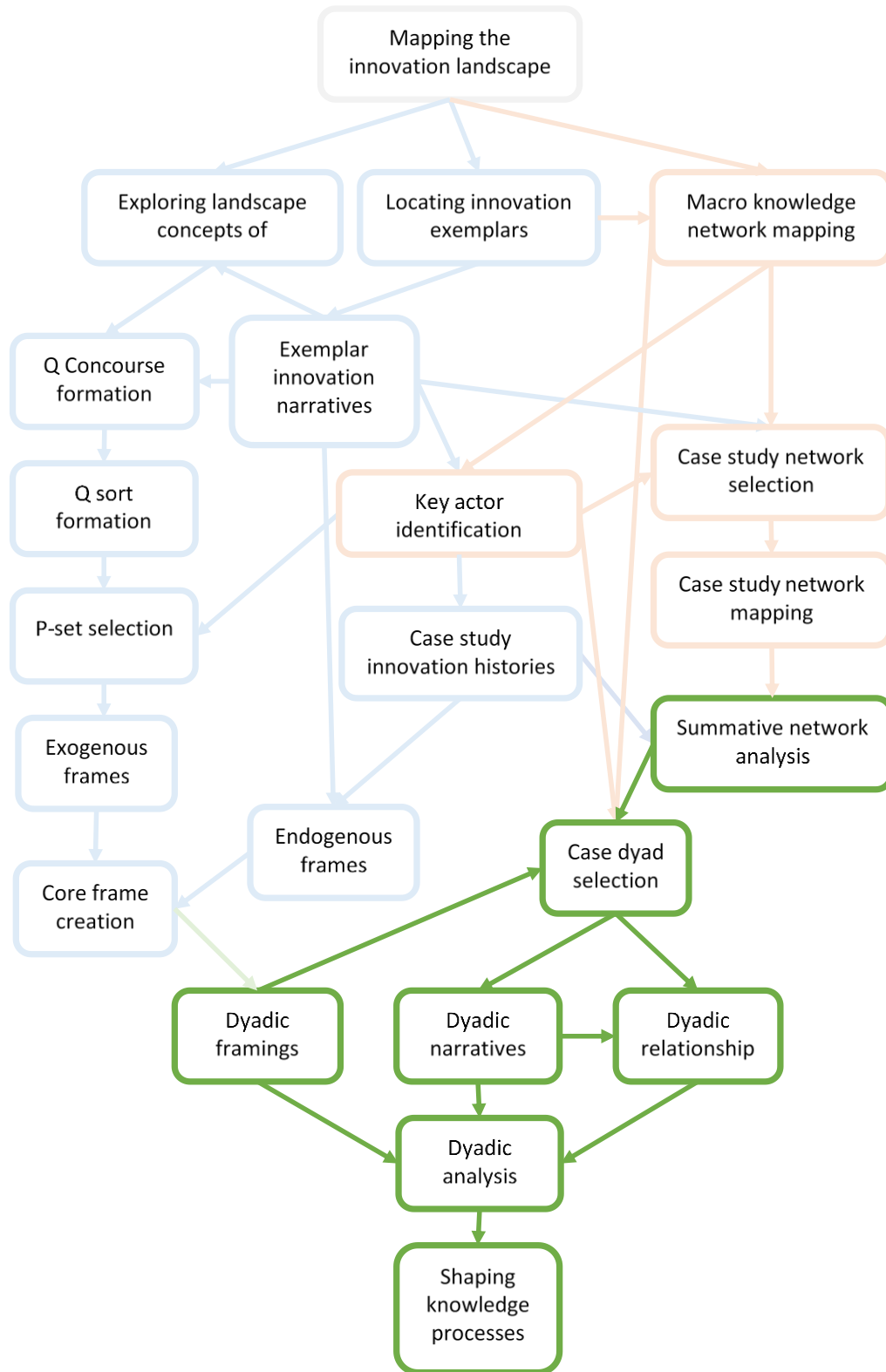
Figure 6: Dyadic methodology schematic

3.5.2 Locating dyads for analysis

The analytical framework development process outlined above concludes by suggesting the use of the framework to explore and explain knowledge creation processes within specific actor-actor dyads. The use of dyads as a unit for analysis is common practice in psychological literature that addresses individual actions, a view that supports this research's position of "*larger social networks (are) comprised of a multitude of interconnected dyadic relationships, where the whole is equal to more than the sum of its parts*" (Burk et al., 2007, p.397).

Individual dyads have varying degrees of interdependence from wider network influences (Cook and Kenny, 2005), influences that can be suggested as shaping the overall knowledge creation processes (Wasserman and Faust, 1994, Carrington et al., 2005, Hanneman and Riddle, 2005). This section is divided into two further parts that describe firstly how dyads were selected for analysis, and secondly how the framework was used to explore hybrid knowledge creation.

3.5.2.1 Dyadic identification

Following the work of George and Bennett (2005) on structured case selection, the following process was used to identify dyads for inclusion:

1. Firstly, network characteristics were used to identify actors with high betweenness and degree values as to focus on interactions that were able to speak to connections between different actor groups in the field setting (see appendix 9).

2. This population was then cross-referenced for representation of Communities of Shared Framings to ensure representativeness (see below)

3. A shortlist was created by continuing to include actors in descending order of betweenness and degree, until all the framing populations identified in the previous chapter were represented by at least three actors.

4. The ego networks of each of these actors was examined to identify examples of strong and weak linkages, and homogeneous and heterogeneous framings.

3.5.2.2 Linking actor characteristics to framings

As mentioned above, one of the dyadic selection criteria was the possession of a specific set of framing characteristics. The process of framework testing required careful case selection to maximise validity and reliability (Morse et al., 2002), to ensure methodological rigor, and to reflect the heterogeneity of the actors within the network (Creswell, 2013).

In the process of developing the analytical framework, identifying framing diversity without a full investigation was a problem. Traditional actor characteristics used for analysis of pastoralist populations include gender, wealth categorisation, education, and occupation (O'Kell, 2011, Barrett et al., 2001, Fratkin and Roth, 2005). Network studies suggest that these actor characterisations may shape personal knowledge networks (Borgatti et al., 2009), but it was less clear how these features related to the possession of specific framings. To avoid exhaustive interviewing of respondents it was decided to explore links between framings and population characteristics to provide methodological rigor in the dyad selection process.

3.5.2.3 Communities of shared subjectivity

To evaluate assumed links between actor characteristics and framings a representative sample of each of the traditional categorisations was selected from within the study population using progressive random sampling of anonymised network nodes until each category contained at least three respondents (see appendix 4). Each respondent was then presented with the core framings developed in section 3.4.4 and asked to evaluate their similarity with the position. Respondents could use any scalar value they wished (unlimited numerical, stone piling, line drawing etc…); responses were then converted to a scalar value and plotted into a graph.

To examine the diversity of framings, the data was plotted as a series of heatmaps to graph the range of each framing by population characteristics (see, for example, Pryke et al., 2007). These maps were used in combination with recorded interviews as an 'eyeball' method to determine which of the four categorisations provided the most relevant differentiation. This categorisation was then plotted to display variance using Microsoft Excel (2016); the plot was then reinterpreted to identify if any further 'best fit' categorisations could be derived to represent communities of shared subjectivities.

3.5.3 Using the framework to explore hybrid knowledge creation

Section 3.5 outlined the process of developing an analytical framework, 3.5 details how dyads were selected to act as subjects for analysis. This section sets out the analysis of the selected dyads using the framework, drawing on theories and techniques from chapter two. This analysis was completed in two principal stages; firstly, the role of relationship characteristics in shaping knowledge creation processes, and secondly, the role of framings and perceptions on the processes.

3.5.3.1 Analysing relationship characteristics using the framework

Section 2.9 described the various ways in which relationships between actors have been shown to influence knowledge exchange and creation. Many of these texts suggest ways in which

relationships can be classified to aid interpretation (see, for example, McCulloh et al., 2013); rather than adopting an established set of characteristics, this study employed discourse analysis-based techniques to locate internally-relevant themes and categories using a similar process to sub-network identification (Ayres et al., 2003, Morse et al., 2002).

The data for this process was gathered through loose semi-structured interviews with the dyads selected in section 3.5.2. These interviews focused on relationships with a specific alter; respondents were asked to provide a brief history, give examples of all types of exchanges with the alter, and to discuss knowledge and knowledge-sharing in general and specific terms. Following this semi-open process, each respondent was asked to describe the strength of their relationship with the alter, a process designed to identify asymmetry within relationships.

Firstly, the respondent was asked to draw a physical scalar line in the sand, and place "*someone you would share little knowledge with*" at one end, and "*someone you would share most knowledge with*" at the other. Respondents were then asked to place the dyadic alter on the line in a place that represented "*how strong is your link is with them*". The word 'link' was chosen following pilot testing, as the terms 'relationship' and 'bond' were felt by many respondents to carry alternative (often complex) meanings associated with friend- or kinship. The position on this line was recorded and translated into a numerical value between 1 and 10. The use of the a context scale for the relationship placed the dyadic link as a form of Boundary Object (Carlile, 2002) that acted to limit recall bias and promote cross-community dialogue. For a full interview guide see appendix 8.

Following this process transcripts and field notes were analysed using NVivo 11 (Bazeley and Jackson, 2013) to identify and develop endogenous themes from each dyad (Strauss and Corbin, 1994). This identification was conducted within pair (within-case) and between dyads (cross-case) to develop and refine common relationship themes (Coffey and Atkinson, 1996). Each dyad was assigned the relevant thematic categorisations and plotted onto the framework. Relationship strength was mapped in a similar manner as a value of out of ten, and graphically mapped. This led to the creation of two sets of twelve dyadic maps, produced to display strength and character data.

3.5.3.2 Analysing framings and perceptions using the framework

Earlier in the thesis this study suggested the use of intersubjectivity to explore links between actor perceptions and knowledge creation. Literature on intersubjectivity contains extensive theoretical debates but makes limited reference to specific research methodologies. This study chose to develop a methodological tool for exploring intersubjectivity in pastoralist settings, building on the four methodological approaches reviewed by Gillespie and Cornish (2010). These four, comparative self-report, observing behaviour, analysing talk, and ethnographic engagement, were assessed for

their potential contribution to validity and explanatory power of the study in order to triangulate the data (Hesse-Biber and Leavy, 2010). Due to limitations in time and resources, this study was forced to adapt the more in-depth ethnographic positions to collect enough data for comparative analysis. This study therefore developed a complementary methodology - Frame Attribution – to provide a structured form of attitude evaluation that would actively engage the respondent in evaluating the proportional distribution of frames (the *Framing Spectra*) of the ego and alter in the dyad (see below).

3.5.3.3 Developing a Frame Attribution methodology

The Participatory Frame Building Process (section 3.4.4) provided this study with a series of core framings, common attitude tropes that existed throughout the network, used as a tool to evaluate dyadic actors' attitudinal distributions. Techniques for comparative attitudinal studies often lacked the requisite depth (such as Likert-style) or analytical comparative rigor (such as interview-led) for use in this study. Endogenously-generated factors such as core frames allowed space to capture nuances as through their contextual relevance and internal validity. What was required was a specific structured methodology for employing core framings to study intersubjectivity.

Drawing on the ranking work of Talbott (1963), the Likert-style literature of Brown (2002), and developments in self-attributed abbreviated categories discussed in Baker et al. (2010), a novel methodology was developed to reflect the possible plural existence of core frames within each actor. Each actor was asked to suggest the degree and proportion to which they engaged with each of the core frames – Frame Attribution - to provide a Framing Spectrum, or *direct perspectives* to use the intersubjective terms from Laing et al. (1966). The advantage of these spectra is that they could also be used to easily and quickly collect actor's beliefs on the perceived core frames of others (*meta-perspectives*), providing comparative data between egos and alters.

Once collected, these Framing Spectra were used to collect data in line with the methods adapted from Gillespie and Cornish (2010):

Comparative self-report

Actors were presented with the three core frames developed using the methodology given in 3.4 and were asked to think carefully about the three statements in relation to innovation occurring in North Horr (Laing et al.'s *object* of intersubjectivity), and if any of their views could not be included in one of the three statements. Once they had indicated their understanding, respondents were asked to draw three lines on a piece of paper that represented the proportions of each Core Frame. The length of these lines was then recorded (in millimetres) and the proportions of each core frame

calculated, providing a *Direct Perspective*. Respondents were then asked to complete the same exercise for the dyadic alter to give a *Meta-Perspective*[8].

Observing behaviour

Behavioural observation such as employed by O'Toole and Dubin (1968) is most commonly associated with biometric or behavioural measurement. This approach was considered impractical and inappropriate for this study, but notions of mirroring and similarity were used to inform other sections of the methodology.

Analysing talk

Intersubjectivity often refers to common reference points or assumed behaviours (Garfinkel, 1967, Schegloff, 1992). Part of understanding how dyads share knowledge was through the exposure of assumptions; in this study these silent conventions were of interest for crossing community and cultural groups. Using the North Horr innovation 'object' respondents were asked to describe their interactions with the alter during a 'real world' innovation, and in response to a hypothetical innovation that focused specifically on communication. The comparison between real-world and fictional events highlighted assumed norms between ego and alter.

Ethnographic engagement

The three approaches above were evaluated independently of one another. Authors such as Robert Prus (1996) suggest that greater depth of understanding could be gathered through a holistic, ethnographic approach, a position that can be both participatory and observatory (see also Ricoeur, 1973). Whilst an in-depth ethnographic evaluation of each dyad was not practicable, where possible respondents were met in their places of work and observed during a series of meetings and interactions to provide complimentary data if available.

3.6 Conclusions

This chapter began by reiterating the challenges of researching complex, subjective topics such as knowledge creation processes highlighted earlier in the thesis. The ability of mixed-methods approaches to triangulate multiple sources of data provided a starting position to capture the variety of actors within the system. This led to the development of a research strategy that integrated multiple methods and theories, the more in-depth diagrams used above are

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[8] It would have been possible to ask respondents to create a Framing Spectrum for their belief of the alter's view of them to gather a *Meta-Metaperspective,* but this was considered beyond the scope of this study.

summarised in figure 7 on page 97; steps shown in **red** in relate to questions of knowledge networks, in **blue** relate to framings, and **green** to hybrid knowledge creation processes.
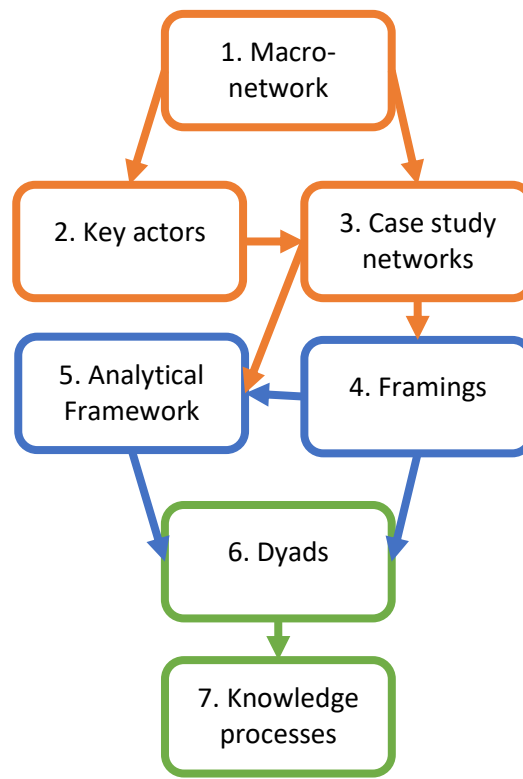
Figure 7: Summary methodology schematic

The exploratory macro-network (1) was constructed from multiple overlapping ego-networks relating to innovations and innovators. Qualitative interview data and quantitative network calculations identified key actors (2) within the network; the data provided by these actors was combined with additional network analysis to identify a series of potential innovation case study sub-networks (3). These case study networks were investigated and analysed using Thematic Analysis, Q-methodology, and Participatory Frame Building to provide a series of framings (4). Information from the case study networks and framings were synthesised through a structured process to develop an analytical framework (5); this framework provided the basis for deeper exploration of selected actor-actor dyads (6) using data on relationships and framings collected in earlier stages of the research. The results of the analysis of the dyads using the internally-relevant framework was the basis for explaining how framings and networks may shape hybrid knowledge creation processes (7) in pastoralist societies.

This research process was designed to engage with the complexity mentioned above and engage with the under-researched topic of pastoralist innovation. The methods were chosen for use in a specific context, these decisions were made based on wider literature and the prior experiences of

the researcher. The following chapter introduces the specific study context, detailing the site and populations that form the backdrop and subject of the empirical portion of the research. The chapter briefly outlines the histories of the communities involved and highlights the changing knowledge flows throughout the region. The chapter concludes by setting out the ways in which development groups and pastoralist communities access knowledge and bridge networks in the twenty-first century.

Chapter 4:

Study location and context

Picture 6: Engaged and active

Despite their geographical and political remoteness, the Gabra of Northern Kenya are actively engaged in creating their own futures. In this picture, the gentleman proudly shows off his ink-stained thumb that marks him as having voted in a local election.

4.1 Introduction

The first section of this chapter introduces the study location and develops the themes of contestation permeating the communities in the study. The chapter provides a potted history of the communities and development in the region to identify the changing nature of knowledge flows into and out of the area. Having established the historical foundations the chapter introduces the cast of actors that populate this research. Reviewing the characteristics of pastoralist and development communities, the chapter moves on to describe formal mechanisms through which knowledge is mediated and transferred in the study site. Lastly channels of knowledge flow are reviewed to locate potential sites of cross-community knowledge exchange as sites of study.

4.2 A crucible in shifting sands:

The margins as sites of innovation

When first encountered, the county of Marsabit does not dispel its reputation as the largest, driest, and most sparsely populated county in Kenya. The seemingly endless sand-seas of the Chalbi region are only interrupted by the eruption of coarse tooth-like banks of black basalt rock that give the area its local name, *Dida Galgalu* (lit. 'plains of darkness'). Punctuating this arid expanse is Mount Marsabit, a black-green volcanic mast moored in a motionless sea. Whether this first encounter is by road, air, or satellite imagery, the cluster of buildings huddled at the foot of the mountain do little to dispel the nautical metaphor. They remind the viewer of nothing so much as arid limpets, clinging to a rock in an attempt to resist the unending and unfriendly attempts to dislodge it by the world at large.

Whilst dramatic, the comparison with a tidal zone is not entirely without justification. From the shoreline the sea can appear to be a uniformly uninviting place, wholly unsupportive of 'our form' of life. But see things from a fish's view, and the rocks appear equally unappealing. One perspective remains in this analogy; that of the tidal-dweller. This liminal zone, uniquely and simultaneously outside and within both worlds, is a place of fantastic diversity and rich variety that is forged of the very 'otherness' that makes it appear alien. These liminal zones exist across the globe and are home to various populations that are considered to exist 'on the margins' of national influence. In the case of Marsabit, these populations are pastoralists, nomadic herders who exist in the transition zone between the industrialised nation-states of Kenya and surrounding countries, and the arid expanses of the Chalbi.

The geographical marginalisation of the region from the rest of the country is very real; traditional rural livelihoods seen elsewhere in Kenya are rarely appropriate for this area - only 3% of the available land is suitable for farming (ALRMP II, 2008). With a lack of mainstream livelihood strategies came a lack of economic, developmental, and government contributing to 62% of the population existing below the national poverty line (Central Bureau of Statistics, 2005). Social, economic and environmental pressures have contributed to the further marginalisation of Marsabit in mainstream Kenyan politics; chronic under-provision of services has led to record low levels of literacy and numeracy compared to the rest of Kenya (Kilele, 2006). This lack of state engagement in combination with a population of diverse ethnicities has led to a volatile situation that is suggested as further inhibiting mainstream economic development activities (Little and Mahmoud, 2005).

These statistics paint a bleak picture of life for the communities who inhabit the region, echoes of which can be heard in the streets of Nairobi, Kisumu, and Nakuru. If, however, we leave the urban centres, step outside the NGOs' 4x4s and listen to the voices of those who live within the dunes, a very different narrative appears. For thousands of years pastoralist communities have lived, traded, travelled, and thrived under the baked Marsabit sky. The close relationship of the desert-dwellers to their environment generated unique and complex social and cultural institutions that have maintained a way of life in the face of such apparent environmental threat.

This study focuses on one of the ethnicities who call the deserts around Marsabit home – the Gabra. The Gabra are traditionally a camel-keeping pastoralist society, but recent years have seen the expansion of herds to include sheep, goats, donkeys and rarely cattle (Ganya et al., 2004). Livestock are economically (Robinson and Berkes, 2010) and socio-culturally (Tablino, 1999) central to the Gabra way of life, generating further specific socio-cultural institutions surrounding livestock and livestock-keeping. These norms are reflected in attitudes of resource sharing and access, for example all Gabra herds have the right to graze anywhere on 'Gabraland' (Schlee, 1989) and use any Gabra-controlled wells (Robinson, 2009).

The Gabra of the 21st century arguably exist in a more contested position than ever before. Gabra communities find themselves positioned between two powerful, often conflicting forces. On one hand come ideas of nation-led 'modernity' with narratives of progress and civilisation arriving hand-in-glove with issues of technological advancement and denial of resource access, increased service provision, and the erosion of traditional norms. On the other are senses of cultural identity, oft-romanticised ideas of 'traditionalism', networks of kinship and community, and fealty to a wider cultural whole.

The tension between these forces is felt throughout the Gabra community. Increasing national and international pressures have led to marked changes in Gabra cultural practices (Tablino, 1999), including the increasing abandonment of mobile livelihoods and resultant sedenterisation (Diocese of Marsabit, 2012, Witsenburg and Roba, 2004). These changes have led to wide diversifications of pastoralist livelihoods with resultant socio-economic differentiation within previously traditional communities (Watson and Binsbergen, 2008). Diversification options in Marsabit district vary in nature and household impact; from limited changes to herd species composition in response to droughts, through to wholesale and retail trade, waged employment, and farming (Little et al., 2001). Farming provides a useful example of how livelihood diversification may result in markedly different outcomes for a range of members of pastoralist society. Argued by researchers as both a viable risk-managed livelihood strategy (Campbell, 1984, Smith, 1998) and a destructive, risky endeavour (Hogg, 1987) pastoralist farming is a common addition or alternative to traditional herding. Farming, as with many other diversified strategies is employed by different members of the community in different ways. Gender plays a key role, with women more readily undertaking small-scale farming and growing projects (Little et al., 2001). Likewise wealth; for many years it has been understood that poorer pastoralists farm for survival, whereas richer members of the community may do so to maximise wealth (Hogg, 1986, Little, 1985). Many authors attribute this difference to resource allocation decisions, however the overall impact is largely the same; once exited it is hard for poorer ex-herders to re-enter 'formal' pastoralism, whereas wealthier pastoralists maintain their livestock in addition to diversification. This dichotomy is centrally relevant to this study. Whilst the definition of pastoralism (and often pastoralists) offered by development groups revolves around a dependence upon livestock, what of those who have exited herding? In many cases these ex-pastoralists still identify as pastoralists, still access and contribute to existing social and cultural networks; often more-so than wealthier members of the community (Tasker, 2012). Rather than a livelihoods-based definition of pastoralism this research opts instead to focus on questions of identity and community, suggesting that this approach will capture not only 'formal' pastoralists, but also those who have exited herding by choice or circumstances. These livelihood ex-pastoralists include some of the most vulnerable and disenfranchised members of the community, and as such should not be overlooked where possible. Despite the introduction of banking and increased market access for these individuals, the cultural value of livestock remains central to Gabra society, with herd sizes a consistent proxy of wealth for Gabra households (Cohen and Little, 1997, Fratkin, 1998, Fratkin and Roth, 2005, Davis et al., 2007, O'Kell, 2011).

These examples illustrate some of the many dialogues occurring in this marginal space, and in taken isolation may appear as part of an evolutionary path. When these changes are considered as part of

a wider complex system the effects are brought into sharp relief. From the examples above, the consequences of sedenterisation can be profound on those who exit mobility. Settling in one location offers herders improved access to services at the cost of livestock livelihoods; whilst a socio-cultural focus on livestock remains those inhabitants who have lost their animals forfeit some access to community coping mechanisms and are consequently most at risk of extreme poverty (McPeak and Barrett, 2001, Mango et al., 2004).

It is precisely these types of changes, these ever-present pressures and opportunities which makes pastoralist regions such an interesting focus for the study of innovation pathways. By rooting this study at sites of contact between tradition and modernity, between incumbent cultural institutions and advancing industrial hegemony, there is an opportunity to explore how innovation pathways are shaped in the crucible of life at the margins.

The specific site chosen for this study is the semi-permanent Gabra community of North Horr. North Horr lies two hundred kilometres North West of Marsabit, across some of the harshest terrain in the Chalbi desert. Historically a waypoint for travellers, North Horr is now home to a small, permanently settled population of Gabra; the settlement continues to act as a social and cultural hub for more traditional herders passing through. North Horr's position and permanent water source made it an attractive proposition for a Catholic Mission in 1963, and in recent years it has become a favourite forward field base for several NGOs. This diversity of traditional and modern, and the potential for knowledge exchange and co-creation between widely differing actors, are the primary reasons North Horr was selected as the location for the study.

Picture 7: Sandstorm approaching North Horr

Picture 8: The commercial heart of North Horr

The Gabra settlement of North Horr is the focus for this study. North Horr does have a limited number of permanent buildings but looks may be deceptive. Since their installation in the 1980s, the power lines in the picture above have never been connected to a generator.

4.3 Knowing and being known:

Knowledge flows and the Gabra of North Horr

4.3.1 A history of knowledge encounters

North Horr's position and role in development provides a locus for knowledge exchange between external and indigenous actors. The recent growth of NGOs stations in North Horr should not imply that prior to their arrival the community has been isolated from external knowledge; quite the opposite, the Gabra of North Horr have a significant history of engagement with external actors and institutions and the development of hybrid knowledges.

Whilst the Portugese were present on the East Coast of Africa since the 16th century, it was only as late as 1888 that Europeans penetrated as far as Gabraland (Tablino, 1999). This period heralded a flurry of European expeditions to the region; the American A. Donaldson Smith first reached Marsabit in 1895, but it was in 1901 that the Austrian explorer Wickenburg recorded the first detailed descriptions of settlements in the area through local informants. Around this time the new Ethiopian monarch Menelik II, and the Imperial British East African Company came into violent contact in Kalatcha, a settlement a short distance from North Horr; the Gabra record the year of the battle (1895-96) as *Sabdi Siddami d'ufe* and *Sabdi Ferenjini d'ufe* – 'the Saturday year when the Ethiopians and Franks arrived', heralding the first references to a non-African people in the Gabra calendar.

Following the establishment of national boundaries shortly afterward the British East Africa Protectorate[9] assigned North Horr into the Northern Frontier District (NFD). The NFD was comprised of sections of lands claimed by multiple ethnicities, Borana, Burji, Gabra, Rendille, Ariaal, Samburu and Turkana; as a result, inter-ethnic tensions were high and violence common. This resulted in the area being administered by a civilian population but assisted by a significant military presence in the form of the Kings African Rifles (KAR). The proximity of The KAR post in Marsabit was the first recorded (limited) means of communication between the Gabra of North Horr and the outside world. During and following WWI, British and South African troops are remembered in Gabra lore as building a road from Marsabit to Mega; whilst a noteworthy event, this new infrastructure did not significantly change knowledge access in North Horr as the NFD remained a 'closed district' that required a pass for any non-resident to enter.

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[9] The 'Kenya Colony' was not established until 1921

Reversion to civilian rule in 1925 saw a proliferation of administrative posts, staffed largely by Goan clerks, and the introduction of a postal system. The postal process relied on dispatching letters and parcels whenever a vehicle happened to be travelling – a system that still exists today. Low levels of literacy meant this method of knowledge gathering was of limited use to the Gabra, however the newly-installed police radio network quickly found favour as a means of reporting conflict and illness. The system of 'police calls' is still popular today, with police and community radio units acting as hubs of contact between distant communities out of mobile phone coverage.

At that time the British administration were actively involved in herding and livestock management; British veterinarians had hands-on involvement addressing the spread of Foot-and-Mouth disease, stock routes and quarantine facilities were established to supply ranchers further south, and bloc grazing was introduced to limit conflict by providing armed police. This last move was warmly welcomed by the Gabra, who consider this year to be "*a golden age and [the administrators were] admired for their devotion and commitment to Gabra wellbeing*" (Tablino, 1999 p. 232). The closing of distance between the Gabra and the colonial administration led to the imposition of village chiefs by the colonialists as the British, monarchists that drew on experiences with the hierarchical West African tribal groups, were unable to comprehend the democratic elder-councils of East African communities – cultural systems such as *luba* and *gada*[10] were understood even less (Hallpike, 1976). Chiefs acted as conduits for colonial input and funnelling out taxes, a deeply unpopular move among the Gabra.

Outside of formal governance, the 1920s saw the expansion of small shops and concessions in Marsabit as enterprising merchants, predominantly Somalis, gained permission to trade providing limited goods and services in North Horr. These traders led to a limited expansion of Somali Islamism, however the local religion continued to flourish. A few months before independence in 1963 the colonial administration gave permission for Catholic missionaries to come and build a school and dispensary within the settlement of North Horr, and with the church came further contact to the wider world.

4.3.2 Contemporary politics and networks of influence

The move from colonial rule to independence did not immediately increase the Gabra's engagement with the nascent state of Kenya. Following the Shifta War of 1963-1967 (recorded by the Gabra as *Ahada haramia*, 'the Sunday year of the bandit') Kenya and Somalia signed a peace treaty leaving the NFD as Kenyan, and entitling every adult Gabra the right to vote in upcoming elections (Branch,

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[10] *Gada* refers to the traditional Oromo social system, or which *luba* is a series of classes. For more see authors such as Hallpike (1976), Tablino (1999), or section 4.4.1

2014). The voting process has only ever returned one Gabra to elected office, a District Commissioner at Isiolo; the Gabra credit a fellow pastoralist, a southern Massai (Phillip Masindet[11]) with introducing the new Kenyan government to the area.

The development of a 'Kenyan identity' has been a slow process to develop in the region, but exposure to external political infrastructure such as voting and democratic representation were well received by the Gabra. The new national sentiment was felt predominantly in the towns, but in many cases Gabra voters would walk for days to cast their vote (Tablino, 1999, p. 236). National elections have become a fixture in Gabra culture to this day; in 1974 a Gabra candidate lost an election by a small number of votes and was replaced by a member from another tribe – this loss was felt as a communal failure and a public calamity by the Gabra population at large.

North Horr did not however entirely escape political influence; politics, and political power, became opportunities to explore new ideas of identity and to capture resources. Under national rule, North Horr was placed administratively in the department of Marsabit North; an area that included significant populations of both Gabra and Borana herders. By the 1980s, old practices of territorial invasion, livestock raiding, and reciprocal violence were influenced by external and internal politics leading to the sub-division in 1988 of Marsabit North into North Horr (Gabra) and Saku (Borana) influenced by Gabra and Borana leaders. This nominal division was however insufficient to stop the violence; the period from 2003 to 2008 saw escalating conflict between the Gabra and Borana that only ceased through concerted efforts that led to the Maikona-Walda Declaration in 2008 (Nyikuri, 2011).

Following this relative peace, arguably the most profound political shift in the last decade has been the 2013 devolution of power from Nairobi into the counties of Kenya (Scott-Villiers et al., 2014). Marsabit was no different, with the county administration given responsibility over matters of agriculture, health, water, trade and infrastructure. Marsabit has been seen to struggle with this process more than many other Kenyan counties; issues of accountability and transparency, wastage, nepotism, and ethnic profiling seen across the country are compounded by poor engagement with the population, substandard economic planning, and wider project implementation (Sanjir, 2017). The resigned belief, commonly held by many Gabra, was voiced to this study as "*devolution is not about giving the power to us, it is about bringing corruption closer to home*" (Anon, 2016). Many authors suggest that corruption and dysfunction may not be signs of a failure of governance in these regions, instead they can be seen as symptomatic of networks of informal power that "*reach below the formal well-mannered surface, growing outwards from elite incumbents in national institutions,*

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[11] Masindet held this office from 1962-1975

penetrating layers of local leaders" (Leguil-Bayart et al., 1999, cited in Scott-Villiers et al. 2014). Seen from this perspective it is possible to visualise devolution not as a gifting of power from one centre to another, but as just another field in which opposing forces attempt to exercise influence and control. The close relationship of power and knowledge in these cases suggests that the tendrils of informal power could operate as much as knowledge conduits as tools of political influence (see, for example, Foucault, 1972).

4.3.3 Infrastructure, development, and access to knowledge

Despite this friction in political spheres, investment in infrastructure and development has flowed into the region (Watson, 2010). In the 1970s a power station was constructed in Marsabit, followed by a local telephone system and banking in the early 1980s. The new (unpaved) road from North Horr towards Marsabit brought in new building materials and eating houses, bars and lodgings. This work continues into the 21st century; most recently Turkish investment has led to work on paving the road between Nairobi and Marsabit, supported in no small part by a perceived desire to attract Asian investment to the region following county devolution. The unfinished paving of the Nairobi-Marsabit road commonly attracts disparagement and mocking by residents who cite the fact that it is currently possible to drive from Marsabit to Addis Ababa without leaving tarmac.

Regardless of the source, access to new techniques and materials through the introduction of roadways has come hand-in-glove with ideological immigration. Along with the now well-established Catholic mission and historic Somali-led Muslim community, came itinerant Muslim teachers, *malinke*, holding Qur'anic classes, *dugsi*. Originally freelance, these teachers are increasingly employed by Islamic organisations based in Nairobi, Saudi Arabia and Iran. Notably there has been limited friction between Islamic and Christian fractions in North Horr, however this may well be attributable to the persistence of local forms of religion, and a historical resistance by the Gabra to both Somali ingress and the idea that you couldn't eat non-halal meat.

Whilst the Catholic Church and Islamic Foundations introduced the region to the beginning of development assistance as we know it today, the major droughts of the 1970s and 1980s resulted in an influx of relief and development agencies (Fratkin and Roth, 2005). By 1985 funders were supporting exits from what they saw as the *"impoverished way of life"* offered by pastoralism (Scott-Villiers et al., 2014, p.7). Settlement and the promotion of farming were major themes in development discourses of this period that have remained to this day, persistent misrepresentations of the problems of pastoralism. These narratives have led to repeating waves of interventions that have failed in similar ways (Sandford, 1983), leaving behind trails of half-formed attempts and unlearnt lessons (Hogg, 1987, Baxter, 1991, Anderson and Broch-Due, 1999). These failures have not

dulled the enthusiasm or interest of development actors, though the realities of working in the area can lead to high attrition rates. By the most recent reckoning publicly available, in 2005 there were upwards of one hundred and fifty Non-Governmental Organisations (NGOs) registered in Marsabit, of which fewer than 15% are currently active (Muriungi, 2012).

In respect to development, North Horr is a mirror of Marsabit town the decade before. Local families trace waves of NGOs and interventions through a timeline of donor-attributed signposts standing next to latrines, water points, roads, and camel corrals. The Catholic Mission still stands in the centre of North Horr, engaging in long-term dialogues with the community, whilst multiple NGOs have ridden waves of funding cycles; arriving, implementing, evaluating, and leaving when resources dry up. At the time of the study the two NGOs found in North Horr were veterans of pastoralist development in the region, Veterinarians Sans Frontiers Germany (VSFG), and Solidarities International (SI). VSFG has been operating in North Horr since the mid-1990s, establishing itself in the town first as an animal health-based organisation, then expanding its reach to include variously water, sanitation, and hygiene (WASH), conflict resolution, livelihoods, and microfinance in response to community need and funding opportunity. SI is a more recent addition, arriving in North Horr in 2007 as a satellite station from Marsabit. Since then, SI in North Horr has grown to include a range of longer-term livelihood projects amongst others. Even in the short time that this researcher has known the area this has changed; a first field visit in 2012 found five operational NGOs in addition to faith groups and community projects. Of the two that remain VSFG and SI follow quite different models in their operation and organisation which contribute to alternative models of community engagement and knowledge sharing; the following section discusses the relevance of these in more detail.

Picture 9: Standing ground

Here, the stone-built Catholic mission to North Horr (right) stands above the sandstorm as it rips around the mobile dwellings of the parishioners.

4.4 Daimtu and development:

Actors and sites of knowledge creation

The section above illustrates the diversity and richness of links between the Gabra of North Horr and the world at large. The research does not limit its exploration of knowledge to a macro-level perspective; this study is interested in understanding knowledge exchange and creation occurring between individuals. The regional-level backdrop of conflict between indigenous and incoming cultures described above can be considered a reflection of individual-level contestations played out in the streets and scrublands of North Horr. Building on this micro-level approach this section introduces specific groups of actors that populate the research, and provides a contextual overview to the cultures, collaborations, and channels surrounding knowledge exchange.

4.4.1 Actors

The history of North Horr is one of meeting and exchange, a literal and metaphorical oasis from the isolation of the desert. Whilst indigenous households were historically mobile, local institutions and

external settlers have established footholds in the town with varying degrees of permanency. These institutions and organisations exist alongside one another with varying degrees of interaction and independence; their relevance to this study is twofold. Firstly, each collective group confers access to wider networks on members, networks that may provide knowledge and resources through behaviours and structures. Secondly, these institutions are not mutually exclusive; individuals may be members of multiple groups which require careful negotiation to maintain but enable bridging of disconnected networks. The three groups of actors used to illustrate these aspects are the indigenous Gabra, local government, and external development actors.

4.4.1.1 Traditional Gabra networks

Despite being buffeted by the winds of modernity traditional Gabra systems of relationships maintain a strong role in day-to-day life. To unpack the complex webs of interconnections and exchange that typify Gabra life, it is worthwhile setting out the major affiliations available to pastoralists.

At the macro level, Gabra society is overseen by the *Gada* system of elected officials who make legal and cultural decisions, for which they are fully accountable. The highest *Gada* unit in North Horr is the *Adula* council of six men, led by the *Abba Gada* (lit. 'Gada father'). The power of the *Adula* is exercised using universally respected *aada* (*customs)* and *sera* (laws); this power is invested in assemblies, both formal assemblies such as the *Gumi Gayo* ('multitude of Gayo') and more ad-hoc local assemblies such as the *barazza* (village meeting). These meetings serve as points of contact for sharing news, information, and ideas. They are also used as places for debate and exploration amongst groups, providing space for decision-making and collective action (Kassam, 2006).

For an individual Gabra there are further levels of network access. Every individual is a member of a *Luba* (Gada-class), tied to an *hariyya* (age set). These age sets are one of the most obvious features of the Gabra, with each *Qomicha* (young man), *Yuuba* (political responsibility) and *Da'abela* (religious responsibility) and *Jaarsa* (retired elder) having specific dress and commanding respect. For this study the primary relevance of these sets is their role in guiding the response of the Gabra community to emergent opportunities and threats and in consultation as respected repositories of knowledge. Alongside the *Luba,* a Gabra will have a *Gogessa* (patriclass or moiety) – either *Jibo* or *Lossa* – that guide marriage options and broad kinship ties. Within each group individuals are considered to be *ilman korma* (active), *ilman yuba* (semi-retired), or *ilman jaarsa* (retired), influencing the dynamics of knowledge sharing within and between these categories (Tablino, 1999, Tasker, 2012, Torry, 1978).

These categories are universal to male Gabra, however the Gabra community is further divided into five *Gosa* (phatries), the *Algaanna*, *Gaara*, *Galbo*, *Odoola*, and *Shaarbana*. These five groupings are possibly the most relevant to this study, as they represent close non-family contacts with whom the Gabra typically exchange knowledge. Each *Gosa* posseses a *Ya'a* (ritual village), overseen by the *Abba Dibbe* (father of the Drum), *Abba Magallata* (father of the Horn), and *Abba Uchuma* (father of the fire), who perform a similar role in advising on cultural matters as the *Da'abela* do for other issues. Each *Gosa* is further sub-divided into a series of *balbala* (lit. 'doors'), for example *Shaarbana* and *Odoola* have nine *balbala,* and the *Gaara* have nineteen.

Balbala are often colloquially translated as the Western equivalent of 'extended family', though this hides much of the subtlety of the relationships. Family networks such as these are often diffuse entities; on the local level individuals are commonly encountered in *milo* (bloodline-sections) or *worra* (extended patrilineal family), found in an *ollaa* (village) comprised of *manyattas* (houses or households).

Picture 10: Barazza

The barazza provides a forum for sharing of knowledge and opinion, conducted at varying scales and locations. Here, a tree provides shade for an ollaa-wide gathering.

4.4.1.2 Traditional Gabra knowledge sharing

These structures illustrate the plurality of traditional knowledge channels available to individual Gabra, including group knowledge-sharing institutions such as *barazzas*. Acts of knowledge utilisation and sharing amongst the Gabra have their own set of cultural norms that help explain how knowledge flows between individuals. These cultural institutions can be broadly separated into two groups; institutions that guide the storage of knowledge, and those that govern the sharing of knowledge.

Pastoralist societies contain a range of communally-accessible knowledges maintained in a range of locations. Previous studies have examined a range of pastoralist knowledge types, commonly these range from broad-based concepts such as natural resource management (Homann, 2005) to more specific subjects such as ethnoveterinary medicine (Gradé et al., 2009, Moritz et al., 2013) to specific disease knowledge such as tuberculosis (Melaku et al., 2013). These studies often record the role of 'wise men or women' as repositories of collected knowledge; these positions range from formal, culturally-recognised specialists to the assumed wisdom of older and more experienced herders. Gradé et al. (2009) records the highly formalised example of traditional veterinary healers among the Karamojong pastoralists of Uganda, noting that these healers were much more effective at transmitting knowledge when engaged in active sharing. The Gabra by contrast have a far less formal system, with *Da'abela* who show aptitude for livestock health receiving the title of *Chilres*, an informal position that recognises the possession of respected livestock experience. *Chilres* do not typically actively disseminate their knowledge, instead they respond to those herders who seek them out.

It is not just the locations of knowledges that are recognised in cultural institutions; processes of sharing knowledge are also supported by cultural norms. A key concept for Gabra knowledge sharing is *daimtu* (lit. 'news'). The process of *daimtu* (exchanging news) is deeply embedded in cultural forms, described by a North Horr Gabra elder as *"the heart of the Gabra lays within our animals, but the eyes and ears of the Gabra are daimtu"*. During seasonal movements, family groups may come into contact either accidentally or at scheduled cultural events; whenever such meetings occur, individuals hail each other with a well-established series of greetings that end with the exchange of "*daimtu*". The process of *daimtu* (exchanging news) is also used by the Gabra to describe how new knowledge enters the community through individuals. *Daimtu* may be considered more than the common noun-translation of 'news' but also as an active verb. The practice of *daimtu* guides knowledge sharing, prioritisation, and presentation. The differentiation between the object and practice of *daimtu* is of possible importance for exploring the response of traditional practices when encountering new spheres of knowledge exchange.

4.4.1.3 North Horr and national governance

As described earlier, the district, and North Horr have a complex relationship with national Government. The most obvious point of political contact is the Village Chief, a community-elected role first established by the British colonial powers. The Chief acts as a point of contact between county resources and local interest groups, advertising opportunities and reporting concerns. The chief's is only responsible for North Horr; other nearby communities have their own elected officials.

The mobile nature of Gabra *manyattas* can lead to confusion as it is often unclear under whose jurisdiction a transitory encampment will fall.

Above the chief, all the settlements in Marsabit North fall under one central official, who in turn is subordinate to the Member of Parliament for Marsabit. In theory it is this MP who can direct goods and services to each community, however in practice the Gabra of North Horr exploit multiple channels to access alternative resources. Examples include using NGOs to engage with drought programming by mobilising resources from the Ministry of Agriculture, Livestock, and Fisheries (MALF), the Kenyan Forestry Research Institute (KEFRI) and the National Drought Management Authority (NDMA). MALF is a particularly relevant agency due to the central role played by livestock in pastoralist life; links between MALF and North Horr are the District Veterinary Officer (DVO) and Animal Health Assistant (AHA), both of whom report to the County Veterinary Officer (CVO) in Marsabit. By understanding these alternative knowledge networks and rationales for selection, this study aims to explore how new knowledge can be created across multiple points of contact.

4.4.1.4 Development actors

Aside from the government structures and traditional institutions listed above, a range of non-governmental actors operate out of North Horr who may contribute to knowledge exchange. Christian and Islamic groups (especially the African Inland Mission and the Catholic Church) have been active in the region for many years providing longer-term, often community-led support and development.

On the other end of the intervention spectrum can be found specific 'development' NGOs, two of which (VSFG and SI) were referenced in the previous section. These work as part of wider consortia, however siloing of knowledge and practice into organisations is commonplace meaning that groups often have limited amounts of formal knowledge exchange. At the time of research, the other NGOs operating in the area were Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) and Cooperative for Assistance and Relief Everywhere (CARE) who work with populations in North Horr on livelihood projects; the Catholic Organisation for Relief and Development Aid (CORDAid) and *Kenya Red Cross Society* (KRCS) and the International Federation of the Red Cross (IFRC) had a focus on water projects. These projects fall under three primary funding programmes: La Nina, Enhancing Resilience in Communities Affected by Drought in Marsabit and Tana River Counties (REACT) and Drought Risk Reduction Action Plan (DRRAP). The relevance of differing donor programmes is the variety of institutional macro-level supports and opportunities (and requirements) for knowledge sharing between NGOs involved in these funding consortia. The links forged between NGOs and donors through formal consortia are often considered by NGO respondents to be less relevant for

knowledge sharing than field-level actions due to the often-political nature of the exchanges and learning processes (discussed in following chapters). Local NGOs may also shape innovation pathways in North Horr, but the only group of this type that was active in North Horr (in 2012) was the Pastoralist Integrated Support Programme (PISP); from 2015 onwards, the only groups with an active presence in North Horr were VSFG and SI.

4.4.2 Engaging with communities

North Horr-based NGOs employ a range of methods to deliver pastoralist development programmes and to engage with communities against a backdrop of governmental policies and projects. The history of development activity in the area shows a fluctuation between humanitarian-type aid deliveries in times of drought, to longer-term peacebuilding. It is not the purpose of this study to discuss the relative impacts of the relief-development continuum (Hinds, 2015, Haider, 2014), save to say that North Horr has experienced both ends of that contrast in the last three decades.

This section firstly examines the backdrop of national development policies relating to health, education and the Hunger Safety Net Programme (HSNP) relevant to the study area. Given the centrality of livestock to pastoralist communities, the role and influence of agricultural extension in Northern Kenya may also be relevant and is reviewed afterwards. At a local level, five principal methodologies for project delivery can be considered relevant for this research: Community Animal Health Workers (CAHWs), Pastoralist Field Schools (PFS), Community Managed Disaster Risk Reduction (CMDRR), Village community banking (VICOBA), and Participatory Epidemiology (PE) with Participatory Disease Surveillance (PDS).

Kenyan governmental support: Education, health, and the HSNP

As described earlier, Marsabit county and North Horr in particular, are geographically and politically remote from centres of Kenyan power. That is not to suggest that national policy and programming has no influence in these marginal locations; however, the enactment and delivery of core services such as health and education face challenges that may be unfamiliar to the relatively richer and better-connected counties surrounding Nairobi. North Horr does boast both state schools and a government health centre, however it is worth considering how these services are accessed and supported when considering their influence on the local population.

The delivery of education to mobile pastoralist communities may be cited as a further point of conflict between national models of key services and local realities. This conflict arises from the fundamental competition between the design and delivery of formal education, and the perpetuation of pastoralism through the learning of specific skills and behaviours (Krätli, 2001).

Regarding innovation and development, paradoxically formal education often undermines the knowledge creation capacities of pastoralist areas by undermining senses of pastoralist identity and reinforcing notions of a centre-periphery divide (Anderson and Broch-Due, 1999). Regardless of the use of education as a development approach or tool of statecraft, delivery to pastoralist areas often face resistance from local populations over fixed school locations, questions of security, access to food, and financial burdens. Added to these concerns, issues over staff recruitment and retention in remote areas and it becomes evident why education delivery encounters unique resistance in pastoralist areas. Three schools exist in North Horr, one state primary, one state secondary, and one charity-funded all-ages boarding school. In addition, many of the outlying communities such as Galesa and Quorqa have their own primary schools, but less well-resourced than those of North Horr. Despite being state funded since 2003, all the primary schools in the region require parents to pay small 'top up' funds, nominally for books and materials meaning that decisions to educate children directly affect household incomes, given the work-value of child labour. The boarding school goes some way further to reducing issues of mobility, however there is still a significant financial burden to bear and conditions inside these institutions may be decidedly anti-pastoralist (Närman, 1990). As an alternative to traditional schools, many countries have tried to engage pastoralist communities in mobile education; projects have ranged from solid successes as in Iran (Varlet and Massoumian, 1975) to marked failures as with Nigeria (Umar and Tahir, 2000). Despite a perceived need for a new model of schooling in North Horr, no such mobile programmes currently exist.

Similarly, the provision of education and health services in North Horr fall somewhat outside the planned national model. The North Horr constituency has three operational government health centres in North Horr, Dukana, and Illeret which provide a variety of health services, focussing on the supply of antiretroviral medications (ARVs), the treatment of common illnesses and injuries, and the provision of basic laboratory and diagnostic services. As with education, the North Horr health centre is in principal cost-free, however several specific diagnostic and treatment options incur local costs that can limit therapy-seeking behaviours. Second-tier referral services are available, again for free in principal at the hospital in Marsabit, however this option is rarely (if ever) used (Duba et al., 2001). Limited data exists on other influences on the use of medical facilities, however in reports from the 1990s the Kenyan Ministry of Planning and National Development identified that of all the constituencies in Marsabit county North Horr had the joint highest average distance for any user to travel to a health centre (80km on average) and the highest medically-qualified personnel to population ratio (1:1,993) and bed to patient ratio (1:2,623) of any constituency in the county (Ministry of Planning and National Development, 1994, 1997). Alternatives do exist to formal

healthcare institutions primarily in the form of traditional or informal health care providers, including traditional healers and cultural practices. It is unclear how these institutions articulate with national healthcare provision, though research from elsewhere suggests that many patients may be reluctant to access formal healthcare for a range of reasons (Hampshire, 2002).

The provision of education and health services described above are driven by national policies, operating through devolved governance, in marginal areas. Despite attempts to adapt and refine service delivery for pastoralist areas, orthodox top-down designs and evaluations can be limiting their effectiveness. In contrast, an alternative national policy aimed and addressing food insecurity has received much greater success, in part by recognising the need to reflect local contexts. The Hunger Safety Net Programme (HSNP) is an unconditional cash transfer programme aimed at reducing poverty in Kenya's Northern counties. Beneficiaries were identified at household level by community-based targeting (CBT) and dependency ratio (DR), and individuals for a social pension (SP). The HSNP has been shown to have a significant role in increasing consumption expenditure and related reduction in poverty gap and severity when compared to control households (Merttens et al., 2013). Many authors suggest that the key to the successes of the HSNP stem from a design that enables engagement with local markets and networks providing culturally-appropriate the use of funds. In the 2017 round of funding, 5,382 households in the North Horr catchment were paid a bi-monthly sum of Ksh. 5,400 (c. 40 GBP) that was used for food, servicing household debt, clothing, education, and livestock. The novel use of SMS messaging, radio stations, and mobile money transfer to raise awareness and implement transfers is credited with increasing uptake and impact rates in locations that have been traditionally difficult to target for development interventions.

4.4.2.1 Pastoralist Field Schools (PFS)

PFS programmes are used by both VSFG and SI in various forms. Evolving out of Farmer Field Schools, PFS approaches were first trialled in Kenya in 2006 and were quickly adopted development groups as a novel means of engaging with pastoralist communities. PFS approaches are included in this study as they provide conduits for external agencies to support local experimentation and exploration of livestock techniques through knowledge transfer, education, and technical assistance. In practice VSFG and SI operate PFS programmes in markedly different ways. Following their establishment over the last four years VSFG now pursue a 'hands off' approach with the established schools, promoting self-mobilisation and a light-touch model. SI began PFS programming more recently and has been more active in convening and enabling groups. SI has a series of indigenous, full time Project Supervisors (PS) who regularly met with PFS groups to support their decision making and engaging with other actors such as KEFRI and MALF on their behalf. A success has been the

Multi-Urea Block (MUB), a supplementary livestock feed that can be manufactured from local materials and stored or sold.

4.4.2.2 Community Managed Disaster Risk Reduction (CMDRR)

CMDRR focuses on community-led decision-making surrounding (normally livelihood-based) investments by NGOs and donors. Village committees develop proposals for CMDRR projects which are presented to the delivering NGO for evaluation. CMDRRs are included in this study as these committees act as NGO-constructed focal points for discussion, and as potential channels for accessing external knowledge stocks. Examples of successful projects in the past include water capture, school building, and market development all of which engaged knowledge from governmental and non-governmental actors in their design and delivery. CMDRR has been used in North Horr for many years under an ECHO La Nina-funded project, however at the time of study only VSFG was delivering CMDRR funded through the DRRAP programme. This method of development has become so established in North Horr that in 2013 VSFG integrated the CMDRR into a Natural Resource Management (NRM) strategy that was adopted by the North Horr administration in 2013 (FAO, 2013)

4.4.2.3 Village Community Banking (VICOBA)

Village banking projects are increasingly used as part of development programming across Sub-Saharan Africa as less than twenty percent of the population of this region is reported to have access to formal banking facilities (Dupas et al., 2012). For rural populations access to banking and specifically credit, may provide an important alternative to less desirable livelihood choices such as selling off productive animals (Rosenzweig and Wolpin, 1993) or high risk, health-damaging work (Robinson and Yeh, 2011). VICOBA projects provide small-scale group banking which affords access to micro-loans; VICOBA groups in North Horr typically had between ten and twenty members, all female. VICOBA projects are designed to be self-sustaining with limited input from NGOs after the initial training period. VICOBA groups are included in this study as they are vibrant places of intra-community knowledge sharing; discussions in VICOBA groups can lead to members asking for micro-loans for the purposes of experimentation with new business ideas.

4.4.2.4 Participatory Epidemiology (PE) and Participatory Disease Surveillance

Building on the foundations of established participatory approaches, Participatory Epidemiology (PE) and later PDS was developed in the 1970s in remote pastoralist areas of the Horn of Africa (Jost et al., 2007). PE and PDS approaches have grown in popularity since then coming to be defined as "*the systematic use of participatory approaches and methods to improve understanding of diseases and*

options for animal disease control" (Catley et al., 2012, p.151). PE and PDS approaches offer this study an often-successful practical example of knowledge hybridisation between pastoralist and development groups. The roots of this success may lay in PE's origin as part of the participatory movement which promotes attitudinal change – particularly those of development professionals (Catley et al., 2012). One of the founders of what is today seen as the 'participatory movement', Chambers (1994) suggested that recognition of the need to rethink practitioners' perceptions was heavily influenced by the Adult Education Movement (Freire, 1968). This mode of thinking recognised examples of farm-level research completed by those with limited formal education that paved the way for further developments that highlighted the presence of complex indigenous technical knowledges; developments that promoted a recasting of development researchers as 'co-learners'. This attitudinal shift was formalised in discussions around participatory approaches that stressed the need to engage farmers and local practitioners in the design and development of research, projects, and programmes in opposition to the 'top down' orthodoxy of the day. These approaches have found traction in a range of disciplines, most commonly seen in animal health in the development and adaptation of Community Animal Health Workers (CAHWs) – see section 4.4.3.2 for more details.

From more general participatory livestock approaches, more specific techniques to engage with specific issues of disease surveillance and reporting have been developed. Most relevant to this study are PE and more recently PDS approaches (Mariner et al., 2011) currently employed in North Horr and funded through the REACT programme and delivered by VSFG in collaboration with OXFAM, ACTED, and Concern Worldwide since 2013. The aim of the PDS programme in North Horr is to formalise the transfer of information on livestock diseases from indigenous populations, through an appointed Community Disease Reporter (CDR), to government Veterinary Officers (VOs) who are trained in participatory approaches. The programme is designed to strengthen links between community livestock keepers and government service providers through collaborative investigations and treatment planning.

Grey literature and anecdotal reports (largely from NGOs) suggest that this PDS works well for pastoralist communities due to the ready and observable treatments offered by government contacts in return for reporting. Summary reviews suggest that the programme is popular (see, for example, Kimondiu et al., 2016), however in the same documents questions over the participatory nature of the project have be posed. The training for the CDRs focusses on '*notifiable disease and those of economic importance'* (Kimondiu et al., 2016); 'important' as defined by the Government of Kenya rather than local herders. Routine filed visits by VOs are suggested as beneficial due to their ability to "*improved awareness by livestock keepers on disease control and more effective*

conventional veterinary practices" and *"participatory approaches gives (sic.) livestock keepers an opportunity to share and explain ethnoveterinary practices with veterinary officers which leads to decrease in ineffective or detrimental practices and maintains effective ones with clear guidance by veterinary officer"* (Kimondiu et al., 2016); the 'more effective' nature of conventional practise is left unqualified. Despite calling into question the collaborative, participatory nature of PDS in that particular case, there have been successes. Despite being notionally integrated into the national disease reporting infrastructure, one of the largest challenges relating to the PDS programme referenced by NGOs include a lack of support at county and national level – alongside a lack of awareness by communities on conventional disease control measures.

4.4.3 Sites of interaction

The sections above describe the main actors involved in development in North Horr and highlights formal channels through which knowledge encounters could occur. Formal channels represent one route of knowledge exchange in pastoralist settings; from East Africa (Homann, 2005) to the Gobi (Schmidt, 2006) to the Pyrenees (Fernández-Giménez and Estaque, 2012) or Colorado (Knapp and Fernandez-Gimenez, 2009) pastoralist communities are renowned for their ability to develop, explore and exploit informal networks of knowledge sharing. Wood (1999) suggested that a process of informal knowledge exploration was central to the Gabra way of life: *"alteration was an essential part of who he (Orto) was. It is what Gabra men do: go out, leave home, venture away from the centre, make friends, have exotic experiences, and then return transformed by the knowledge"* (Wood, 1999, p.113-114). The following section illustrates two contemporary informal networks of knowledge sharing in North Horr; community mobilisation and mobile communications to

4.4.3.1 Informal networks

The previous section identifies a series of formal indigenous and NGO-led networks through which individuals may seek and engage with various knowledge sources. These networks are often characterised by barriers to open use, either through cultural affiliation or project recruitment. Just as with the notion of culture described in the earlier chapter the inclusion or exclusion of an actor from a network rarely means that actor has no alternative knowledge-transfer relationships; pastoralists are adept at seeking advice and knowledge through multiple channels. These alternative channels are referred to here as informal networks, though it should be recognised that whilst they may be informal when compared to the examples given earlier they are not without rules and expected behaviours. The adaptive role of extension workers and the private sector, and traditional community mobilisations are described below as illustrations of these types of networks.

4.4.3.2 Extension workers and the private sector

If one considers indigenous traditional networks and NGO-interventionist knowledge-sharing as two ends of a spectrum, there exists a series of networks between the two poles. These networks most commonly centre on key actors who can provide access and resources that indigenous and NGO networks may not; a common example of this relates to animal health. Using the scale suggested above, at one extreme lies the *Chilres* and traditional ethnoveterinary knowledge, at the other programmes like the VSFG-led PDS scheme and government interventions. Between the two there are alternative sources of knowledge that herders may choose to engage with from actors such as Community Animal Health Workers (CAHWs) and agroveterinarians. CAHWs have been a common feature of NGO and government extension work across East Africa, acting as treatment providers and access points for wider animal services in remote areas (Allport et al., 2005).

Initially developed in India (Hadrill, 1989), Afghanistan (Leyland, 1992), and Africa (Leyland, 1996, Maranga, 1992), early CAHWs based much of their practice on participatory enquiry and collaboration with livestock keepers. When combined with increasing interest by the international community in 'ethnoveterinary knowledge' (Mathias-Mundy and McCorkle, 1989) CAHWs are well positioned to act as interlocutors between state veterinary services and silos of livestock knowledge in remote communities. This model of services driven by local demand has provided a unique situation enabling, in many situations, almost complete privatisation of veterinary services in remote areas (de Haan and Bekure, 1991, Holden, 1997). In some cases this position has led to mistrust or opposition from formally qualified veterinarians (Mugunieri et al., 2004), often forcing CAHWs to rely on the support of NGOs rather than existing infrastructure (Sikana et al., 1992).

CAHWs are in many cases able to engage with and mobilise knowledges and other resources from a range of contacts throughout formal and informal animal health systems, however the Government of Kenya has recently altered these interactions by removing the statutory recognition of CAHWs since 2011, at the behest of professional veterinarians, the experience and knowledge of individuals still informally practicing prior are still available in North Horr. Ex-CAHWs often continue to command local respect and the privileges of their previous position, often based on maintaining links with other animal health professionals.

This recognition of experience and resource access is mirrored in the agroveterinarians of North Horr. These individuals operate a series of private shops supplying medicines, supplements, and feed stuffs to livestock owners; owners who will often ask for advice relating to non-responsive disease cases or troublesome conditions. As unqualified para-professionals, agroveterinarians often operate

within a wider network of animal health contacts than 'lay' herders but do not possess have the same leverage with state livestock services as more formally qualified actors.

4.4.3.3 Traditional community mobilisations

CAHWs and agroveterinarians represent two ways in which the Gabra are able access external knowledge networks from within the community. There also exist in North Horr informal cultural practices which enable herders to access internal networks of resources, including knowledge through group actions. The two described below are *Haram-bei* (a 'merry-go-round' system of fundraising), and *ad-hoc* methods of labour mobilisation such as well desilting.

As with many pastoralist societies, systems of reciprocity and sharing are integrated into Gabra culture. These mechanisms of lending and borrowing are often considered by scholars to be a risk-mitigation device termed a 'moral economy' by James Scott (1977). Leaving aside the section of Scott's work suggesting that poor actors are risk adverse (for a counter argument from the pastorlaist perspective, see for example Doss et al., 2008, McPeak et al., 2012) this model of communal sharing highlights is the integration of resource-pooling into indigenous institutions. The *haram-bei* collection is one such process, whereby the family or friends of those in need of assistance will ask for contributions from the community at large. There is no stipulation on reasons for collection or the nature of the gift; examples of *haram-bei* include medical bills, funeral costs, graduations, or political campaigning. Gifts could be financial, time, food, or a myriad of other items or services. The important feature is the cultural act of donation and free sharing both establishes and reinforces links between actors.

Haram-bei collections are almost invariably focused on a single event or person, as such they are considered by the Gabra to be less suitable for chronic or abstract issues such as the ongoing repair of a corral or the clearance of a well. Water and well-maintenance is a central to the Gabra way of life, with a complex series of socio-cultural practices governing how supplies are to be apportioned (Opiyo et al., 2011). Contemporary shifts in livelihoods and mobility have exposed new problems in the management of water points that raise questions of ownership and viability. Traditional water management practices consider water to be communal but attribute ownership of a well to the individual that provided resources for digging. Once dug, there is no compulsion to maintain a water-point and it is likely that he (for it is always a man) and his household will have moved on seeking alternative water sources rather than re-digging a collapsed well. If a drought continues, the *Da'abela* of nearby villages may consider it prudent to reopen a well, in which case a meeting would be held and young men of a suitable age-set would volunteer to dig out the silt. The wealthy

members of the community would normally contribute animals or refreshments for the work party, and historically women would sing around the well to mark the event.

Since the arrival of international development organisations, a proliferation of boreholes, sand dams, water troughs, catchments, and bowsers have provided alternative water access to traditional wells. These high-volume, static points of water access do not easily harmonise with the rhythms of traditional pastoralist life and have resulted in stark changes to traditional cultural practices. As a result, methods and patterns of community mobilisation have changed, with many wells around North Horr remaining unusable due to the reluctance of a youth employed in non-traditional professions to commit themselves to the physical effort of digging out a well they may not use.

4.4.3.4 The digital age

The section above describes ways in which traditional pastoralist institutions are adapting to the 21st century. Alongside pressures, the new millennium has seen the introduction of new technologies that are profoundly shaping pastoralist knowledge sharing. Mobile telephones have quickly become one of the most widely available platforms for knowledge dissemination and interactions across East Africa (Mwantimwa, 2017). As with many emerging technologies, rural communities have adapted more industrialised patterns of phone usage to better suit themselves, for example with models of phone ownership. Whereas in the Global North mobile phones are often personal objects, in East Africa sharing of handsets is common (Krone et al., 2014), overcoming issues of accessibility, affordability, and ease of use (Hellström and Tröften, 2010) can be overcome, the knowledge access afforded by mobile phones can have both direct and indirect benefits to rural communities (Dannenberg and Lakes, 2013) characterised by the integration of mobile communications with existing non-technical strategies, for example the co-sharing of market prices through technological and traditional channels (Sinha, 2005, Munyua, 2000).

As with many of the cases cited above the arrival of a Safaricom telecommunications mast in North Horr is arguably one of the most significant developments in knowledge sharing of the last few decades. Built in the late 1990s, the installation followed the classic Safaricom model of initially offering low-cost, 'bare-bones' type services that supported 'early adopters' of technology (Ngugi et al., 2010). The simultaneous installation of free phone-charging points encouraged purchase and use of phones, tariffs were set to be affordably low, and the benefits of M-PESA (a form of mobile banking) in an area that had had no previous financial services became rapidly apparent to the indigenous population. Many Gabra developed further opportunities associated with these new technologies, including setting up fee-based solar charging stations, and establishing shared handsets with personal SIMs as models of community access.

Recent improvements in the data connection and reductions in cost have enabled the introduction of smartphones with web-enabled apps to North Horr. These phones are typically purchased in Nairobi for under 10,000 Ksh and transported to North Horr by a community member; the increased functionality of these types of mobile phones has led to a meteoric rise in the use of social media, including networking apps such as Facebook and WhatsApp. WhatsApp (WA) in particular has swiftly established itself as the platform of choice. WhatsApp is a smartphone-based application that allows text, picture and video data to be shared between users on any enabled handset or computer, either one-to-one or via groups. Groups may be created by any user who by default becomes a group administrator ('*admin*'); admins are able to recruit to the group, change logos and exclude group members at will. Administrative privileges may also be invested in other group members but the application limits the group size to 100 members, with admins having sole discretion over inclusion or exclusion.

Despite limits on group size and technological barriers to access, WhatsApp has been a runaway success story in North Horr. The language and norms many Gabra use to discuss WhatsApp groups often mirror that of other forums for social exchange such as *barazzas*. This has led to many technologically-conversant Gabra establishing mirror institutions online, including *hariyya* and *gosa* groups; the 'young Algaanna' WhatsApp group was particularly active at the time of the study. Unlike their real-world doppelgängers, these online forums have barriers to entry other than birth and family characteristics; technological use (access to handsets, the price of airtime, ability to charge, reception, and technical literacy) and social position (enough social standing for recruitment and retention) both constrain access. The study uncovered online networks that promote local issues, provide forums for political debate, empower minority groups, and provide professional networking amongst other uses that are dealt with in later parts of this study.

4.5 Conclusion

This chapter provides the context in which the theories of chapter two and methods of chapter three operate. Interpreting the results of this study requires an appreciation of the liminal zone in which the Gabra of North Horr exist, occupying positions of simultaneous engagement with indigenous and external sources of knowledge. Contestations and misassumptions directed at pastoralist groups highlighted in chapter two are key features in the history of North Horr.

Contextual details of modern-day North Horr challenges many of these narratives and support many of the conceptual and methodological choices suggested in chapters two and three. Identification of informal networks across multiple communities supports suggestions that Innovation Systems and

grassroots approaches may be of limited use in understanding pastoralist knowledge hybridisation processes. The presence of multiple overlapping cultural networks and emerging technologies require researchers to consider new ways of exploring knowledge creation; many of the details provided in this chapter support the use of the combined knowledge network and framings approach proposed in the second chapter pf this thesis.

The later stages of this chapter reviewed current ways in which communities may access new knowledges which the network methods described in section 3.3 are designed to capture. Tensions between traditional and modern influences within the community will be explored through framing and dyad analysis methodologies given in sections 3.4 and 3.5. Ultimately the information contained within this chapter informs the collection and interpretation of data that will from the internally-valid analytical framework. The findings of this process aim to provide an explanation of the hybrid knowledge creation processes growing from the dry riverbeds and scorching sands of North Horr.

4.5.1 From theory to fieldwork

Chapters two and three outlined the theoretical and methodological positions taken by this study. The following four chapters present the findings of this research process; chapter five provides details of the macro- and case-study networks and highlights the contribution of these data to establishing an analytical framework. Chapter six reviews the data relating to framings and attitudes and contributes to developing the framework further. Chapter seven details the selection and initial analysis of the case study dyads, whist chapter eight uses the framework to explore the relationship characters and perceptions within these dyads. Chapter nine synthesises these strands using the results of the framework analysis to explore hybrid knowledge creation processes in pastoralist societies.

Chapter 5:

Mapping knowledge networks

Picture 11: Contacts and connections

The Gabra of the 21ˢᵗ century no longer find their knowledge exchanges limited to chance encounters and cultural occasions. Here, a young Gabra woman checks WhatsApp on her Nairobi-sourced smartphone.

5.1 Introduction

The previous chapter introduced the actors and context that form the background to this research. The stage is set with a varied cast of pastoralist and development actors, many of whom bridge conventional ideas of populations and cultures. This chapter sets out the data gathered during the exploration of knowledge networks introduced in chapter two using methods outlined in chapter three to explore links between and within groups and sub-groups that overlap and interact to form the macro-network.

The data in this chapter is presented in the same order as the methodology in the chapter three. Firstly, the exploratory macro-level network is presented to provide a contextual introduction to the differing sub-networks that make up the system. The macro-network is used as the basis to identify key actors by their position and influence in the wider structure; the data provided by these actors helps to select and map specific case study networks. These sub-networks are then examined to explore relationships and knowledge creation in greater depth than in the exploratory network. Lastly, the findings from all three sections are reviewed and synthesised to identify the key features of relationships that help shape the construction of an analytical framework with which to explore process of hybrid knowledge creation.

5.2 Macro-level Knowledge Network mapping

Respondents	Selection	Locations	Field Session	Data collection
88	6-person initial Snowball	17 Nairobi 71 North Horr	1	Semi-structured interviews

The methods for constructing the exploratory, macro-level network was described in chapter three; the complete network contains 152 individual actors and 1 institution, Gabra traditional knowledge (see following section). This gave a total network size of 153 *nodes* with 1,792 *edges* (connections) between them. All *edges* were *directed* (each *edge* passed from one *node* to another), there were no *self-loops* (*nodes* where the *edge* starts and ends with itself), and no *edge weights* (indicating the strength of the relationship) were included at this exploratory stage.

5.2.1 Actor versus institution

The inclusion of an institution proves problematic for network analysis. Mixed institution-individual networks ('*2-mode*' networks) require connections to be actor-institutions, forbidding individual-individual edges to enable analysis. In this research the inclusion of institutions was avoided where

possible; when respondents suggested another actor was linked to an organisation, the interviewee was often unsure who was directly involved (i.e. "*my co-worker speaks to DfID*", as opposed to "*actor X, who works for DfiD, knows*"). Those situations were readily resolved by tracing the individuals with personal contacts and removing the need for a generic institution label. The most significant confounder to this process of individual identification were pastoralists' referrals to 'local knowledge' as a source of guidance. Through clarifying questioning it was clear that this represented a consultation 'up' a cultural hierarchy to engage individuals who held and curated indigenous knowledge on particular topics. During the analysis of those transcripts, respondents would characterise their relationships and discussions with 'local knowledge' in deeply interpersonal terms through a two-way process. This personal-level characterisation of 'local knowledge' informed the decision to include this institution as a node in a *1-mode* network. Consideration was given to excluding the institution, however it was retained to highlight differences between those actors that did, would, or could consult local knowledge reserves and those who would, or could, not.

The data were initially displayed using a two-dimensional Fruchterman-Reingold plot as described in section 3.3. Network plots are displayed with no X and Y scalar values, the plot in figure 8 represents the lowest-energy distribution of nodes and edges, helping the identification of clusters of more highly connected actors within the broader network (figure 8 on page 132).
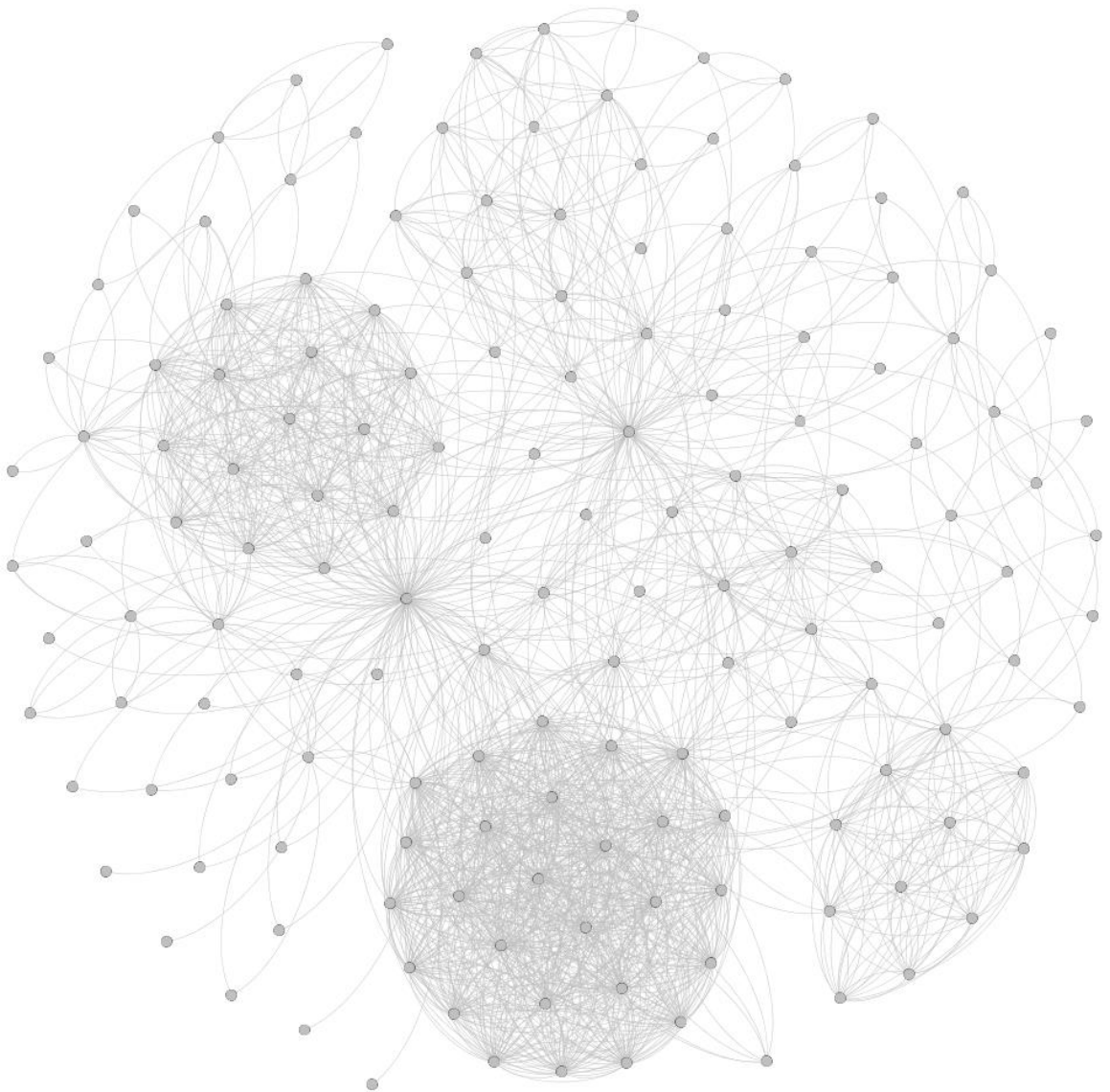
Figure 8: Macro network Fruchterman-Reingold plot

Using this graph as an exploratory tool a cluster of higher-density connections can be seen in the South, North West, and to a lesser degree the South East of the network. These suggest a series of three sub-networks situated within in the macro-network. Network characteristics were calculated following the methodology in section 3.3; the three most useful descriptive values are given below to help compare between macro- and sub-networks.

Measure	Value
average degree	11.71
network diameter	6
graph density	0.08

Table 1: Macro network calculated values

5.3 Key Actor identification

Respondents	Selection	Locations	Field Session	Data collection
24	Network measures (NM) and respondent-led (RL)	*NM:* 1 Nairobi 12 North Horr *RL:* 4 Nairobi 7 North Horr	1	Semi-structured interviews

As described in chapter 3, the macro-network dataset and plot allows identification of key actors within the system based on their position as knowledge intermediaries or network brokers. Following the methodology in section 3.3.2, key actors were in located in part by their connectedness (have a high *degree*) or their position on multiple paths between alternative actors (high *betweenness*). Using calculated values for degree and betweenness the graph was re-plotted to display colour range to reflect degree[12], and size to reflect betweenness[13] (figure 9 on page 134). In this plot, edges were coloured the same as the source node:

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[12] Red as high degree, through yellow, to green for low degree
[13] Size range 1 (lowest betweenness) to 5 (highest betweenness)
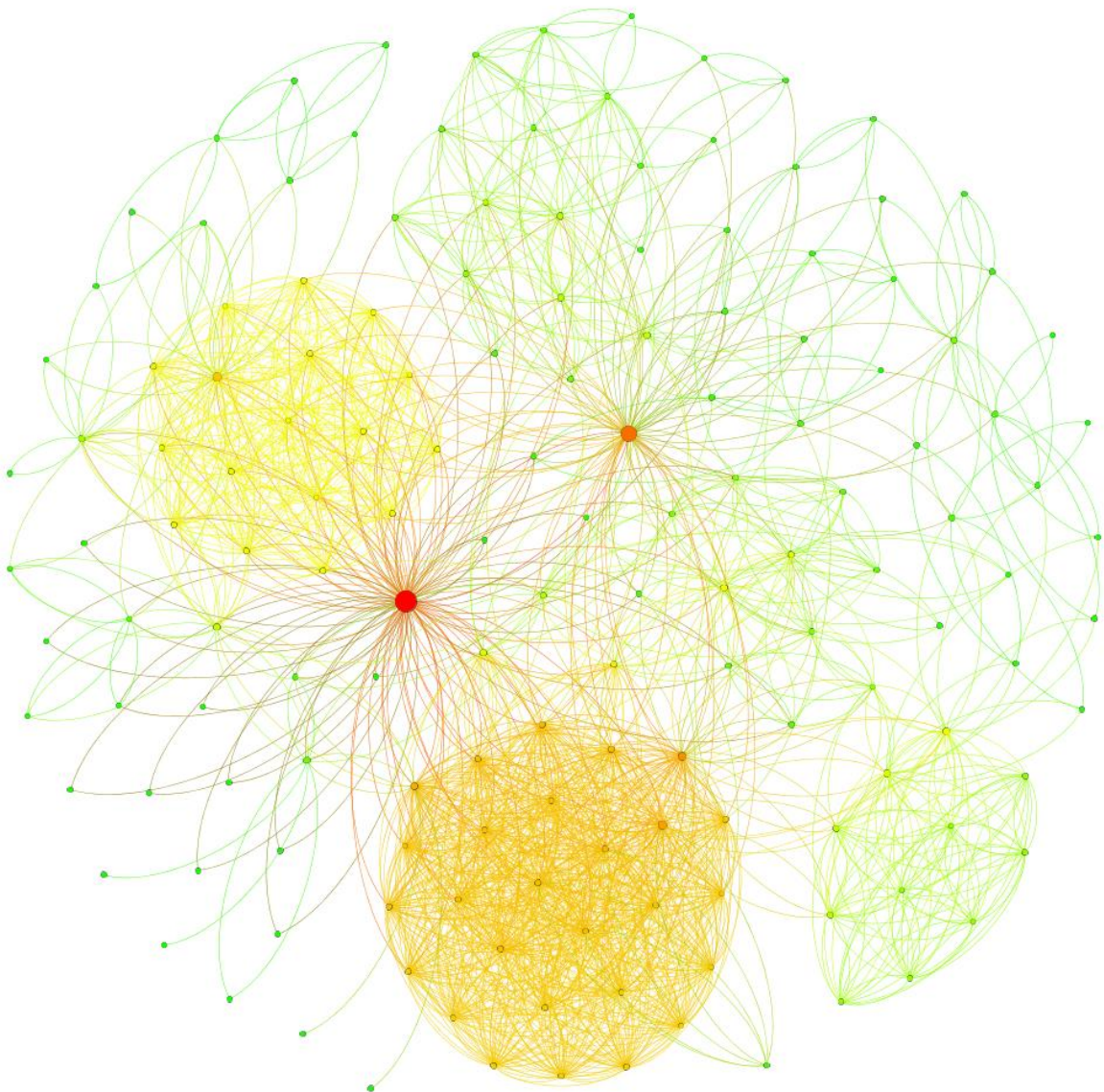
Figure 9: Macro network Fruchterman-Reingold plot showing degree

Degree shown in green (low) to red (high), size proportional to betweenness centrality.

This distribution highlights the interconnected clusters seen in figure 1, suggesting additional yellow-edged sub-networks centrally positioned within the wider network. At the individual level, two key nodes occupy central positions, but it is difficult to identify other potential Key Actor nodes as many of the actors appear to have similar levels of interconnectedness. To identify key actors more systematically low-degree nodes were filtered by value (figure 10 on page 135). There is no established method for calculating the most appropriate threshold level; by referring to qualitative interview data and through exploratory experimentation this study elected to use a degree of equal-or-greater-than fifty-nine to highlight the nine most connected nodes.
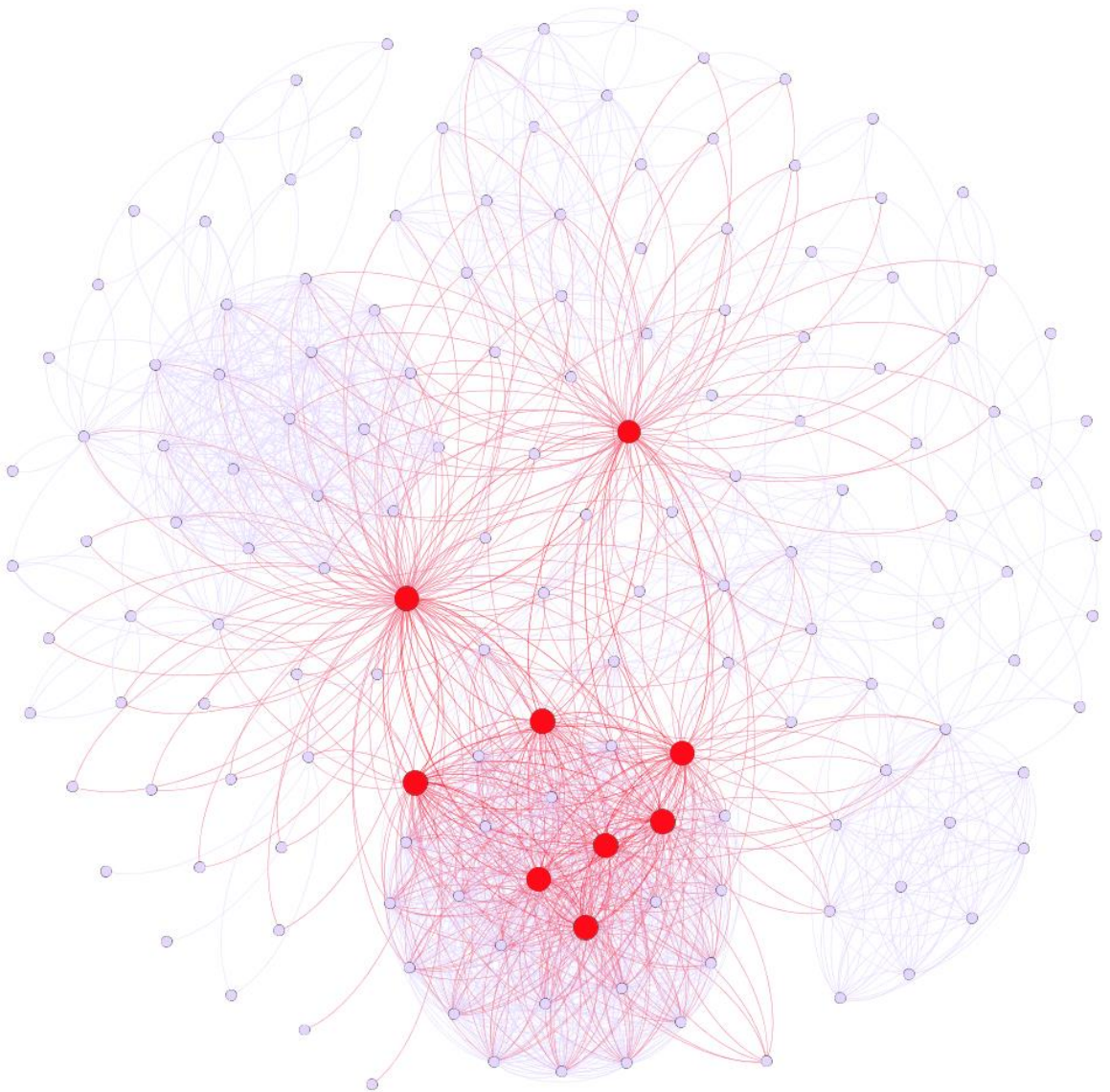
Figure 10: Macro network Fruchterman-Reingold plot highlighting high-degree actors.

These nine nodes are coloured red in this diagram. The 'Southern' cluster contained seven of these nine high *degree* actors, whilst the remaining two bridged further out across the network. To explore links between these Key Actors, all nine were isolated and mapped onto a separate projection given in figure 11 on page 136:
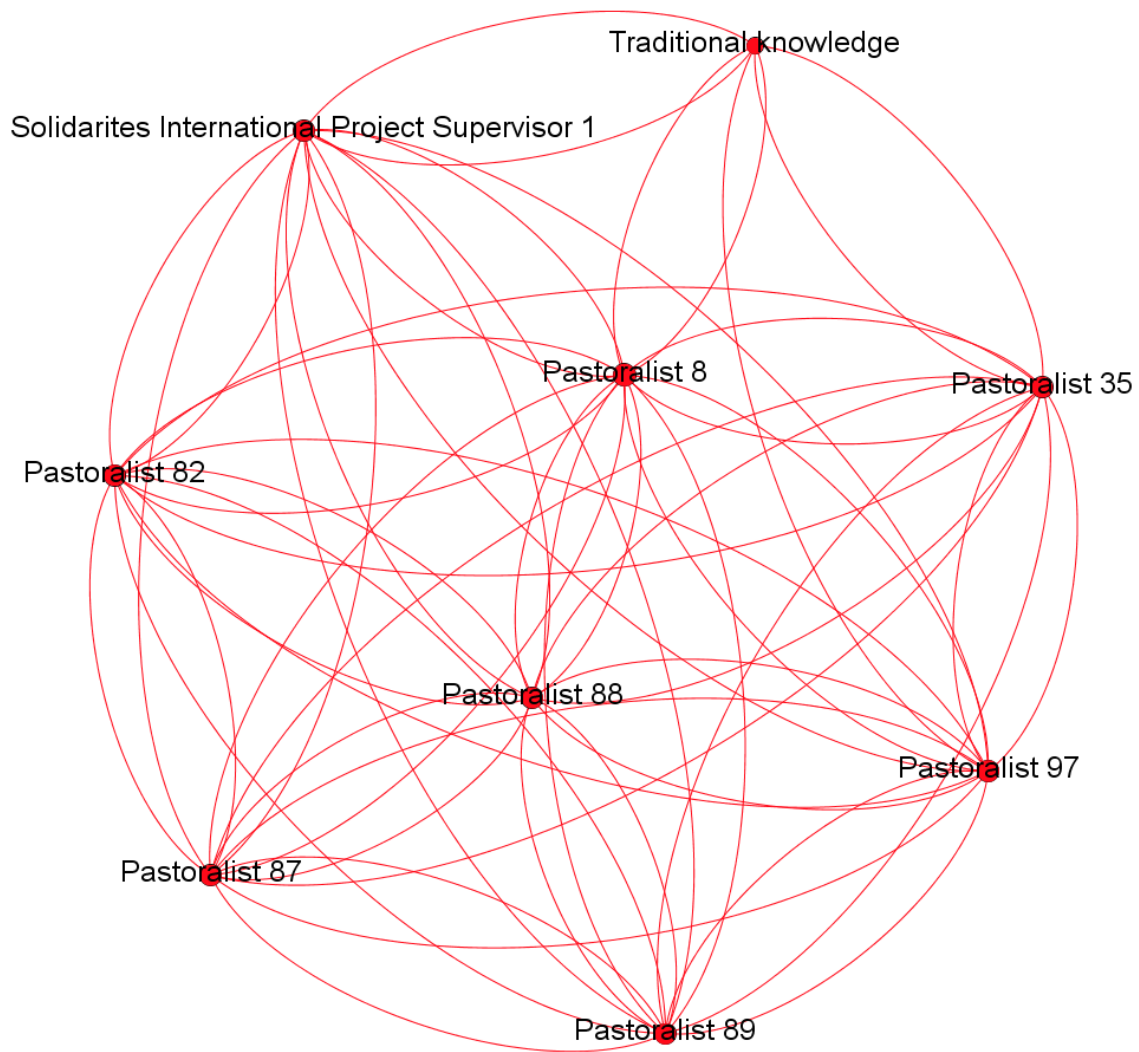
Figure 11: Fruchterman-Reingold sub-network plot of high-degree actors

This network illustrates a tightly interconnected set of pastoralists, with the notable inclusion of one of the (ethnically Gabra) Solidarities International Project Supervisors. The high *degree* values of each actor could be representations of intra-cluster connectivity, showing multiple routes of knowledge exchange within a single group at the expense of knowledge diversity that may result in limited knowledge diversity and a pseudo 'echo chamber' effect.

To expose how Key Actors could serve as bridging points between clusters, the data were re-plotted to identify the actors with the highest *betweenness* values. As with degree, no received methodology exists for setting a threshold; in this study qualitative data and exploratory network analysis established a cut-off point of six hundred and ninety that yielded ten high-betweenness Key

Actors, comparable with the nine high-degree Key Actors in figure 11, indicated in red in figure 12 on page 137.
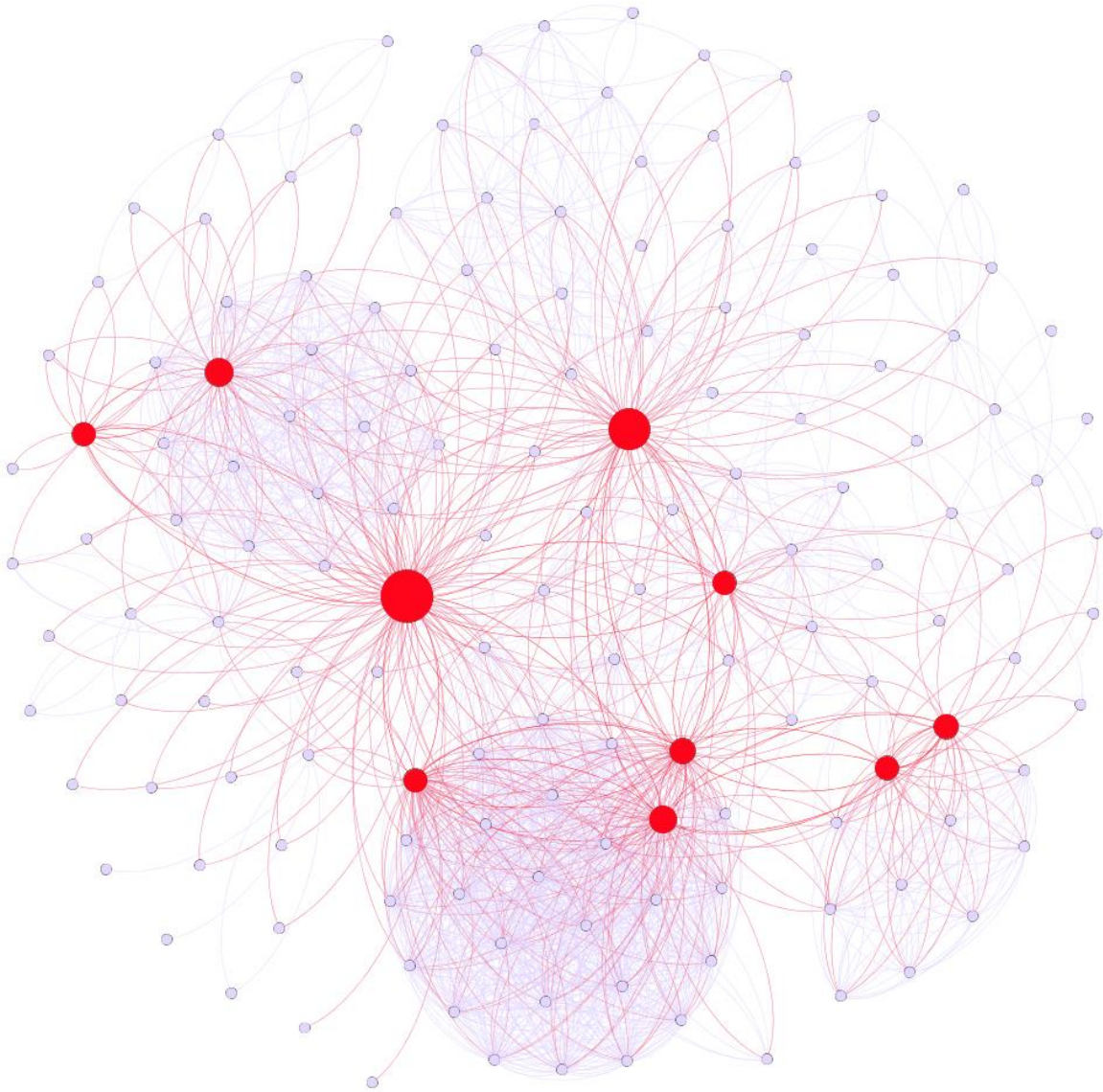
Figure 12: Macro network Fruchterman-Reingold plot highlighting high-betweenness actors

Three of the seven high-degree nodes seen in the Southern cluster remained after filtering, but several lower-degree nodes emerged as important for interconnectivity. These actors were variously situated in sub-networks (such as the North West) and were more isolated from specific clusters. To examine these actors further, a filtered projection of betweenness is given in figure 13 on page 138:
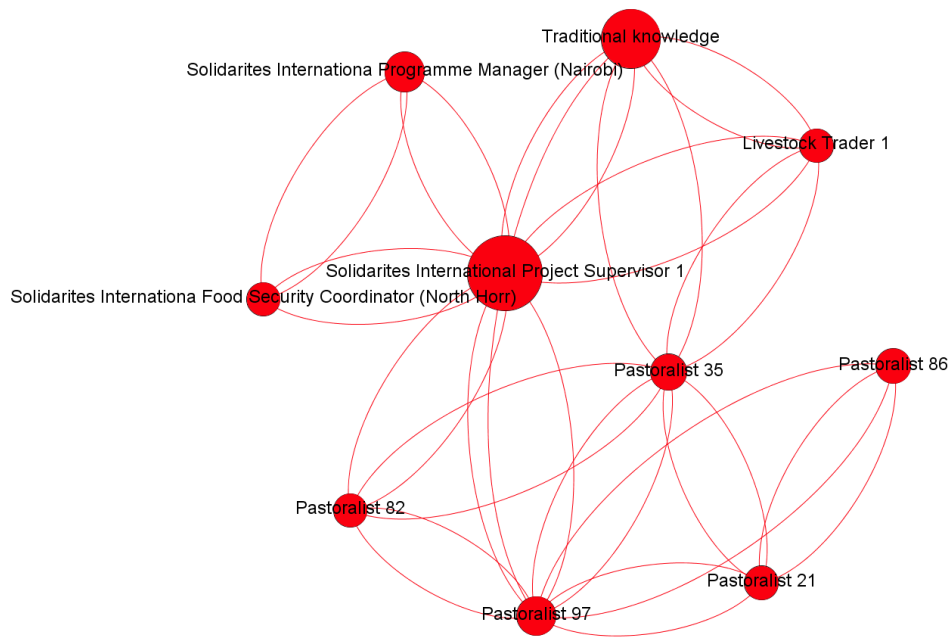
Figure 13: Sub-network Fruchterman-Reingold plot of high-betweenness actors

The Solidarities Project Coordinator is common to both groups, joined in the betweenness plot by two further NGO staff from the same organisation along with new pastoralists and a Livestock Trader. The high-betweenness, low-degree status of these new actors suggests they function as bridges between sub-clusters and communities within the macro network.

These plots set out the topography of the macro-network and identify key actors that may help inform the selection of specific case studies. The next section develops this further, illustrating the process of identification and selection of case study networks.

5.4 Case Study Knowledge Network identification

Respondents	Selection	Locations	Field Session	Data collection
11	Key-informant selection	3 Nairobi 8 North Horr	1	Interviews, artefact description

The macro-level, degree and betweenness visualisations in figures 9 to 13 suggest the presence of clusters (*sub-networks*) of actors within the larger system. This clustering is potentially important for examining knowledge flows and innovations; groups of highly-connected nodes often have well developed knowledge sharing techniques that lead to a rapid 'equilibration' of knowledge stocks limiting knowledge diversity.

This study wished to explore not only knowledge transferred within sub-networks, but between heterogeneous networks and knowledge stocks. It was therefore necessary to identify and explore the character of each sub-network, and the individuals who acted as bridges between sub-networks.

5.4.1 Qualitative review

As part of the data collection process, respondents described both their views on innovation, and gave examples of innovative activity (*innovation exemplars*). This exercise yielded forty-one examples of endogenously-defined innovative activity listed in appendix 3.

The macro network presented above shows little direct evidence of forty-one clusters, instead these exemplars exist within multiple overlapping sub-networks. Setting aside the qualitative 'one innovation, one sub-network' model, this means that either sub-networks contained multiple examples of innovative activity, or innovations were in 'micro sub-networks', or that innovation was occurring across sub-networks. The qualitative data suggested that all three exist to differing extents within various groups; what is clearer was the potential importance of specific sub-networks such as technological or livestock-centred groupings to guide further analysis.

5.4.2 Spatial layout

The Fruchterman-Reingold representation in figure 8 on page 132 suggested a series of sub-networks. Using the Force Atlas algorithm as an alternative graphical layout, this can study drew apart the clusters within the network to create the plot seen in figure 14 on page 140 in which degree is given from green (low) to red (high) and size proportional to betweenness, edge colour by node origin.
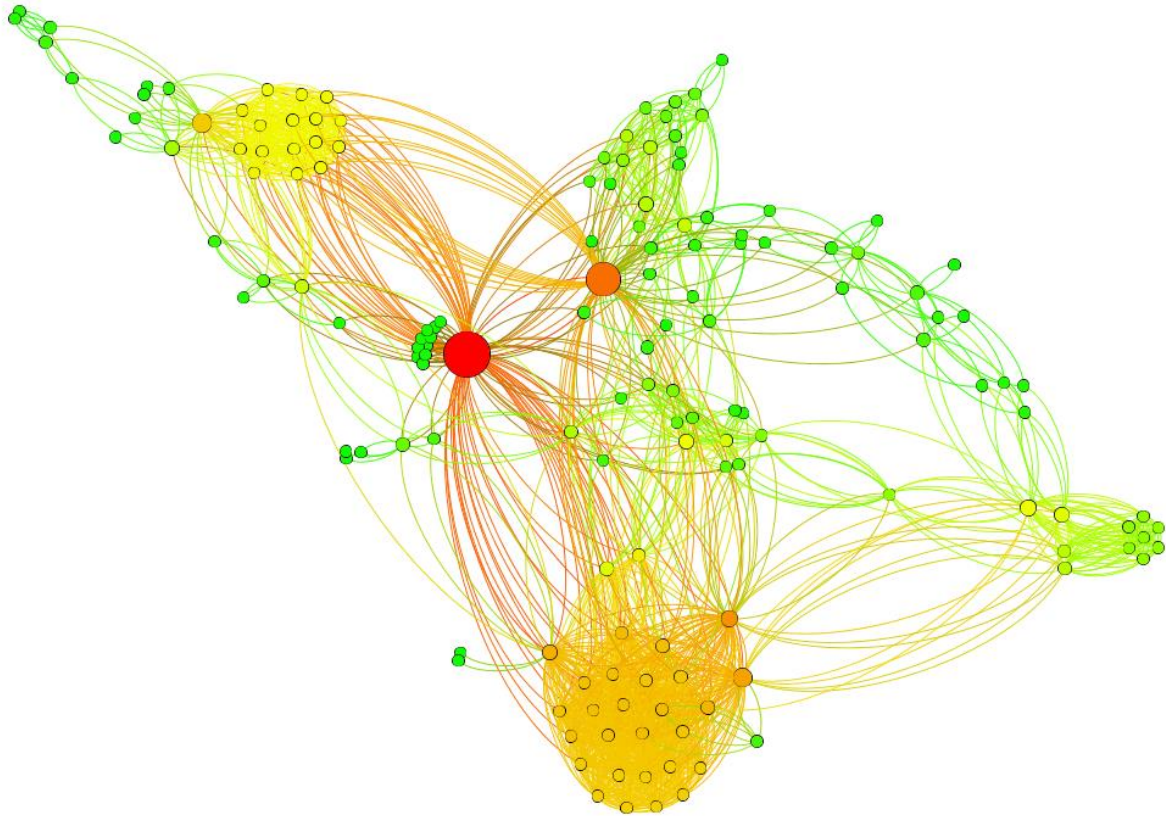
Figure 14: Macro network Force Atlas plot

Degree shown in green (low) to red (high), size proportional to betweenness

This distribution began to tease apart the smaller sub-networks suggested in the qualitative review. The tightly interconnected group seen in the South of figure 14 remained a discrete unit, alongside the emergence of several additional sub-networks spread throughout the wider system.

This visualisation provided support for the existence of sub-networks, however the 'eyeball' approach did not enable consistent bounding of sub-networks. The qualitative data enabled recognition of the fluidity and complexity of sub-networks, however to compare network structures and knowledge dynamics it was necessary to further refine the specific sub-networks. The use of a modularity algorithm provided a valuable point of triangulation from which to interrogate the macro network, and help bounding sub-networks.

5.4.3 Modularity algorithm

A modularity algorithm provides a computational approach to identify communities of actors within a network that are more densely connected to one another than the rest of the network. These communities have significant real-world meaning (Blondel et al., 2008), and provide objective bounding with which to identify and compare sub-networks amongst macro network complexity.

This algorithm identified five modularity classes[14]; figure 15 on page 141 gives the distribution of these with each class represented by a different colour (blue, yellow, green, purple, and red):
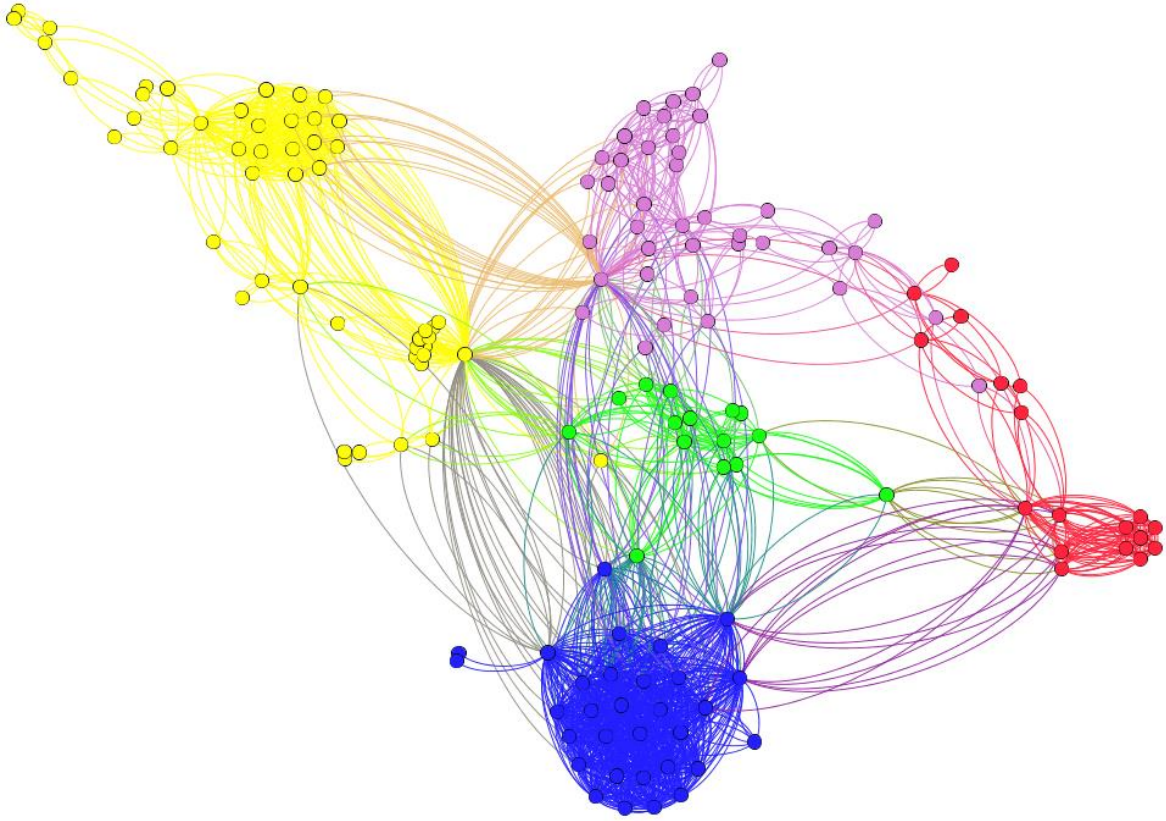
Figure 15: Macro network Force Atlas plot, colour linked to modularity class

Triangulating the qualitative data, alternative layouts, and modularity-class plots provided a useful starting point from which to begin analysis of the network features. The five sub-networks identified from this analysis are summarised in table 2 and described below:

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[14] Using a resolution of 1.2 in the above algorithm.

Colour	Description	Nodes	Edges	Av. degree	Diam.	Density	Av. path length
Purple	Animal health and disease reporting	39	194	4.974	6	0.131	2.583
Green	Livestock markets	20	97	4.85	5	0.255	2.237
Red	Local economic innovations	18	128	7.111	5	0.418	1.941
Blue	Well desilting	31	732	23.613	3	0.787	1.163
Yellow	Multi-Urea Block programme	45	410	9.111	4	0.207	2.074

Table 2: Sub-network characteristics

Sub-network 1: *Animal health and disease reporting (shown in purple)*

This network shows a series of connections between traditional herders, private and state veterinary health suppliers, and NGO actors involved in livestock programming. Drawing on the qualitative interview data and notes collected during the network mapping exercise, most edges present in this network related to the flow of both knowledge and information on livestock diseases. The primary innovation evident within the network related to the choice of using the NGO-developed PDS disease-reporting channel rather than alternative socio-cultural, professional, or political channels.

Sub-network 2: *Livestock markets (shown in green)*

Approximately half the size of the previous sub-network, this collection of actors was more densely connected than sub-network 1. The network represented herders and traders actively employed in the movement of livestock from the pastoralist regions to the larger markets of Nairobi. The primary focuses of innovation related to the use of agents in Nairobi, the evolution of socio-cultural institutions, and modifications of feeding and herding techniques in response to market pressures.

Sub-network 3: *Local economic innovations (shown in red)*

This network was notable in that it contains a majority female population, connected by membership of a village banking group (VICOBA). The sub-network was comparable in size to the market-based network but had a significantly higher average degree and density. This likely reflected a greater degree of interconnectivity between actors in this sub-group than the previous two.

Sub-network 4: *Well desilting (shown in blue)*

This network was the most densely connected of all the five, predominantly populated by educated, wealthy pastoralists using a variety of communication methods. The increased interconnectivity emerged when researching an innovative well-clearance event that mobilised a diverse actor base through a combination of traditional socio-cultural institutions and modern technological channels.

Sub-network 5: *Multi-Urea Block programme (shown in yellow)*

This network focused on the MUB livestock feeding programme administered by SI North Horr. The network density centres around intimate relationships between the participants of the MUB programme and the field-level Solidarities International Project Supervisors (SIPS). The periphery of the network contained a series of field-, national-, and international-level NGO and government actors who contributed to project development. The primary innovation focus was on the adaptation and development of the MUB technology.

5.5 Case Study Knowledge Network mapping

Respondents	Selection	Locations	Field Session	Data collection
78	Key actors in Case Study (CS) populations	CS1: aimed 39, completed 32 CS2: aimed 45, completed 26 CS3: aimed 31, completed 20	1	Semi-structured interviews

5.5.1 Introduction

The previous section set out the macro-network of interconnections between the actors in the study and highlighted the existence of multiple sub-networks and key actors within the system. This section builds on these foundations to explore specific examples of knowledge sharing between actors.

Given time and resource restrictions it was not possible to fully evaluate all five of the sub-networks given above. Referring to the central research question that related to hybrid knowledge processes, this study elected to maximise the chances capturing cross-cultural knowledge flows by focusing on the three of the sub-networks that included the most heterogeneous populations of actors. The two pastoralist-specific networks (VICOBA and Nairobi market access) offered supporting ethnographic information which informed later discussion, but their composition of predominantly similar actors and relative isolation from other sub-networks suggested that the primary focus should be on the animal health/participatory epidemiology, MUB programme, and the well desilting sub-networks. These interlinked networks involve multiple heterogeneous actors and suggest very different outcomes from knowledge interactions that are explored in the body of this section.

5.5.2 Case study 1: Animal Health Disease Reporting

This sub-network predominantly centred on animal health knowledge exchanges, specifically those that illustrated the innovative channels available for the transfer of knowledge surrounding livestock disease. Linkages between community and NGO actors included the presence of the recently established Participatory Disease Surveillance (PDS) programme outlined in section 4.4.2; in addition to this channel of knowledge exchange, three further sub-networks of knowledge exchange were identified.

To properly evaluate the nature, role, and interactions of these networks it is important to understand the wider dynamics of livestock knowledge exchange in North Horr. This section sets out the relevant background to these forms of knowledge sharing to provide contextual information to interpret the results.

Picture 12: Deworming as development

Animal health interventions in pastoralist areas often highlight where technological knowledge is insufficient to generate engagement. Issues of trust and reciprocity must also be overcome, particularly in surveillance projects, for a programme to be successful. Here, a known 'early adopter' herder takes a worming treatment, watched by other herders who will decide on their participation based on observed outcomes.

5.5.2.1 Background

The central role of livestock in pastoralism has resulted in the development of specific cultural institutions surrounding the practice and knowledge of livestock husbandry (Vayda, 1968, Mair, 1974). These forms of knowledge exist in complex inter-community and -household dynamics, for example in response to herd theft (Sweet, 1965) or the teaching of tacit herding techniques (Schillhorn van Veen, 1997). The lack of 'mainstream' animal health services in remote areas has led to continued reliance on widely diffused traditional ethno-veterinary knowledge (EVK) (Martin et al., 2001, Schillhorn van Veen, 1997). EVK is most commonly viewed by development groups as a subset of a body of wider indigenous knowledge (McCorkle, 1986) concerned with "*everything traditionally known and done to keep animals healthy and productive or 'happy'*" (Mathias and McCorkle, 2004). Traditional EVK techniques are situated in indigenous knowledge reserves (Vandebroek et al., 2004) that are transferred within the community through family, peers, and structured or unstructured teaching (Philander et al., 2008, Ladio and Lozada, 2001).

Providers of 'Western' knowledge sources have often argued that pastoralists' animal health practices are "*backwards*" (Muhereza and Otim, 2002), however EVK has received recent interest through the current development of combined animal-human 'One Health' systems (Zinsstag et al., 2011). One Health's focus on elevated pastoralist morbidity and mortality rates (Hill, 1985) has brought zoonotic diseases such as brucellosis, tuberculosis and anthrax to the foreground of pastoralist health research (Pike, 2004). One Health offers an interesting site of contact between EVK and 'Western' knowledge stocks; whilst biomedical scientists consider these conditions as interlinked, indigenous understandings suggest these diseases to be independent of one another (Gradé et al., 2009). Respondents cited different causes, symptoms, and modes of transmission for animal and human variants of the disease, suggesting that "*the risk of animals making us sick is minor since we live in close proximity and are still alive*" (Krönke, 2004 p. 80).

Projects that are able to bridge differing world views in animal health anecdotally seem to have greater success, such as framing vaccination programmes within existing indigenous cosmologies (Heffernan et al., 2008), or increasing access to wider external knowledge stocks such as with mobile phone usage (Kithuka et al., 2007). Many interventions have deliberately avoided engaging with local knowledge stocks in attempts to move pastoralists away from an animal-centred mobile lifestyle (Quam, 1978, Mandani, 1986, Dyson-Hudson et al., 1998); these approaches ultimately depleted the quality and depth of indigenous animal health knowledge (Gradé et al., 2009). This mirrors a wider trend in pastoralist knowledge transfer practices, whereby increased formal schooling comes at the opportunity cost of decreased family- and peer-sharing of indigenous

learning (Voeks and Leony, 2004, Srithi et al., 2009); herding and husbandry skills in particular require extensive experience to acquire. The loss of this tacit knowledge poses a significant threat to 'the pastoral way of life' (Schillhorn van Veen, 1997, Somnasang and Moreno-Black, 2000, Voeks and Leony, 2004, Srithi et al., 2009).

Whilst not a 'classic' One Health approach, PDS mirrors these approaches in providing a point of contact between EVK and more formal, scientific knowledge. This section of the study elected to map the various flows in surrounding livestock disease knowledge to explore the interactions between indigenous and scientific knowledge stocks.

5.5.2.2 Network overview

This network contains a wide range of actors ranging from the highly traditional *chilres,* through to contemporary providers of livestock services such as the CAHW and agroveterinarians (AV1 & 2), NGO and government actors.

5.5.2.3 Knowledge pathway analysis

This network traced a series exchanges surrounding livestock health and disease reporting knowledge. Using the qualitative data gathered during interviews and network construction, it was possible to identify existing, emergent or imposed thematic pathways that offered a plurality of channels for actors within the network illustrate in figure 16 on page 148.

1. A **PDS** pathway using NGO-led programming to reinforce existing structures (shown in red)
2. A **traditional** pathway that works through traditional institutions. (shown in blue)
3. A **local** pathway centred around animal health professionals working in settlements (shown in green)
4. A **political** pathway that exerts pressure on service providers through political pressure (shown in yellow)
5. A **technological** pathway used by professionals, with significant barriers to access (shown in purple)
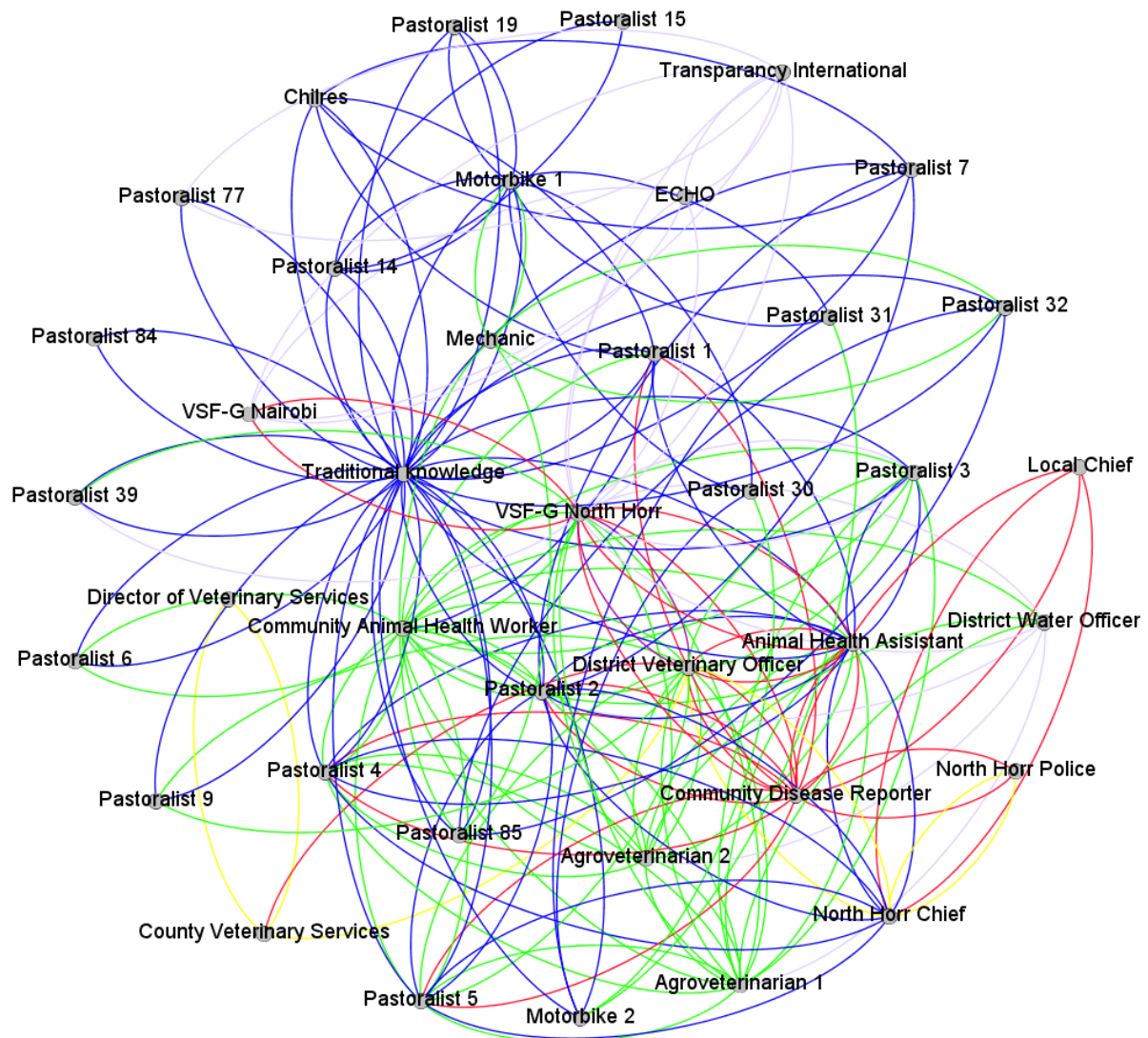
Figure 16: Animal Health case study, sub-networks by colour

The following sections discuss the characteristics and relevance for knowledge exchange of each of these sub-networks.
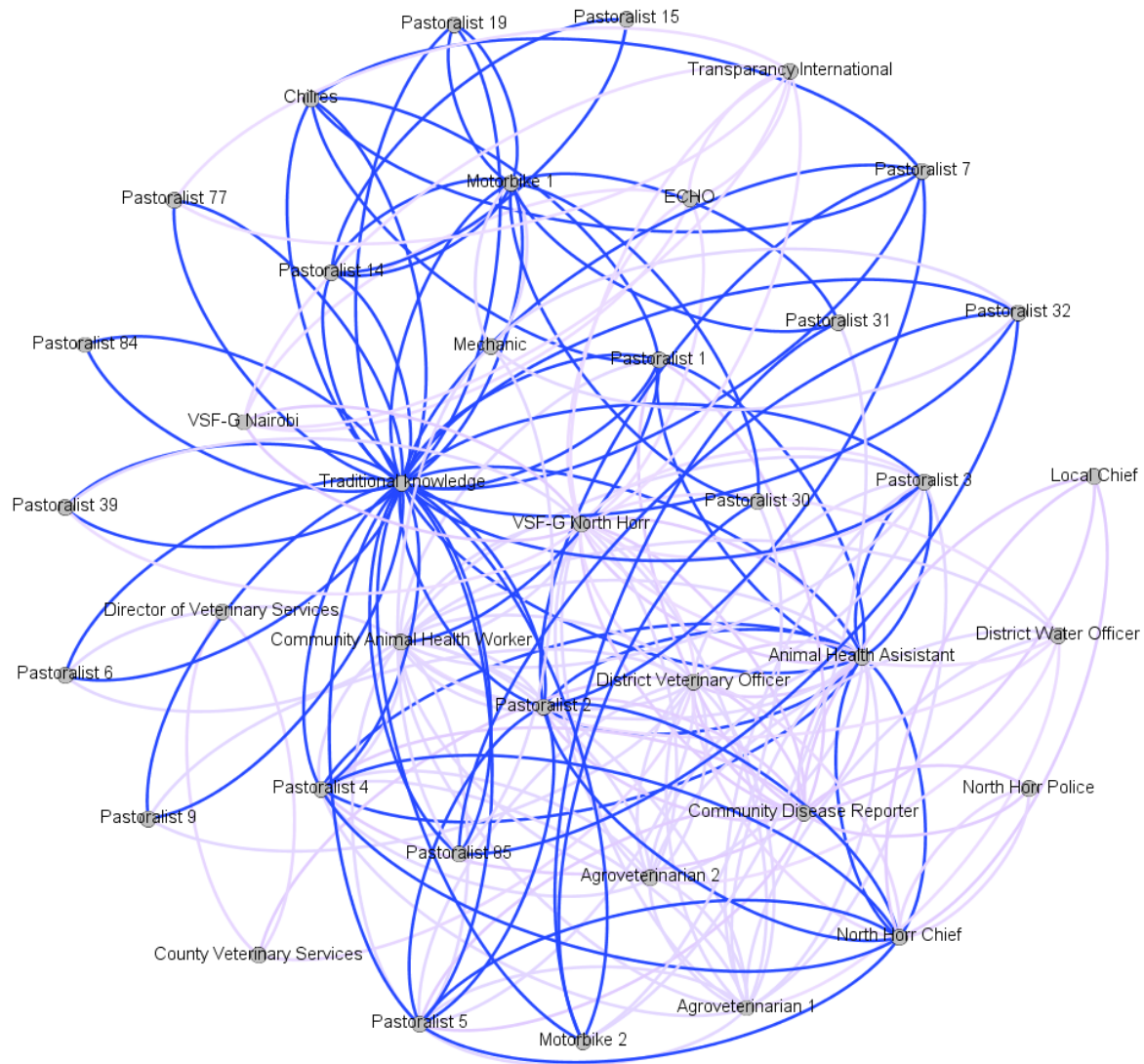
Figure 17: Animal health case study, traditional sub-network

The Gabra within this network frequently constructed and curated an extensive, culturally-rooted repository of livestock knowledge. The traditional knowledge node was clearly central to the traditional sub-network, accessible by all herders, the *chilres*, and notably the AHA – also a Gabra herder. The *chilres* and AHA provided a useful insight in to the nature of communally-held Gabra livestock knowledge.

Only two of the ten herders suggested the *chilres* as a source of livestock disease knowledge. Further questioning suggested that this did not mean the other eight eschewed traditional disease-combatting processes, instead these herders suggested that a *chilres* does not hold privileged

knowledge but is simply more connected to local knowledge stocks on animal health than most herders. Whilst a common translation of *chilres* is 'traditional healer', this is somewhat a misnomer; rather than protecting and promoting traditional approaches, pastoralists described the *chilres'* as collators of information on livestock health, including contemporary treatments and methodologies. *Chilres'* were able to suggest treatments and provide directions to seek help from other points of contact; the primary reason given by those herders for not suggesting the *chilres* as a means of knowledge gathering on livestock disease was more prosaic; either they did not know one, or there was not one within easy contact.

The AHA bridged the traditional, technological, local and PDS sub-networks through a range of characteristics. The social and cultural capital possessed as a livestock-owning male Gabra allowed inclusion in the traditional network; technological literacy, ownership of a smartphone, possession of a government role, and academic ability permitted entry into technological and PDS relationships.

Local livestock owners suggested key differences between AHA, DVO and NGOs; the DVO was seen as most able to provide treatment directly, the NGO was able to exert pressure on the DVO to attend (often facilitating transport and costs), however the AHA was someone whom one informed of symptoms, and who advised on treatments or further sources of knowledge – not dissimilar to the *chilres* in many ways.

The reciprocal relationship between the AHA, *chilres* and herders underpinned the traditional knowledge sub-network. Participants shared a knowledge repository to inform their own actions, and more importantly feedback experiences and outcomes. This included the results of experimental and innovative approaches, or anecdotes from non-Gabra herders elsewhere. Examples were given of Boran, Turkana and Samburu treatments for Rinderpest and Foot and Mouth disease (FMD) that had been gathered by unknown contacts elsewhere; these examples were not used as a 'gold standard' of treatment, but to inform the treatment selection of individual herders. Fundamentally the traditional sub-network demonstrated action at an individual level in combination with a societal and cultural knowledge sharing (to varying degrees), resulting in a rapid and far-reaching distribution of experience. Care should be taken not to read this as some utopian, egalitarian knowledge hub – opinions and value judgements are very much part of the fabric of the network; one clear example was the Gabra's experiences with early-stage IBLI (Index-Based Livestock Insurance). Having recruited a number of herders onto the initial scheme, when drought came payments were not made due to thresholds in forage cover not being passed. In the eyes of the Gabra these thresholds were inappropriate; aggregated across the region there was sufficient forage, however due to friction with neighbouring ethnicities (principally the Dassenach in the North-West), Gabra herds

were unable safely to access those feedstuffs. This led to a belief that IBLI was "*unfair*" (P31), and a communal narrative negative to IBLI began to emerge following conflicts in 2012. Since then both the financial provider, the implementation, and the thresholds have been altered but the narrative remains in an easily-accessible group knowledge repository.

Local sub-network
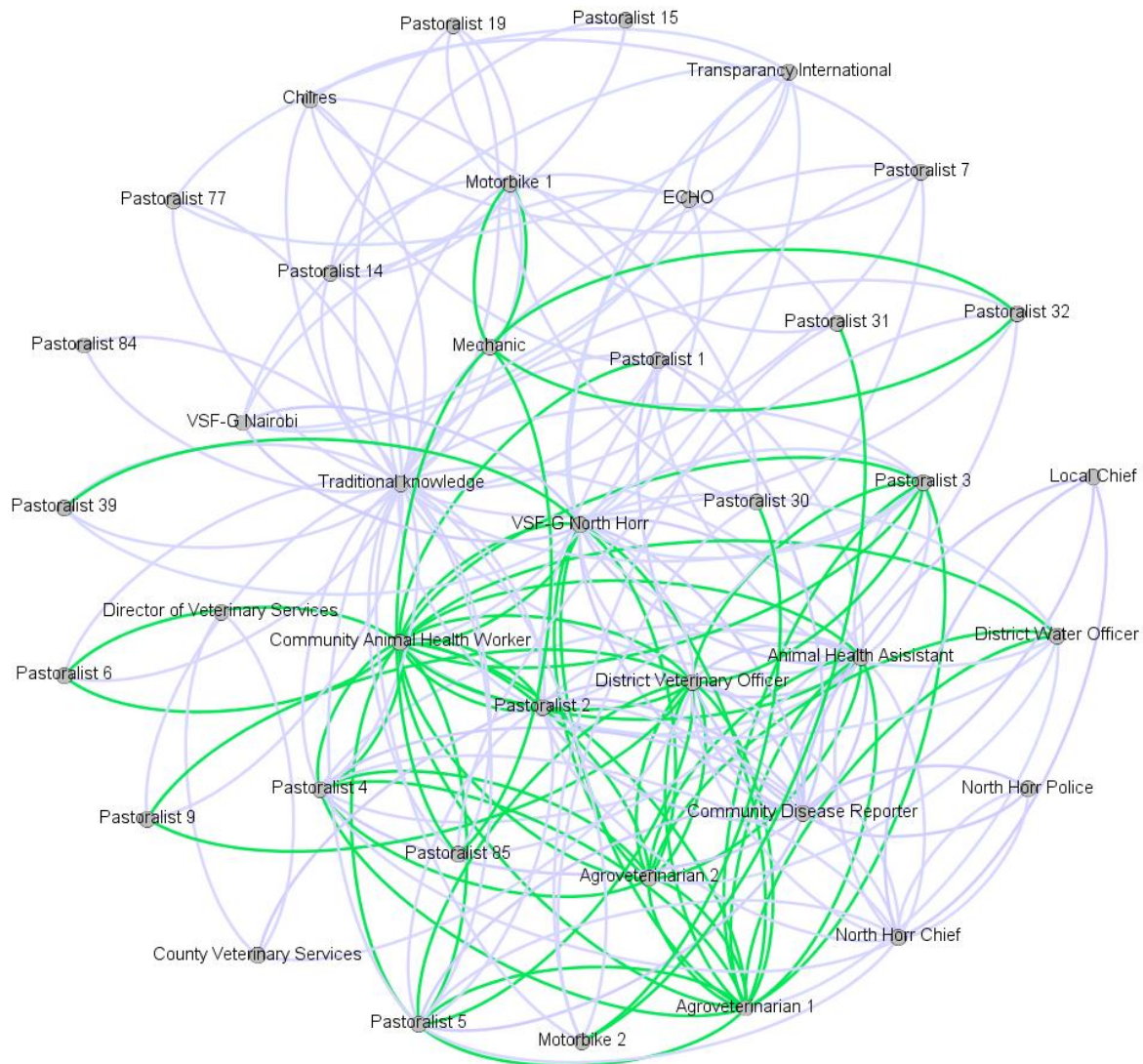
Figure 18: Animal health case study, local sub-network

The local sub-network is in many ways similar to the traditional sub-network; actors tend to be from within the community, no specific qualification or skill is required to access the knowledge base. Where it differs however is in the location of the knowledge – much more held by individuals such as CAHWs and AVs. Two types of herder-actor relationships exist; either herders ask for treatments and

confirm with the AV/CAHW their suitability, or the herder approaches these actors with symptoms and receives diagnostic and treatment decisions from the new actor. Which of these routes was chosen depended on the herder's experience using other (typically traditional) pathways to get a diagnosis and treatment, the perceived ability of the CAHW/AV, and the resources available to both actors. The learning and development captured through consultation fed back into wider community knowledge stocks, but predominantly through experiential sharing of outcomes. A good example of this was the use of Oxytetracycline to treat respiratory infections; this drug is widely stocked by CAHW/AVs and used for a range of conditions. This became common wisdom among herders, who often asked for the compound by the manufacturer's name without providing symptoms or disease history. Should Oxytetracyline fail to resolve the condition, advice was sought from fellow herders and CAHW/AVs as to alternative options, with results being reviewed afterwards.
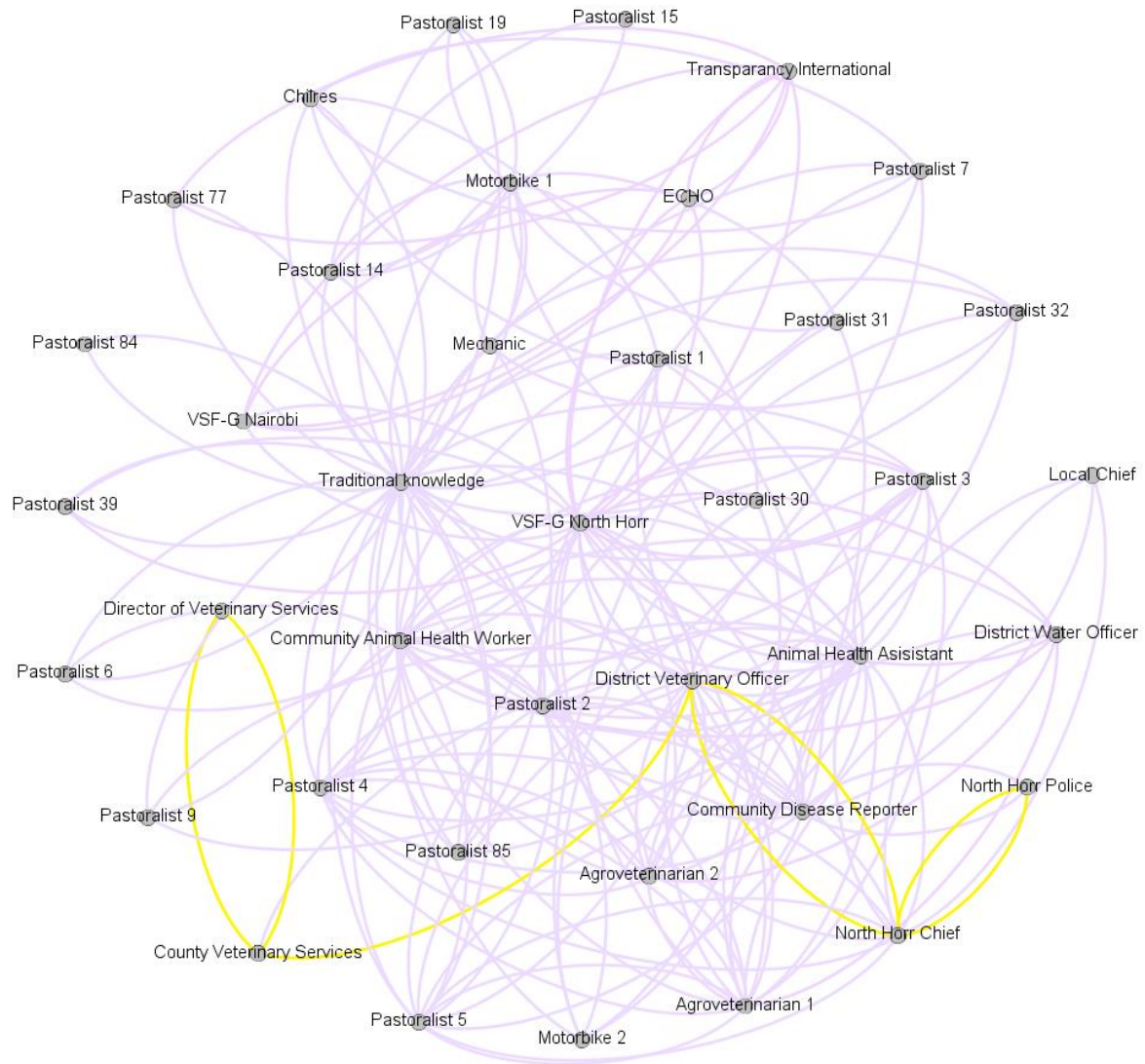
Figure 19: Animal health case study, political sub-network

The political sub-network differed from the others in that it acted predominantly to exert power and influence. Herders' reported disease outbreaks to members of the local political establishment in a belief they could maximise the chances that local DVOs will be directed towards addressing their problems. Access to political figures, and the possession of the necessary capital was done either through kinship networks, or in return for promises of political support. In many cases local political actors have limited ability to influence activities outside of their direct control, for example laboratory testing in Nairobi, but this is understood by the local applicant. This route involves very limited knowledge flows and provides little opportunity for knowledge co-creation.

Technological sub-network
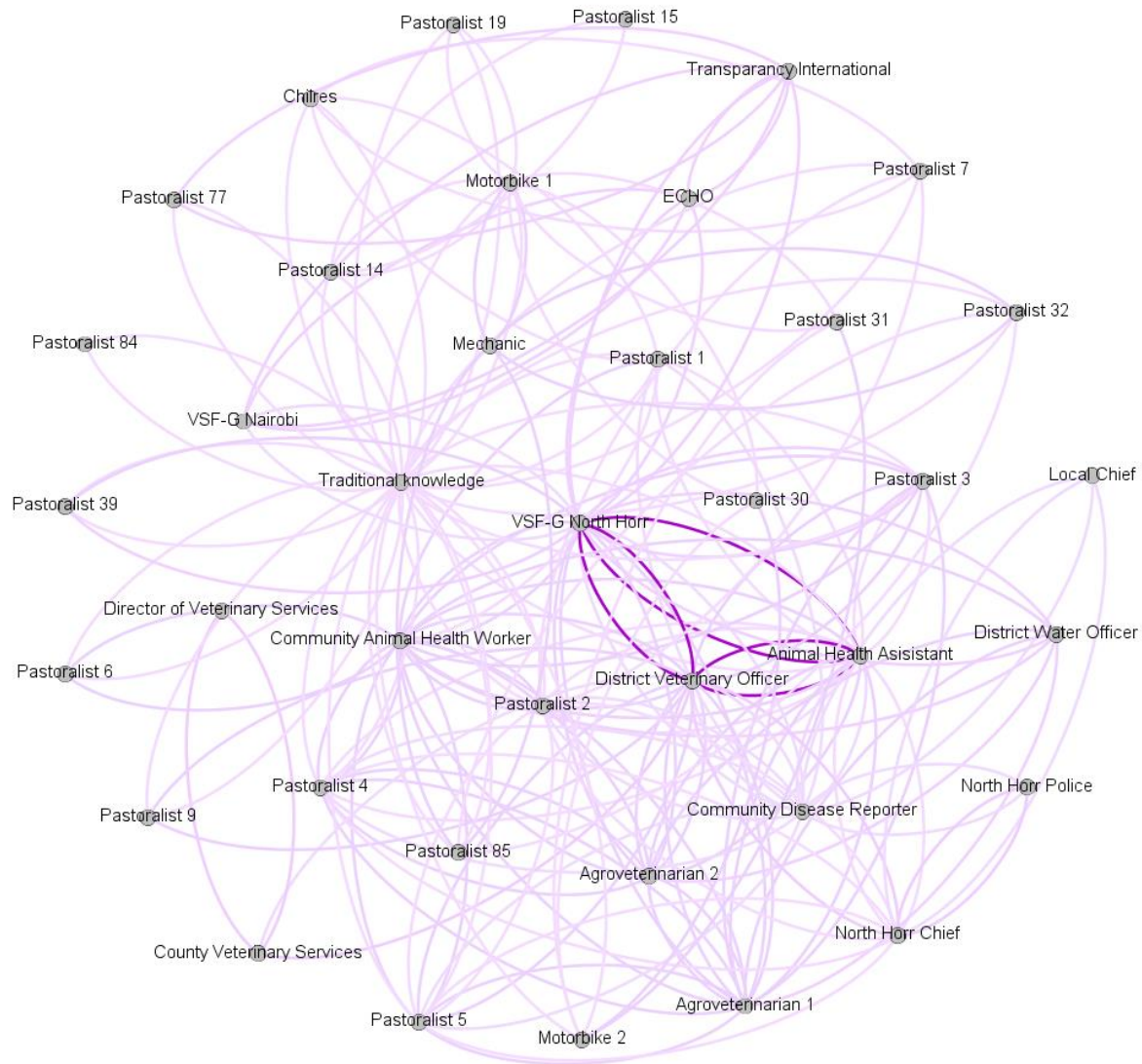
Figure 20: Animal health case study, technological sub-network

Whilst theoretically open to all-comers, the technological sub-network had arguably the tightest access criteria of any of the sub-networks due to limitations of the peer-invitation process and the ability to access a mobile telephone (and associated charging and English-language skills). The technology sub-network was not wholly limited to a virtual medium; the views and influence of both ECHO and the VSF-G office in Marsabit were given access, moderated through a VSF-G actor in North Horr. This technical network was further distanced from others using technical language – actors within the network considered themselves to be animal health professionals and tended to use medico-technical terms to reinforce these divisions. The idea of a 'professional' identity was

fundamental to understanding how these techo-professional networks could influence knowledge co-creation. The platform, WhatsApp, provided an open and transparent discursive space (for permitted members) from which to draw opinions and access resources (such as laboratory space or political will). In many cases knowledge and resources were contributed by forum members to maintain membership of a perceived professional elite, hence couching responses in markedly professional language. These free exchanges resulted in multiple linkages and combinations of knowledge, often focused around individual events or disease outbreaks. The lack of formality in reporting or contributing further enabled the generation of discursive, creative solutions, though not free of the sub-textual influence of power. For example, vocational hierarchies of veterinarians, assistants, and technicians could still be observed in exchanges between contributors.

Where the greatest impediment to free exchange occurred was in bridging the outputs of this creative microcosm into wider communities. Examinations of this network showed three primary routes of entry into the community, the AHA, DVO and VSF-G North Horr. The responses of these three actors surrounding the use of information from technological platforms was insightful.

AHA

The AHAs' position as a non-veterinarian and non-senior government official meant that he perceived himself as less able to shape conversations within professional virtual spaces. However, access to the forum itself was a form of professional acceptance, and as such he was keen to contribute where possible, to underline and maintain his right to involvement. The AHA had arguably the most direct contact with the community and individual herders, but he was cautious of acting as a direct conduit for community concerns as he felt these could appear less 'professional' than the discussions of more senior or qualified colleagues. Where he did feel able to contribute was on observations of new disease outbreaks or surrounding epidemiological changes where he felt his 'ear to the ground' has much more worth to the professional collective. There was far less knowledge flow from forum to community through the AHA; this may have been due in part to the sometimes-abstract nature of questions on the forum, and his belief that he lacked the power to mobilise new technologies and treatments for use in the region. The forum was largely seen by the AHA as a means of disease reporting to the wider veterinary community, and a form of professional recognition, rather than as tool or knowledge source that could be used for community benefit.

DVO

For communication within the WhatsApp group, the DVO sat apart from the AHA due to his formal veterinary qualification making him the 'equal' of the professional population of the forum. His

exchanges tended to be highly technical in nature – new treatments, disease characteristics and political developments surrounding diagnosis and treatment. This knowledge was largely used in service of the community, but not with the community. The forum informed professional veterinary practice by drawing on a wide knowledge base that provided suitably qualified professionals access to expertise never available in dryland settings; little of the knowledge developed through the forum was passed to, or constructed with, local peoples.

VSF-G North Horr

The VSF-G representative tended to use the forum on two levels. Firstly, as a veterinarian, he wished to maintain a professional credibility; contributing to the forum provided a form of peer validation that was hard to achieve elsewhere. Secondly, the forum contained members who could illuminate or influence political directions. As with both the AHA and DVO, this resulted in the content of the forum working for the community through mediation with professionals, but not created with the community.

5.5.2.4 Reviewing the animal health sub-network

The sub-network described above highlights the presence of multiple channels for knowledge transfer, co-existing and interacting within a broader set of linkages. Drawing on the methodology outlined in chapter three, these different aspects were used as the basis for comparisons to search for broader themes relating to processes of hybrid knowledge creation.

Drawing on the data presented above, four interrelated aspects of each network were identified as common between all of the networks. These were the range of knowledge types being shared within the relationship (knowledge *diversity*), differences between two-way discussions and one-way transfers of knowledge (the knowledge *dynamics*), the nature of relationships (see methodology section 3.5), and the ways in which relationships enable or limit the use of power.

A summary of these key features is given below, and a tabulated overview follows in table 3 on page 158. This review is designed to illustrate commonalities and differences between subnetworks, and to inform the creation of the analytical framework outlined in section 3.5.

Knowledge diversity

The *diversity* of knowledge transferred within a relationship provides an insight into the use and utility of the link to each actor; specifically, for hybrid processes, this may represent the breadth of knowledge that could be integrated into acts of creation. In the political and PDS networks, this followed a very utilitarian pattern, designed largely to access services. The technological and local networks exhibited more diversity of knowledges, but also focused on securing livestock treatments

alongside health-related knowledge. The Traditional network had the widest diversity of knowledges flowing through well-established indigenous linkages.

Knowledge dynamics

For hybrid knowledge creation, the dynamics of exchanges demonstrate the degree to which both actors may negotiate solutions between themselves. Within the political, technological, and PDS networks most exchanges were of a give-and-receive nature, providing little opportunity for discussion and debate. With the traditional, and to some degree local networks, there was a greater emphasis on counter exchanging ideas and views, an observation that this study chose to explore regarding hybrid knowledge processes.

Relationships

The six relationship categorisations suggested in section 3.5 were derived from the work of McCulloh et al. (2013). Using these as the basis for exploring the types of possible interactions within the sub-network, all of the networks contain multiple categories. Broadly speaking there was limited use of transactional links (local and technological sections), and large numbers of sub-networks involved kinship, transfer, and affiliated linkages. It is less clear what these features mean for hybrid knowledge creation at this stage; it is possible to suggest links with both dynamics and diversity (given above), but aspects of relationship character require further exploration.

Power

Power is a complex and disputed topic, important to reference in this study, but not engaged with directly in the supporting literature or methodology as this was not the purpose of the research. In this sub-network power is included to draw attention to the ways in which existing power dynamics may influence knowledge sharing processes. For this sub-network, several models of power relationships existed, from professional memberships providing privileged access to knowledge networks in the technological sub-network, to indigenous positions of respect providing resource-mobilising and convening power in the traditional sub-network.

A comparative overview of each of these categorisations for each sub-network is given in table 3 on page 158.

Network	Knowledge diversity	Knowledge dynamics	Relationships[15]	Power
PDS	Explicit disease reporting channels.	Largely one-way reporting, few iterative exchanges	Individual, transfer, affiliation, formal, kinship	Open access, passive issues of power surrounding logistics and implementation
Traditional	Knowledge repository, group sharing of livestock and associated knowledges.	Multiple exchanges building discursive patterns between multiple individuals	Individual, transfer, affiliation, kinship	Reflect wider social and cultural power structures, limited influence on knowledge sharing but strongly shape opinion-forming
Local	Primary service delivery, some feedback into traditional sub-network	Direct knowledge transfer with some opportunities for discussion	Transactional, transfer, limited formal, kinship	Customer-provider relationship, choice of provider based on access and reputation
Political	Solely service delivery surrounding securing livestock interventions	Unidirectional information sharing	Individual, transactional, transfer, affiliation, formal, kinship	Strongly rooted in power dynamics, many imbalances explicit in exchanges
Technological	Primary knowledge sharing, limited opportunity to influence resource allocation	Unidirectional information sharing	Transactional, transfer, formal	Professional reputation and ability primary power drivers, political positions also reflected

Table 3: Case study 1 sub-network summaries

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[15] See relationship categorisations in section 3.4.4

5.5.3 Case study 2: Molasses-Urea Block (MUB)

This case study focused on the innovative development and adaptation of a Multi-Urea Block by local groups as part of the SI PFS. MUB-type programmes were found throughout dryland Africa; this example was selected to highlight ways in which local groups were able to shape development programming. The MUB example was a particularly relevant example of collaborative hybrid action when set against the PDS example, in which community actors explored alternative channels to NGO-developed processes. The MUB network contained four primary sub-networks that represented a range of knowledge exchange dynamics occurring within and between a varied population of actors.

Picture 13: The thresher

The picture above shows the latest diesel-powered thresher to be sourced by SI for use in the MUB programme. This unit is an adaptation from the original as it is hoped it will break down woodier vegetation for inclusion in the block.

5.5.3.1 Background

The MUB programme is one aspect of a set of larger projects that are run simultaneously by SI in North Horr. SI has run Pastoralist Field Schools in North Horr since 2014 (longer in other areas of Marsabit) with these groups acting as hubs for multiple activities dependent on the direction and funding of development at that time. Currently the PFSs are run as part of Disaster Risk Reduction (DRR) programming in conjunction with the Marsabit county government Agriculture Sector Plan to provide economic opportunities to the region. The longstanding relationship SI has with many of the communities in which it works provides opportunity for relationship building not often seen in and around North Horr, enabling SI to focus on programming attractive to the community that the NGO believes has potential for significant benefit. One such area of interest is increasing livestock production, especially for those herders unable to afford expensive additional fodder.

The challenges of maximising livestock production under difficult conditions are not unique to transhumant African communities. For pastoralists' livestock, the primary feedstuffs are fibrous crop residues and low-quality pasture; these materials are typically low in minerals, vitamins and nitrogen, key components in the microbial manufacture of protein and a prerequisite for increased growth and milk production. Direct protein supplementation is often unavailable to pastoralist herders; where markets can source protein-rich pellet feeds, oil cakes or similar, prices are often prohibitive and supplies erratic. This has forced herders to look elsewhere for answers for increasing livestock dietary protein, with many exploring options of non-protein-nitrogenous sources.

Alternative nitrogen sources such as urea can compensate for the nitrogen deficit in the main forage component of the livestock diet. These nitrogen sources augment rumen fermentation, enhancing intake, digestibility and nutrient availability through rumen microbial activity. Urea is rarely used alone, most commonly it is combined with mineral, vitamin and carbohydrate sources to form a urea-molasses block (UMB) (also known as a multi-nutrient block – MNB). These forms of non-protein nitrogen supplementation offer advantages including ease of transport, storage and use, whilst limiting the disadvantages of non-block forms such as water supplementation, application to fibrous feeds and ammonization of crop residues.

The use of blocks in international development is well documented, with a rich tradition of adaptation and modification to local contexts. Whilst the first systematic trials of block-form urea appeared in literature from the 1960s references to more ad-hoc usage can be found as far back as the 1930s. Early block manufacture was monopolised by animal feed companies; prices were kept high resulting in negligible use in developing-country agriculture. During the 1980s the importance of smallholder agriculture began to be recognised and the FAO and UNDP started to promote block

technologies across Asian, African and Latin American countries. In the early stages block manufacture was an energy-intense 'hot' process. Recognising the often-prohibitive costs of the heating process, the FAO Feed Resources Group developed what is now known as a 'cold' process that employed chemical solidifying agents such as calcium hydroxide or cement.

Cold block manufacturing was of relevance to pastoralists, as the process could be employed in energy-poor areas. The move away from 'scientific agriculture' meant the MUB was amenable to local adaptation and refinement. Ingredients were mixed by hand, shovels, dough or concrete mixers; moulds have been made from metal, wood, cardboard, plastic, car tyres and buckets to form blocks in square, rectangular and cylindrical forms to suit local needs. These local modifications mean that the composition of the blocks can also vary, with urea typically between 4 to 10 percent, molasses 30 to 45, and binder 6 to 15 percent for an 'average' MUB. Once manufactured, blocks can fall prey to scavenging and microbial growth; this has proved particularly troublesome where blocks are made for sale; polythene wrappers are now common for longer-term storage.

The data describing MUB effects are often drawn from commercial herds and are closely linked to increasing yields and decreasing input costs. Cattle fed blocks alongside crop residues can provide milk yields sustained at 4 or 5 litres per day. Whilst reduced fodder supplementation for fattening is of benefit for meat-production herds, uptake of MUB by milk-producers has been easier and faster due to the observable increases in milk yield from the third or fourth day of use. For pastoralists it is important to note that this observation is species dependant; effects are recorded as most pronounced in cattle, then buffalo, yak, sheep and finally goats – suggested due to goats' ability to graze a greater range of protein-containing foliage.

MUBs have been widely employed outside production agriculture; MUBs have been used for emergency supplementation of winter rations in Mongolia and China, and drought mitigation in India, Sudan and Zimbabwe (El Khidir et al., 1989, Owen et al., 2012, Tekeba et al., 2012). In the latter cases, the poor-quality fibrous foodstuffs found in drought-affected areas were complemented by the nitrogen, minerals and vitamin additions in the blocks to enhance the available energy supply. The simple and rapid production process, and compact form allowing easy transport from non-emergency areas has proven useful in livestock drought-response.

For this study, the potential for modification of the MUB programme provides opportunity for knowledge sharing between heterogeneous groups. Recent developments in block technology have included the addition of tannin-inactivating agents (such as polyethylene glycol) to enable the use of tannin-rich foliage, the rectification of phosphorous deficiencies, and the inclusion of anthelmintic agents (such as fenbendazole). Alongside these technical modifications can be found local

adaptations; the by-products of local manufacturing such as olive cake, kenaf (*Hibiscus cannabinus*), *Vigna unguiculata* beans, cassava (*Manihot esculenta*) powder, *Cassia moschata* fruits, *Albizia saman* and *Gliricidia sepium* leaves have all featured as replacements or additions to MUB manufacture. In some cases, alterations to the manufacturing process are required; where molasses is replaced with wheat flour, additional pressure is required in forming the blocks.

5.5.3.2 Network overview

This network is focused on the MUB groups, and linkages between these groups and the Solidarities International Project Supervisors (SIPS), spreading out to wider NGO institutions and supporting government actors such as NEMA and MALF.

5.5.3.3 Knowledge pathway analysis

As with the PDS network, the qualitative data surrounding this network reveals thematic pathways between nodes. The four primary pathways observed are:

1. A **local** pathway covering exchanges between individual herders and particular members of NGO staff (shown in green)

2. A **governmental** pathway that primarily provides oversight and 'rubber stamping'; actions which serve to shape the directions of NGO staff (shown in yellow)

3. A **NGO** pathway constructed of intra- and inter-NGO relationships that exist as part of the project design and implementation process (shown in red)

4. A **technological** pathway providing the exchange of specific technical ideas and expertise (shown in blue)
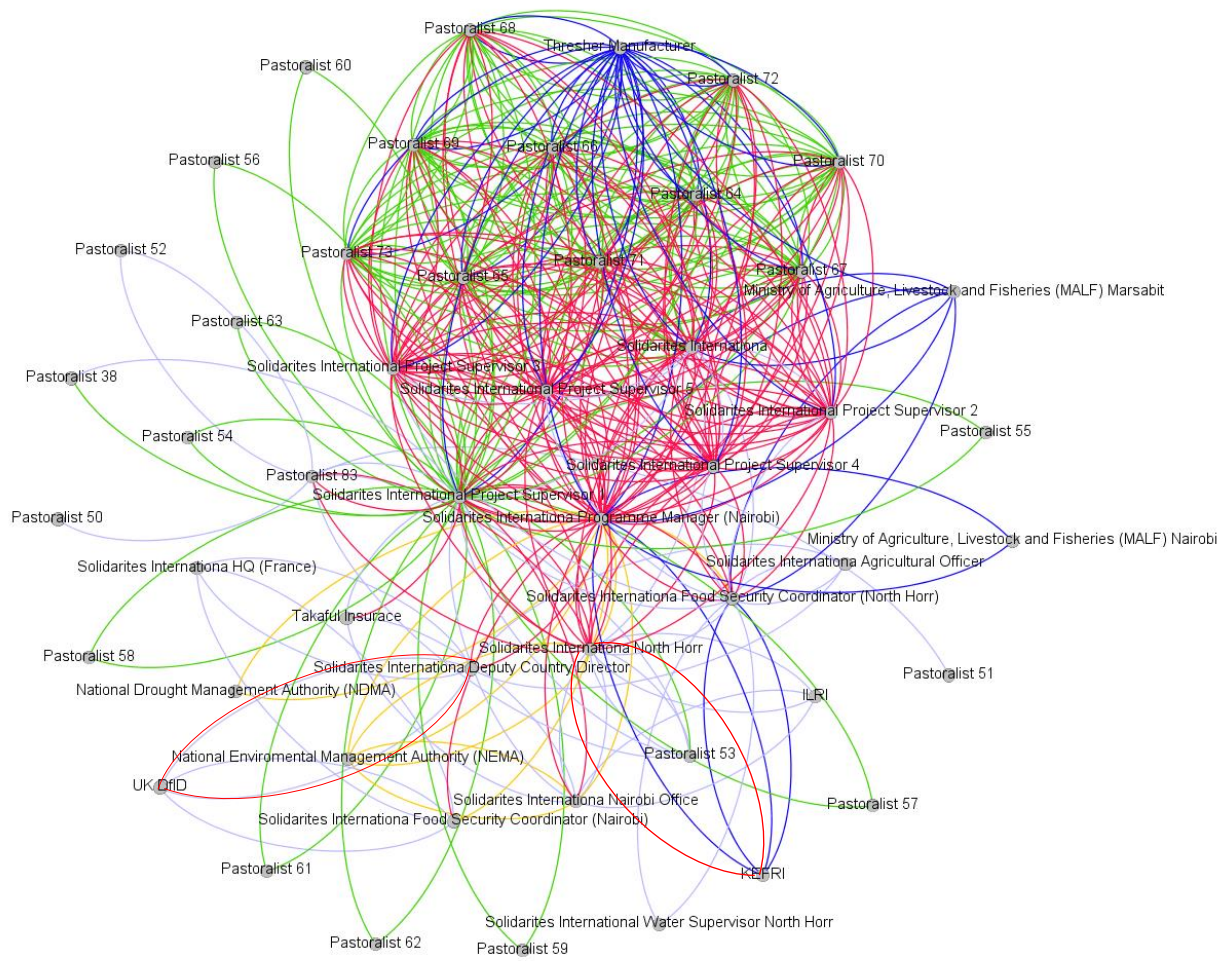
Figure 21: MUB case study, sub-networks by colour

This layout can prove difficult to interpret due to the overlapping nature of relationships. To expose the clusters within the network it can be re-visualised by illustrating instances of local pathways as:

Local sub-network
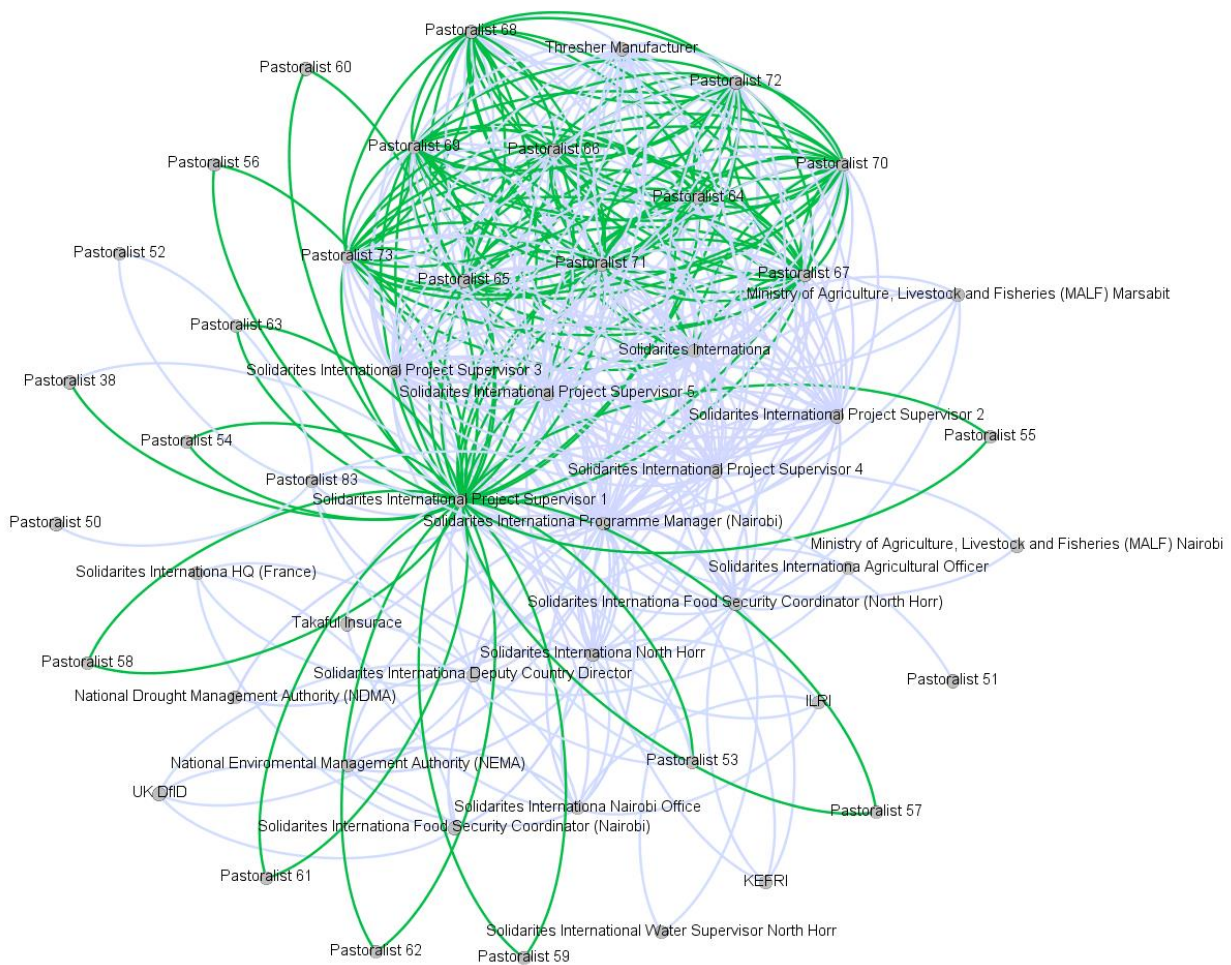
Figure 22: MUB case study, local sub-network

The local subnetwork was characterised by iterative, discursive exchanges not limited to the MUB

programme. During meetings of the MUB programme, herders' conversations included a variety of

topics including local news and the sharing of information on other livestock programming in

different communities. The inclusion of one of the five SI Project Managers (SIPS1) in the local

network is noteworthy; SIPS1 was both ethnically Gabra, and dynamically engaged in community

matters with multiple linkages to projects occurring within and around North Horr. The language

used by MUB group members in describing SIPS1, and the explanations offered by SIPS1 (as opposed

to SIPS2-5), revolved around relationship-building. Phrases such as *"He (SIPS1) is able to work for*

Solidarites. He knows them and their systems. He can help us understand what they are doing, how

they help" (P66), or *"he is one of us"* (P68) are typical of the framing of SIPS1 as a community agent,

a 'local boy' with the ear of the development organisation. This is in stark contrast to the

descriptions of the other project managers, who *"bring the programmes to the community"* (P64),

"let us know what they (the NGO) wants" (P72), or *"tells us how this thing, these things, must be done"* (P66). The differences between SIPS1 and SIPS2-4 were further reflected in the discourse used by these actors about community members; *"the (MUB) programme is taking an idea that is known to other organisations, and using it here with us. We get much out of it – (the blocks) can be sold, or wrapped and stored. This is good"* (SIPS1), versus *"it is important to use projects that work, that we know work, as these people, the pastoralists, will not try anything that is not going to work"* (SIPS4). The 'us' referred to by SIPS1 was ambiguous, variously meaning the NGO, the Gabra, and pastoralists in general; the 'them' referred to by SIPS4 is much clearer.

These conversations informed the pathways surrounding the MUB project, most clearly demonstrated by the comparison of two different MUB groups. The actors within this network were drawn from two projects, one MUB group in North Horr (whose members are represented in the network diagram by pastoralists up to number sixty-three), and an MUB group based in Galessa ('Gas', pastoralist number sixty-four and above). Gas is a more rural community a few hours drive from North Horr; the network graph in figure 21 on page 148 shows these pastoralists in the Gas MUB group reported far greater interconnections between each member, and a close relationship with SIPS1; the North Horr MUB group reported no linkages with any of the other SIPS actors, and no interconnectedness between each other. Investigating this further there seemed to be marked differences in innovation and knowledge sharing and iterative developments of MUB adaptations that may have occurred either because of, or contributing to, the differences in density of network structure.

The Gas group was highly motivated and invested in the MUB project with time and energy, and attempted to drive forward modifications and adaptations. The group had realised that sale of the completed blocks would require better storage than was available; having brought this to the attention of the SI team, the NGO responded by exploring options for plastic wrapping. Similarly, having seen that the Gas group were actively pursuing block storage for sale, the SIPS team (initiated by SIPS1) suggested that a lack of marketing knowledge would quickly become a barrier. In response, the SI Programme Manager went to the community to provide marketing-specific training for interested groups.

This interconnected, iterative relationship seen between Gas and the wider NGO structure is not replicated in North Horr. The North Horr group described much lower levels of engagement, with many members participating in an almost exploratory manner. This was further questioned, a typical response was *"Many projects come, and these are good. But every project (is) different, and some can be better than others"* (P56). Asked to clarify, several of the group members suggested that

North Horr is a centre for external NGO programming, and that projects become available across the year. As the range and nature of projects can be wide, participants will often not understand what is offered and required by NGOs until after recruitment. Participants further reported the time input required of new projects should be measured against other livelihood activities; often if the project lacks immediate return it may not be worth investing in further. This was tempered with a desire to keep in the NGO 'good books' in case the project evolves, resulting in a pseudo-passive population that 'go through the motions' as required, but feel no attachment to the programme. This conclusion was supported by the differing opinions of SIPS1 versus SIPS2-5, as the North Horr group reported SIPS1 as being aware that all members had multiple livelihood streams and making (unsuccessful) attempts to integrate the MUB project into participants' wider livelihood choices. SIPS2-5 were cast by participants as more passive, only interested in receiving meeting sign-offs to appease organisational outputs and little more.

Other factors may have led to these differences in attitude. Recruitment to the MUB programme included one stipulation that participants should own stock. The cultural strata in Gas and North Horr are different, meaning that owning some stock in Gas has connotations of not being impoverished; in North Horr, due to the plurality of livelihood options available, it is possible that owning the same amount of stock could place an actor in a very different wealth category. Similarly, the lack of non-livestock economic opportunities and external networks in Gas may drive motivated actors within the community to enter programmes such as the MUB. In North Horr, successful and driven actors may have no need of NGO assistance to build networks and develop new ideas.

Governmental sub-network

Pastoralist 68
Thresher Manufacturer
Pastoralist 60
Pastoralist 72
Pastoralist 69   Pastoralist 66
Pastoralist 56
Pastoralist 70
Pastoralist 64
Pastoralist 52   Pastoralist 73
Pastoralist 71   Pastoralist 67
Pastoralist 65
Ministry of Agriculture, Livestock and Fisheries (MALF) Marsabit
Pastoralist 63
Solidarites Internationa
Pastoralist 38   Solidarites International Project Supervisor 3
Solidarites International Project Supervisor 5
Pastoralist 54   Solidarites International Project Supervisor 2
Pastoralist 55
Pastoralist 83   Solidarites International Project Supervisor 4
Solidarites International Project Supervisor 1
Pastoralist 50   Solidarites Internationa Programme Manager (Nairobi)
Ministry of Agriculture, Livestock and Fisheries (MALF) Nairobi
Solidarites Internationa HQ (France)   Solidarites Internationa Agricultural Officer
Takaful Insurace   Solidarites Internationa Food Security Coordinator (North Horr)
Solidarites International North Horr
Pastoralist 58   Solidarites Internationa Deputy Country Director
Pastoralist 51
National Drought Management Authority (NDMA)   ILRI
National Enviromental Management Authority (NEMA)   Pastoralist 53
UK DfID   Pastoralist 57
Solidarites Internationa Nairobi Office
Solidarites Internationa Food Security Coordinator (Nairobi)
Pastoralist 61   KEFRI
Solidarites International Water Supervisor North Horr
Pastoralist 62   Pastoralist 59

Figure 23: MUB case study, governmental sub-network

The governmental sub network was much smaller than the others within the wider MUB graph involving just six actors; three NGO-based (SI North Horr, SI Nairobi, SI Programme Manager (Nairobi) and three from the Government of Kenya (NEMA, MALF (Nairobi), NDMA). There were other governmental actors in the wider network who were excluded as exchanges with these actors were of a markedly different nature.

The exchanges between the primary six actors were characterised by a general belief that the government inhibits adaptation. NGO actors suggested this perspective as no government department were available to respond to the study questions; the use of an NGO-perspective on government action may also account for the lack of evidence of cross-linkages between departments. The inhibitory process described by NGO actors was described in two ways; firstly, through *compliance*, secondly through *anti-variation*.

Compliance-based reasons saw NGO actors at all levels describing government actors as in need of appeasement, gatekeepers to continued NGO operations and future approval. This is most commonly seen associated with the 'Kenya 2030' plan[16]; "*everything we (the NGO) do must be aligned with Kenya 2030. If we have a new idea, we must show, from the outset, how it fits in and benefits (the department's) part of Kenya 2030*" (SIPMN). The need to 'fit in' with departmental aims - Kenya 2030 or others – shaped notions of legitimacy surrounding the type and nature of innovations NGO managements were willing to consider incorporating within their programmes. This inhibition most commonly operated at the macro/strategic level, contributing to the formation of an artificial national-local or planning-practice divide; this divide came between 'approved (and funded) innovations' as part of formal planning, and emergent 'adaptations' at the field level. Senior field-level staff often reported the need to moderate reports of innovation or programme change going back up to Nairobi *"the programmes provide us with what we aim to do, and how we will do it. This is what we get our resources for. But many times we have to change a little, focus on the things that will work or do work, whilst accepting that we have to do all of the things – even those that may not be so good. They (the Nairobi office) are told these things in conversations, but the reports? They have in them what they ask us to report, not what we see"* (SIPMNH).

Anti-variation conversations typically follow the compliance stages. Once an innovation is approved for use (it is 'compliant'), NGO actors often perceived this to as a locking-in of the innovation. Approaching government and donors to get variation approved to protocols and technologies was often seen as not being *"worth the risk. If you make changes, it can mean that you did not do your research, and it makes extra work (for the government) which they do not like"* (SIPMN). As with the compliancy issues, this pressure was felt most keenly by those actors responsible for programme design, and who are in closest contact with governmental actors; further contributing to the formation of a planning-practice divide mentioned above.

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[16] http://www.vision2030.go.ke/
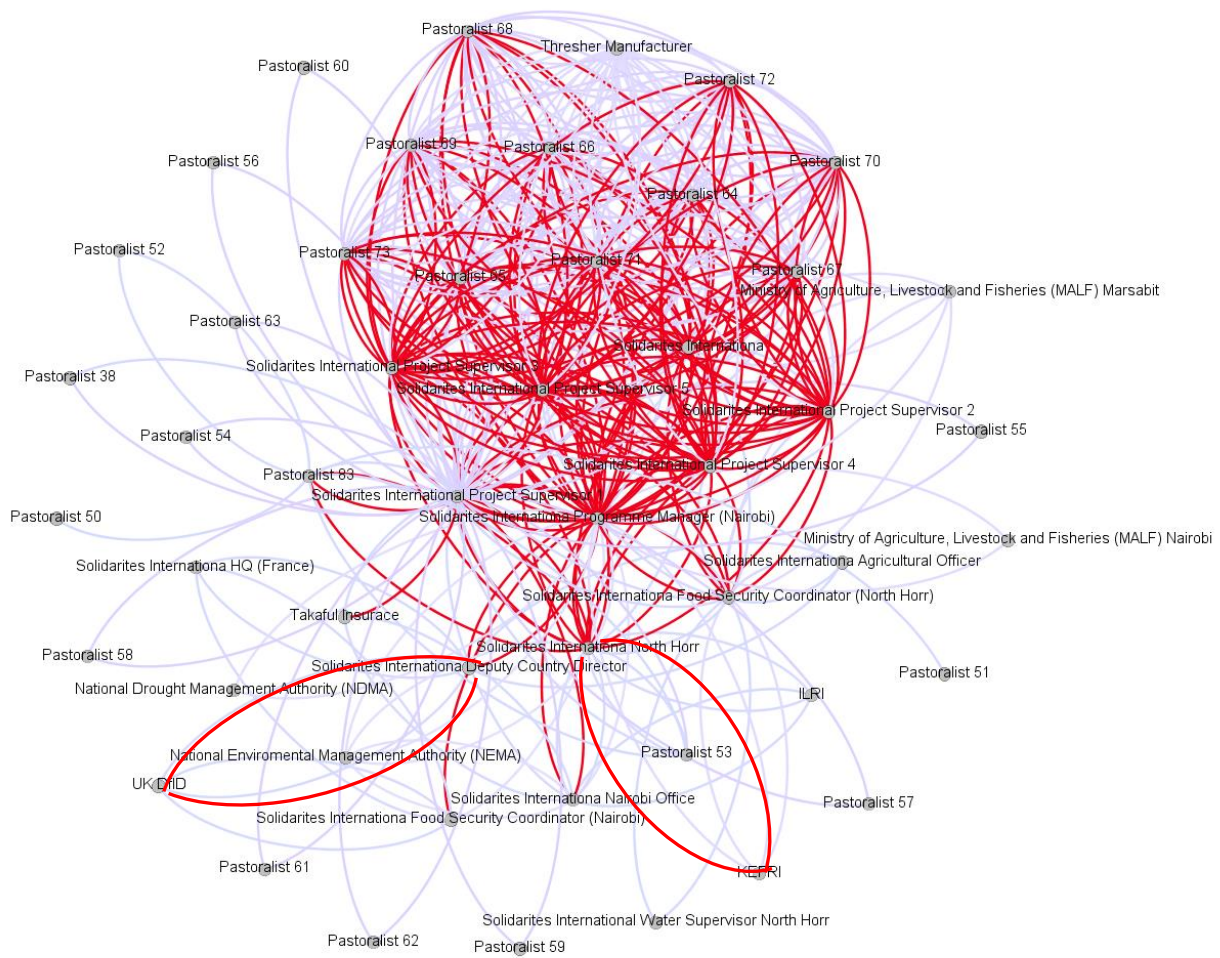
NGO sub-Network

Figure 24: MUB case study, NGO sub-network

The NGO sub network was one of the more complex found in the MUB network, comprising a diverse set of actors including local participants, local- and national-level NGO workers, and international NGO and donor members. The network is characterised by the reciprocal exchange of information that produced (often small) iterative changes in active projects. It is worth noting the exclusions from this network; the nature of these exchanges meant that the North Horr MUB group were omitted, while the Gas group was included. Similarly, GoK agencies do not feature, but the Paris SI HQ and national-level DfID office do.

At the field level, the most obvious example was the work with the Gas MUB group on dry matter inclusion. The group suggested that forage and dry matter for inclusion in the block were proving difficult to find, leading the NGO to explore alternative possibilities. This involved an informal search within and between local organisations for experience in similar situations, in part facilitated by DfID's role in promoting collaboration between consortia members. One promising route of enquiry

was the use of *Prosopis juliflora* pods, an invasive species in the region. *Prosopis* was introduced to North Horr from Mexico as part of a dune stabilisation programme, most likely in the 1970s. Now a known noxious invader, pastoralists dislike *Prosopis* due to the local belief that it forms a habitat for poisonous snakes, and that sheep, attracted to the greenery, injure their mouths on spines leading to eventual death (it is often referred to in local terms as the 'Devil Tree'). Development programmes integrated *Prosopis* removal as part of wider aims, most recently as a charcoal burning project; SI is now exploring the possibility of using the seed pods as part of the MUB programme. KEFRI[17] also provided advice to assess the quality and composition of the blocks (*"make us a recipe"* - SIFSCNB).

One key feature of this example was the donor facilitation, not inhibition, of the search for new ideas and opportunities. The perception of field-level staff was of donors as hands-off and inflexible, requiring appeasement to secure future funding: *"you have to do what the donor wants. We have few resources and we cannot just risk losing these and future projects. Telling a donor 'it does not work', or 'we did it different', you must be careful"* (SIPMNH). Nairobi-level staff however describe the relationship slightly differently; *"we talk to her (the donor) a lot, and we tell them how it is going. She helps us share with partners, with the consortia. You still do not want to say 'we cannot' or 'it went wrong', but there are places where we can talk"* (SIPMN). From the donor perspective, this is quite different; *"this (project) is quite small for us, so we have very little money for employing knowledge management coordinators. We try and get partners to talk with each other, to share. If they (the NGOs) need something, we will suggest a place where they can get it if we know one. We want new ideas, so long as they fit with the programme, yeah, that is fine"* (DfID). This more open, but still guarded, approach seemed common in dealing with donor-NGO relationships which have operational history as opposed to new or untested partnerships. The idea of donor-NGO relationships as facilitators or inhibitors is explored further in the discussion section.

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[17] See technical sub-network

Technical sub-network
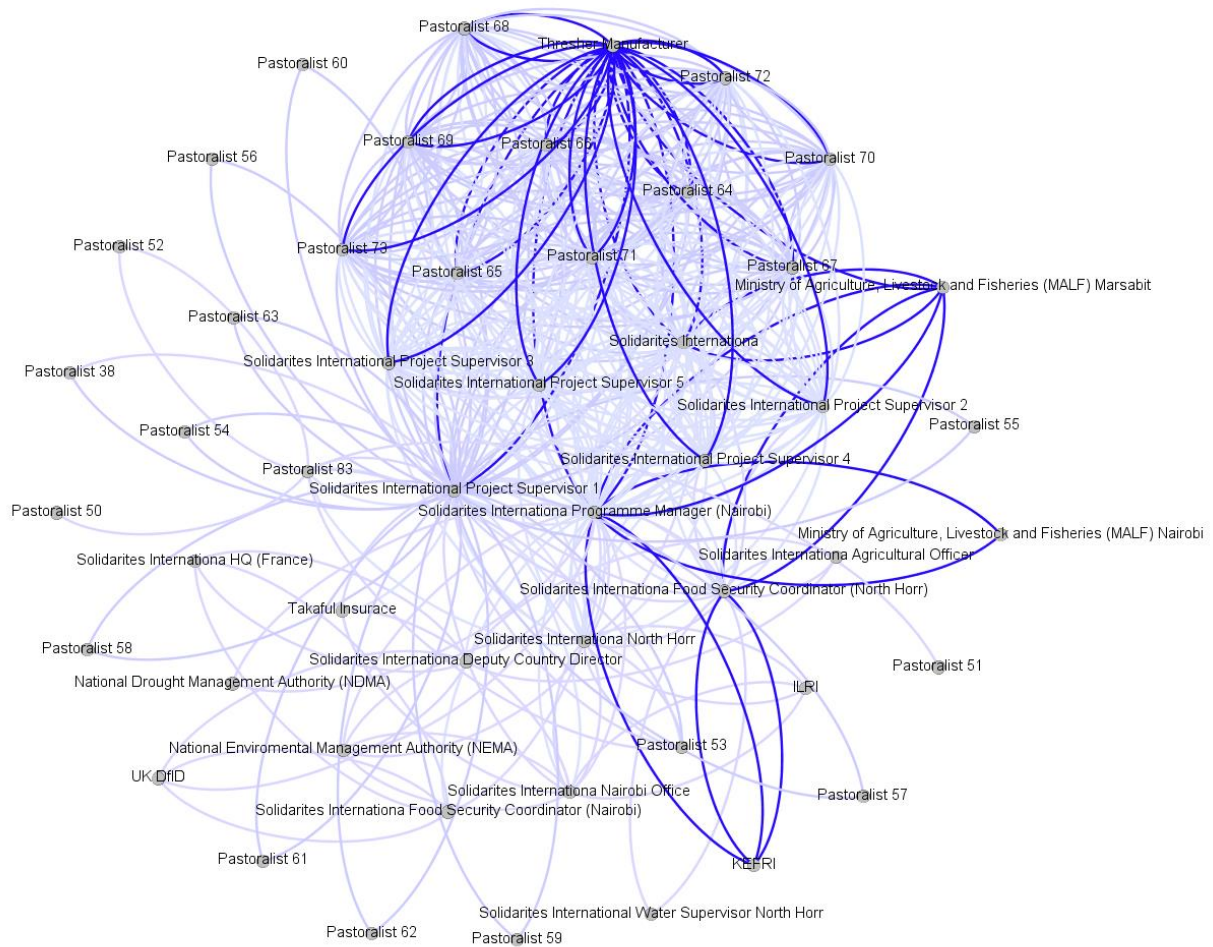
Figure 25: MUB case study, technical sub-network

The technical subnetwork is characterised by the exchange of highly specific, technical knowledge between actors. In terms of innovation, these exchanges most commonly occurred as the result of a prior development by an actor somewhere else in the network, requiring some expertise to be 'brought in'. Key examples included the provision of basic training in MUB-block manufacture to MUB groups by MALF-M, modification from a hand-crank to diesel powered MUB units and associated training by the thresher manufacturer, and (as mentioned previously), input from KEFRI on modifications to the MUB recipe – possibly to include *Prosopis* pods.

Exchanges occurring throughout these relationships did result in the development of new ideas and knowledges, but the fundamental difference between the technical and, for example, NGO sub network was the site of creation. In the technical network, each actor was exposed to a new situation or problem but would then retreat to relative isolation to develop a response – KEFRI to

their labs, manufacturers to their workshops. This was a marked change from the NGO model where multiple, iterative changes and adaptations were made between nearby actors.

5.5.3.4 Reviewing the MUB sub-network

The analyses presented were reviewed to identify common themes in the same manner as the animal health sub-network data above. The MUB sub-networks supported the comparative characterisations developed for use in the animal health sub-network, highlighting differences in diversity between wide ranging NGO and local exchanges, and more focused technical and governmental knowledge flows. Dynamics followed a similar split; NGO and local sub-networks showed iterative and energetic transfers; technical and governmental channels tended towards more static types of flow. Power and relationships were linked in a similar way, with formalised technical and government sub-networks providing specific formal, transactional channels that operated with a clear power hierarchy demonstrated in exchanges.

In summary, this case network demonstrates an alternative model to the animal health scheme of interactions between development groups and pastoralist beneficiaries. Rather than exploring alternative channels running in parallel to NGO programming as with the PDS, the MUB sub-network highlight ways in which development and pastoralist actors can develop hybrid forms of knowledge through shared aims and experiences. These observations also support the further exploration of the four categorisations for use in building an analytical framework that is discussed later. The findings from the MUB sub-network are summarised in table 4 on page 173 below.

Network	Knowledge diversity	Knowledge dynamics	Relationships	Power
Local	Point of exchange of technical and local information, specific site of group and individual sense-making	Iterative group- and individual discussion, opportunities for communal learning and knowledge exchange	Individual, transactional, transfer, affiliation, kinship	Implicit power through affiliation with, for example, SI, however forum-design and experimental nature of PFS/MUB groups allowed specific rebalancing
Governmental	Limited knowledge exchange, more explicit and implicit exercises in power	Unidirectional 'signing off' of ideas, limited input. Site of influence was often pre-contact through modifications made by NGO assumptions	Transactional, affiliation, formal	Direct and indirect influence of power through NGO belief of GoK desires, formally actioned through oversight processes, informally through pre-project design
NGO	Multiple knowledge types brought to sites of exchange, with the mobilisation and engagement of external actors	Discursive, iterative exchanges to develop and refine projects and programmes in line with local agendas	Individual, transactional, transfer, affiliation, kinship	Examples of convening power and resource inequality easily observed, but MUB group dynamics allowed for moderate rebalancing
Technical	Technical knowledge about specific topics engaged by a third party	Uni- and bi-directional exchanges, little evidence of multiple iterative changes by more than one actor	Transactional, transfer, formal	Implicit or assumed power of scientific/technical organisations mediated by third parties (often NGOs) to engage with local groups

Table 4: Case study 2 sub-network summaries

5.5.4 Case Study 3: Desilting of Horr Gutha

The previous two cases described ways in which community actors could engage with (MUB) or run parallel to (PDS) development programming. This case focused on the indigenously-led innovative use of traditional and modern knowledge networks, in combination with communication technologies, to mobilise local and NGO actors to participate in a traditional well-clearing event. Three primary sub-networks were identified that illustrated the range and nature of connections surrounding the clearance.

Picture 14: Community action

The well desilting of Horr Gutha represented a community mobilisation that included elements of the community who would not typically have engaged with activities of this type. Here, traditional herders, elders, and school teachers can all be seen removing the darker brown silt that fowling the channels seen in the top right.

5.5.4.1 Background

The dependence of Gabra households and livestock on wells, boreholes and oases has led to a complex series of socio-cultural practices in order to apportion supplies (Opiyo et al., 2011). At the core of the Gabra relationship with water is the tacit agreement that any Gabra living or grazing on Gabraland can have access to water where available. Contemporary shifts in livelihoods and mobility have exposed new problems on water points management, including questions of maintenance. The adaptation of traditional water management practices provided a useful case study from which to explore ideas of innovation relating to community.

Traditional Gabra cultural practises surrounding water use were outlined in chapter four, highlighting the ways in which high-volume, static points of water access have resulted in stark changes to cultural practices. A Kenyan development practitioner of twenty years' experience reported disappointment at how badly maintained the water points were. This belief that locals just 'didn't care' about maintaining water points was repeated throughout the NGO community, often associated with ideas of the failure of 'participation' and 'ownership' as part of project design. Interviews with respondents suggest that these results are not unexpected, for example one elder in North Horr reported that "*we do it (dig the well) when we need to, when water is needed. The elders, they show us where to dig. Also they (the NGOs) dig, they dig where their men tell them. But when our wells are full of sand we think 'is it time to move on'? When (the NGO's) well fills with sand they say 'it must be made better, must be repaired. More concrete! More digging!*" (P78). Desilting has seen something of a comeback with the CDMRR programme, but arguable as it emulates existing practices around social mobilisation whereby the community chooses to desilt and repair. This may be changing; the case study below outlines this novel means of mobilising the community and explores some of the ways in which this mobilisation reflects on changing trends in the wider community.

5.5.4.2 Knowledge pathway analysis

This network is unique amongst the three case studies in that nearly every actor involved in the network is employed in the same activity – the physical desilting of the well. As such the prevailing knowledge pathways largely reflect the ways in which the individual received and disseminated the 'call to arms', but these channels provide a good opportunity through which to explore further questions of knowledge sharing and creation.

These pathways are:

1. A **cultural** pathway reflecting traditional knowledge sharing routes (shown in red)
2. **Church** and **mosque** pathways identifying formal and informal sharing (shown in green and yellow respectively)
3. A technological pathway formed from three WhatsApp groups; the **North Horr Ward** (dark blue), **Gabra Professionals** (purple), and the **Algaanna** (light blue) groups
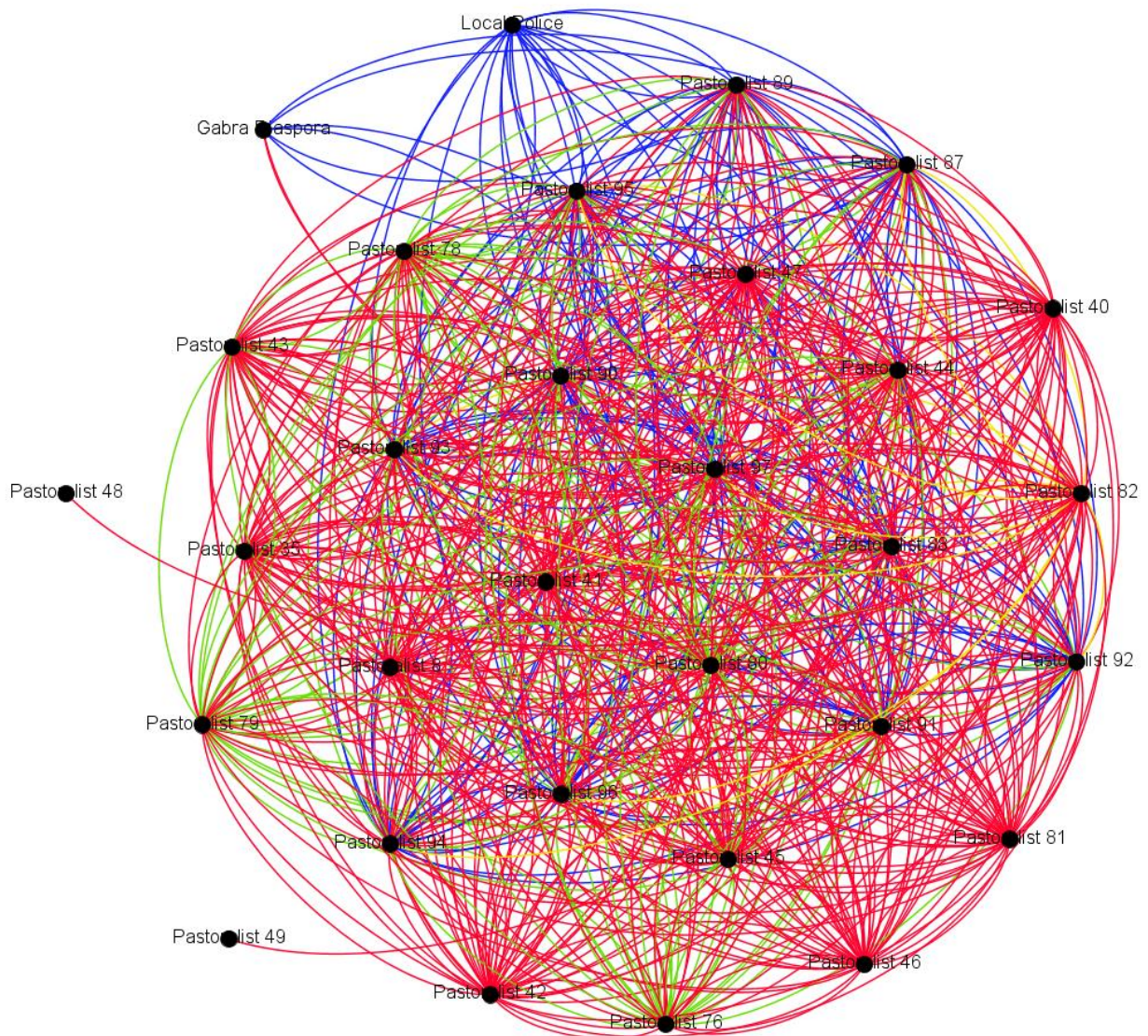
Figure 26: Well desilting case study, sub-networks by colour

Cultural sun-network
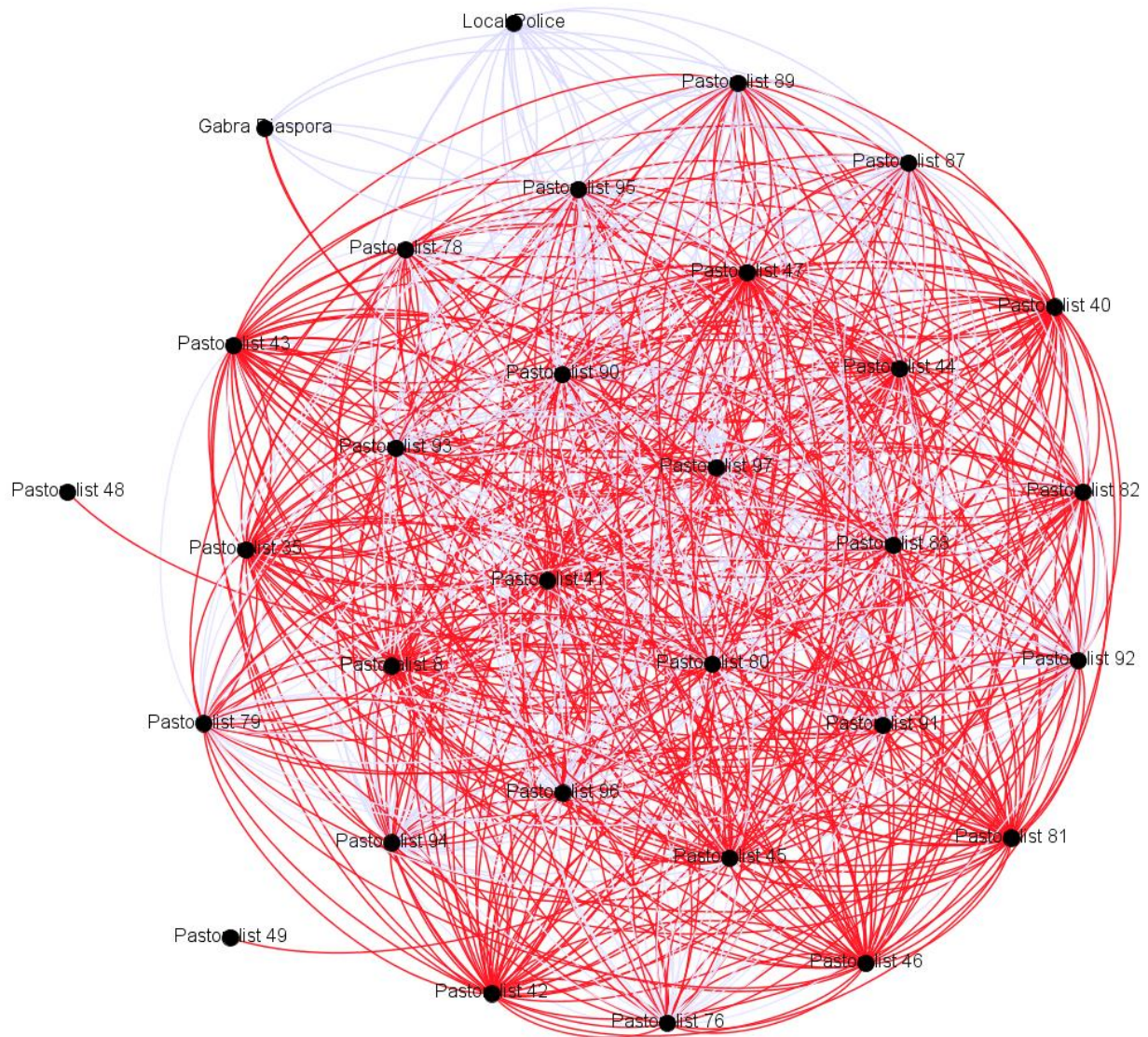
Figure 27: Well desilting case study, cultural sub-network

The cultural subnetwork was one of the mostly highly interconnected of all the case studies,
representing the range of pastoralists engaged in the well desilting. Connections between actors
were formed and characterised by deep-rooted, traditional, knowledge exchange mechanisms that
connected most (if not all) Gabra in the region; typified by *daimtu* (see chapter four). Within this
case study, and throughout the others the term *daimtu* was universally employed by respondents to
describe how new knowledge was shared between individuals and within and between
communities.

Whilst possessing deep and strong cultural roots, the concept of *daimtu* shows remarkable evolutionary utility. When discussing the emergence of online messaging, a typical exchange was *"by having that (smartphone) you can reach many peoples, from many places. It gives you much digital daimtu"* (P17). Upon further questioning, *'digital daimtu'* was described as an evolutionary process that stemmed from traditional *daimtu*. An elderly lady respondent suggested that failure to possess the technology was not necessarily a barrier to accessing *digital daimtu*; all one needed was a child or relative with a mobile telephone, and the rest of family could consider themselves as having full access.

Given the universality of *daimtu* within the pastoralists of North Horr, it was unsurprising that the medium played a significant role in the mobilisation of community members wishing to participate in the desilting case. In this subnetwork many educated, rich, non-herders referred to *daimtu* as one of the routes of knowledge exchange, despite having access to a range of faster and more direct channels. Further questioning suggested that the relevance of *daimtu*, and the decision to engage in the physical labour of desilting, was borne of a strong desire to engage with the more 'traditional' aspects of Gabra life. For many of these 'modern elites' there was no compulsion to help; tradition would dictate it was the users – the herders and their families – that would shoulder the burden of the work. But this desilting event seemed to mark a sea-change in the community, one that was remarked upon by participants due to the novelty. Members of the community who have 'good jobs' – teachers, nurses, business owners – but who directly possess few livestock[18] were motivated to organise and engage in a traditional community-driven action. The primary organiser was a local teacher (P97) who articulated this feeling common to many modern elites; *"We are Gabra. Livestock are in our blood, our culture. But there are many things a Gabra can do now, he can have a shop, he may have a good job, go to university, but he still must be Gabra. I have not the knowledge of the soil and animals like my grandfather, but this does not mean I am not Gabra. By caring for our water in this way, for Gabra camels, we are Gabra"* (P97). Whilst the innovation in this case study could be considered the novel mobilisation of previously unengaged actors through a variety of mediums, this case further highlights the fundamental place of knowledge sharing and creation within Gabra society.

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[18] Many rich Gabra salary poorer members of the community to herd for them.

Church and mosque sub-networks
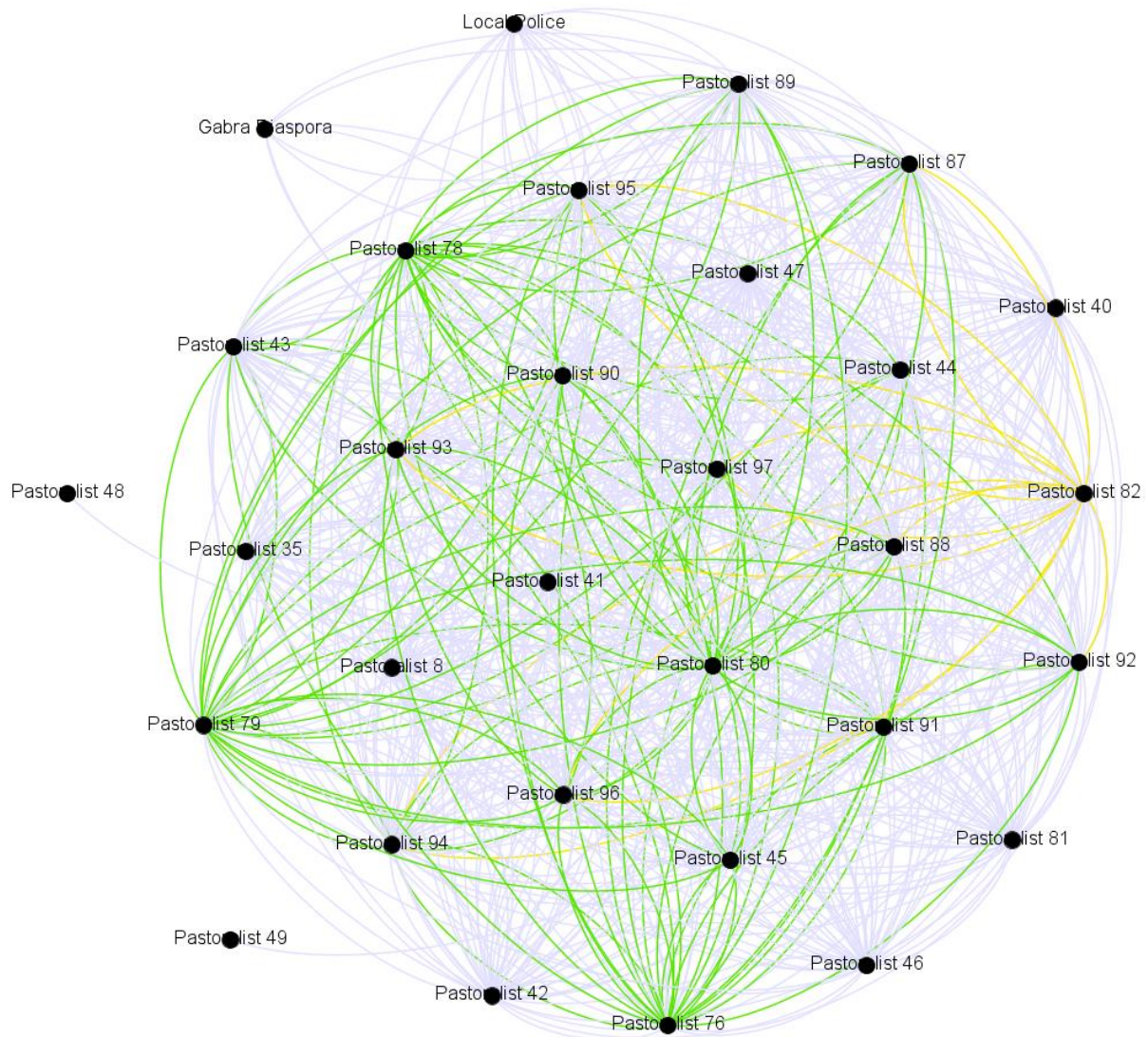
Figure 28: Well desilting case study, church and mosque sub-networks

Religion in North Horr prior to the 1960s was dominated by the local religion, with limited influence from a Somali Islamic minority associated with Arab traders. In the months leading up to Independence in 1963, the colonial administration gave permission for Catholic missionaries to build a school and dispensary within the settlement of North Horr. These three religious institutions continue to co-exist, both within the community and frequently within individuals. Many of the Gabra frequent either mosque or mission whilst retaining a strong sense of local religious identity – a state that rarely seems to result in religious tension. These multiple, non-conflicting identities reflected a fundamental aspect of Gabra society; that both identity and networks of any one individual are drawn from several different groups. A pastoralist may have an ethnicity, a phratry, an

age-set, a family (biological, married, close and extended), a physical community, a mobile community, one or more religions, possible work and educational affiliations amongst other identities. It could be suggested that one characteristic about which Gabra society and other, more typically western cultures, differ is in the ease with which, and expectation that, one can and will draw upon and contribute to exchanges within these diverse networks. There are both costs and exceptions; most strikingly the more traditional networks were preferred by poorer herders than by richer (Tasker, in prep.). The motivations at the heart of the well desilting network are in direct contrast to this trend; elite members with access to broader networks choose to invest time and resources to retain a sense of 'Gabra-ness' that was valued higher than any direct physical or risk-mitigation value returned on the investment.

Technological sub-network
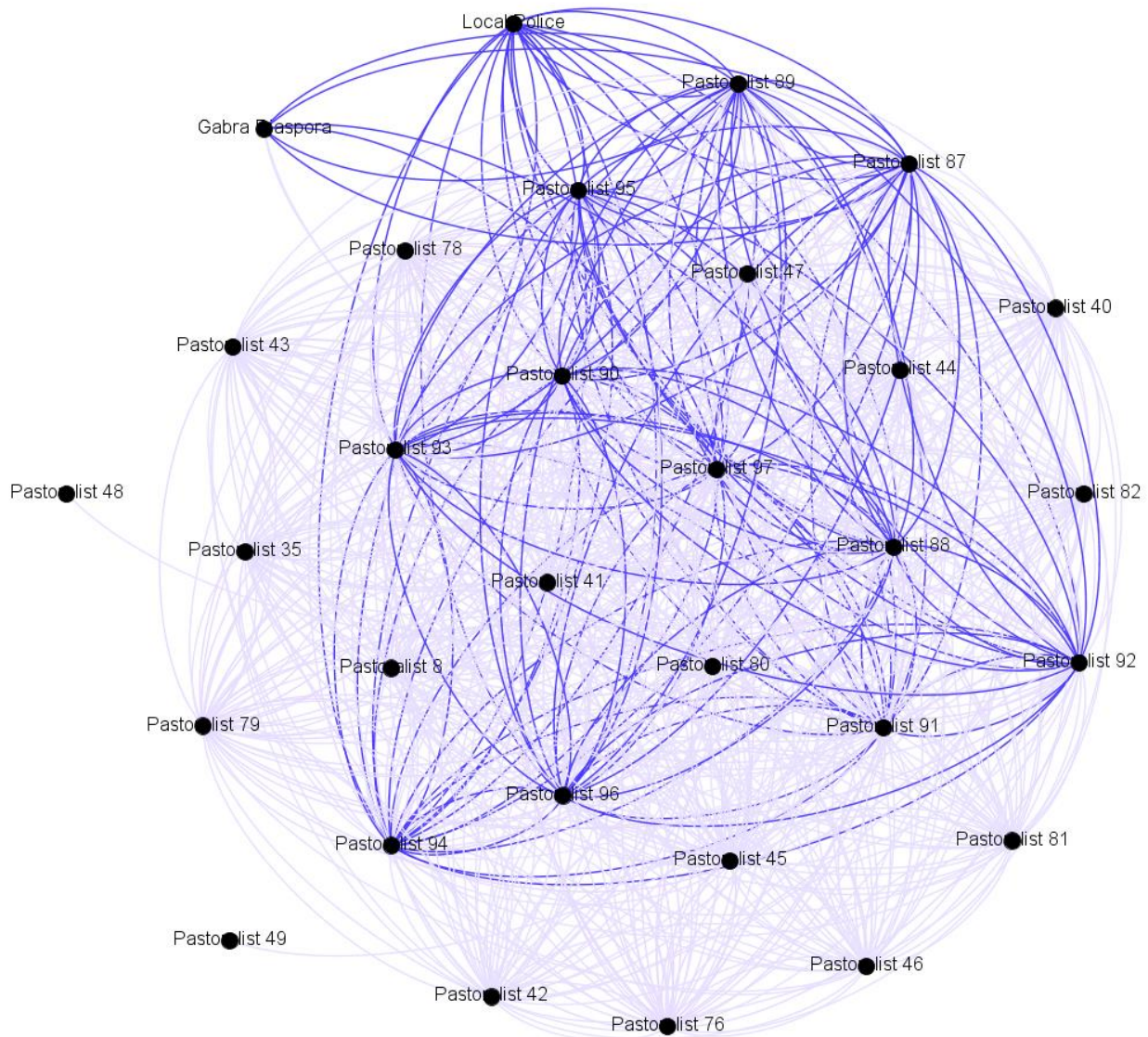
Figure 29: Well desilting case study, technical sub-network

The technological pathway illustrated the most recent addition to Gabra knowledge sharing channels. The pathway primarily used WhatsApp, a mobile messaging service, to link members together. In this case study three differentiated but interconnected groups existed: The North Horr Ward Forum, Gabra Professional Network, and the Algaanna forum. Many other WhatsApp forums were present in North Horr but were not employed as part of this case study.

WhatsApp North Horr Ward Forum

The North Horr Ward Forum (NHWF) was conceived as a community-level means of engaging in political debate around local issues and sharing local news. The forum quickly recruited members

through word of mouth and remains popular across the community, receiving multiple joining requests daily. This led the appointment of two further administrators in addition to the first, who share responsibility for the inclusion or exclusion of members. Interviews with two of the admins suggest that selection for group inclusion is based on utility to the group, good standing within the community, or recommendation by a powerful group member.

- *Group utility*. Traditionally group discussions were communicated to local political representatives through *barazzas* and community consultations. As technological access increased, it became increasingly possible to include representatives in the group itself. At first this meant North Horr-based representatives, but later (and increasingly) Marsabit-based political elites have gained membership. Anecdotal evidence exists of members of parliament having either direct or indirect (through office staff) access to WhatsApp groups, particularly ethnically-centred forums populated by powerful individuals. One of the NHWF admins proudly described having recruited a member of the Marsabit MP's office immediately post-devolution. The presence of powerful or connected individuals within a group was acknowledged as influencing the conversation, with admins moving to limit divisive or contentious topics to retain the powerful member - *"they (group members) should be respectful. We have good discussions, but they must be spoken in the way that the good contact (powerful group member) will listen to and not just leave. If it happens, we can take away the member who is shouting, causing trouble"* (NHWF admin 2). When questioned further on this censure, the admin agreed that debate was necessary and acknowledged that the most common result was for the perceived demagogue to start their own forum – often recruited from the original members. The primary risk here perceived by the admin was not the loss of free speech or the creation of an 'echo chamber', but that the new group may prove more popular than their own and attract further powerful members.

- *Good community standing*. A range of elite sub-populations exist within the wider community of North Horr. Whilst a relatively new medium, the WhatsApp group was strongly rooted in Gabra cultural beliefs and practices, the influences of which can be seen in the way forums were constructed and used. Community members who were well respected, such as elders, or larger herd owners, who are technologically conversant were able to leverage this privilege for membership access. Having one of these individuals as a member of a WhatsApp forum provided a form of 'cultural legitimacy' to the debates occurring, and facilitated the movement of information between virtual and real-world meetings.

- *Recommendation*. Whilst apparently less common as a reason for recruitment than the previous two rationales, both admins interviewed suggested that if an active and respected

member of either a virtual, or real-world community recommended a member be added, this would merit serious consideration. It does not appear that these recommendations were made lightly; serious consideration was given to the political effect of including a member (and by necessity excluding another) at the behest of a non-admin. A common reason for acceptance can be the 'purchase' of skills into the group, further increasing the breadth and depth of knowledge available to the group. For example, when discussing the Uweza fund (an upcoming call for village improvement projects), the admin suggested *"many group members wanted to know how they must register their business, what is to be done about bank accounts. One member, he has a brother who works for KCB (Kenya Commercial Bank) in Marsabit. He is added to the group, and he answers questions. He is very good and we are like the information he can give. The group, they like it"* (NHWF admin 2)

As the group was both popular and limited to 100 contributors, the retention of forum members was a more complex and contentious issue. Members primarily maintained their positions through regular and insightful contributions – "*if a member goes quiet, he or she knows that they may lose their place to another who can give more*" (NHWF admin 1). This rule was exercised with some flexibility; political elites and powerful members were tolerated as 'lurkers', passively receiving but not contributing. Their presence was earnt by the cache and contacts that they brought, rather than active contributions.

As mentioned above excluded members often fragmented existing groups and formed their own breakaway groups. In many cases group members overlapped within several forums; information on the well desilting case was widely shared through the Gabra Youth Forum and the Third Eye forum, but few additional members were recruited from these groups.

Perhaps most significantly for the well desilting event, the NHWF membership included one of the Solidarites International Project Managers (SIPS1). SIPS1's membership of the NHWF was as a 'private citizen', though his recruitment onto the ward some years earlier was almost certainly helped by his privileged position within the NGO. Because of the membership of the forum he was able to informally requisition shovels and wheelbarrows belonging to the SI field office for use in the digging. This 'soft' interaction underlined the ways in which informal and parallel networks can facilitate the spread of resources – including knowledge – through channels often hidden to superficial observation.

WhatsApp Algaanna

The Algaanna are the largest in number of the five Gabra phratries (see chapter four) and have strong representation in the North Horr area. The phratry system has roots as far back as Gabra communal knowledge is able to recollect and continues to perform a number of functions within Gabra culture. Outside of 'formal' cultural functions such as dispute resolution and age-set progression, members of a phratry communicated and supported one another on a day-to-day basis; borrowing, lending, advising, and mentoring were all conducted within the phratry. The Algaanna WhatsApp group was viewed by members as a natural extension of the physical Algaanna institution; where previously aspirational school-age Algaanna may have written to a fellow Algaanna alumnus at university, they now posted on the group looking for advice or support. Notices of *haram-bei* collections for an Algaanna widow were no longer limited to immediate settlements, donations were solicited from the Algaanna diaspora through virtual forums. In the case of the well desilting, the initiator (P97) was both culturally Algaanna and an active user of the Algaanna forum, making its use an easy way of reaching and mobilising additional contributors.

WhatsApp Gabra Professional Network

The Gabra professional network differs significantly in both structure and organisation. This WhatsApp group was formed as an extension to the paid-membership Gabra Professionals networking organisation. This organisation has membership far outside of both North Horr and Marsabit; it boasts contacts in the US, Europe, and Asia. The exchanges found on the network are also different to those of NHWF and the Algaanna; job opportunities, training availability and mentoring take up the bulk of the messages (alongside the obligatory political commentary of any Gabra conversation). These exchanges lent the forum the feel of a select business club, with membership allowing the access to a wide network of potential contacts set against a background feeling of *"supporting the Gabra who wish to make more, go further, so they can continue helping our community"* (P97). The activity and bonds that exist within the network were evident through the well desilting; once publicised on the forum, Gabra members outside of Kenya began to send financial donations via MPESA for the purchase of refreshments for those working on the project. This reach and mobilisation also applied to knowledge flows, allowing members with privileged access to tap into a variety of wider networks – often of a technical or professional nature.

5.5.4.3 Reviewing the well clearance sub-network

When comparing the animal health and MUB sub-networks using the four categorisations developed in the previous two cases, the well desilting appears much more homogenous between the specific channels. The three sub-networks found within the well clearance case study all contain broad,

reciprocated exchanges of knowledge that occur through multiple relationship types. The most obvious differential between cultural, religious, and technical networks was the role of power; in both religious and cultural linkages the influence of indigenous and emergent elites could be seen. Technical-type relationships varied in their application of both real-world (as with the previous forms) and online positions of power.

The findings of this case network suggest an alternative series of interrelations to the previous MUB and animal health networks. In the case of desilting, hybrid knowledge is shaped within a far more interconnected and negotiated space, one which permits access more easily that the previous two cases, but still retains notions of power within knowledge sharing. The findings of this section are summarised in table 5 on page 186 below.

Network	Knowledge diversity	Knowledge dynamics	Relationships[19]	Power
Cultural	Traditional *daimtu* exchanges of varied knowledges and information throughout the network	Multiple and iterative exchanges around a variety of topics	Individual, transnational, transfer, affiliation, kinship	Manifested through traditional roles and seniority as with the *Da'abela*, and through emergent elites such as teachers or businessmen
Church and mosque	In many ways mirrors the cultural sub-network, with religious institutions acting as sites of varied knowledge exchange not limited to religious matters	Multiple and iterative exchanges around a variety of topics	Individual, transnational, transfer, affiliation, kinship	As with the cultural network above
Technological	Multiple knowledge types through direct and indirect access to wider groups and individuals. WhatsApp group design and membership largely influences the nature of knowledge exchanges	Public forums give room for debate and development of new ideas, but mostly knowledge transfer was through awareness-raising; knowledge creation often occurred either offline, or in 'spin-out' groups	Individual, transnational, transfer, affiliation, kinship	Multiple and complex power interrelations linked to real-world and online positions of authority. Recruitment and retention of locations of power a key feature of many groups

Table 5: Case study 3 sub-network summaries

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[19] See Case Study methodology in chapter three

5.6 Conclusions

This chapter explored complex, interconnected networks of knowledge exchanges between, and within, pastoralist and development groups. An exploratory macro-network was mapped and used to identify key actors within the system. From these key actors and network analytical measures, five case study networks were isolated and reviewed for their contribution to understanding hybrid knowledge creation processes.

From these five cases, three were selected for further study relating to animal health disease reporting, the MUB programme, and a local well desilting event. These three illustrated different aspects of hybrid knowledge creation processes, and in particular interactions between indigenous and development groups. The animal health network demonstrated the decisions of local actors to use or bypass formal NGO planning; the MUB network provided contrast by showing ways in which local beneficiaries could engage with and adapt, or ignore, planned development interventions. Both are set against the use of modern and traditional knowledge sharing and creation mechanisms illustrated in the well desilting process to provide a broad illustration of knowledge hybridisation processes.

Part of the analytical process leading to these observations was the search for common themes between the three networks. This process identified four discrete factors, common to all three cases, that provided analytical hooks for comparison. These four aspects, knowledge diversity and dynamics, relationships, and power, are considered below for their contribution to creating an analytical framework.

5.7 Constructing an analytical framework

The four themes described above provide perspectives on different aspects of hybrid knowledge creation processes. Each of these is reviewed in turn below; the four are then synthesised and developed further to propose a matrix-type framework to help further exploration of the topic.

5.7.1 Knowledge diversity

Within each network, sub-network, and relationship a range of different knowledges exchanges were evident. From highly focused exchanges, such as disease reporting in the PDS, to the plural streams of personal relationships, it was possible to suggest links between the width or narrowness of the *diversity* of knowledges contained within a relationship and the types of knowledge created by that relationship.

5.7.2 Knowledge dynamics

Separate to types of diversity within relationships were observations of the *dynamics* of relationships. Many examples of static, unidirectional knowledge or information transfer were identified; for example, technical MUB information or Government oversight. There were also relationships characterised by active, iterative exchanges, often occurring over longer periods of time. These discursive relationships did not necessarily form constant wells of new knowledge, but the iterative and experimental nature of these conversations provided rich ground for knowledge hybridity.

5.7.3 Relationship types

This study used categorisations of relationship types adapted from Ian McCulloh et al. (2013) and described in the methodology contained in chapter three. There did not seem to be a direct correlation between knowledge hybridisation and any one relationship form; there were however links between the types of relationships and the diversity and dynamics referred to above. For example, formal relationships seemed to be linked with univalent, one-way transfers, whereas individual relationships were more frequently multivalent, discursive exchanges.

5.7.4 Relationship power

As mentioned previously, knowledge and power are intimately associated. Case study network observations serve to highlight the complexity of these relationships, where explicit incumbents of power such as politicians and traditional elders exist in networks with micro-contextual and emergent power holders such as WhatsApp admins or SI Project Supervisors. Notions of power and access permeated all of the networks and sub-networks, but these aspects of power could not be reduced and simplified at this stage to inform a framework for analysis.

5.7.5 Suggesting a framework for analysing pastoralist innovation

Examining the characteristics above is was possible to assemble a possible framework for explaining how these four features could help explain knowledge hybridisation and creation process. Initial attempts focused on the integration of all four factors into a single analytical tool, however through developing the tool it became clear that some links between aspects were more analytically useful than others. Drawing together these observations it was decided to create a matrix that could investigate linkages between power and relationships using a lens provided by knowledge diversity and dynamics. This diversity-dynamic matrix could be used to map various relationships to explore

how these two factors led to different forms of knowledge creation and hybridisation. The matrix is presented below in figure 30.

Knowledge dynamics
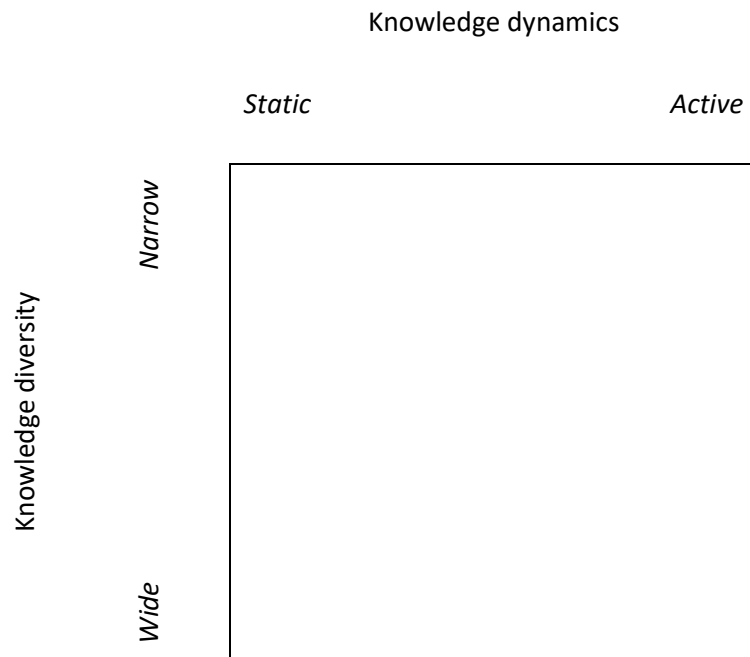
Figure 30: Proposed dynamic-diversity matrix

This matrix provides a framework through which to develop further ideas surrounding the role of relationships and power in shaping knowledge creation and hybridisation. The knowledge flows observed in the case study networks provide limited insight into actor-level acts of creation, acts that form the steps in the knowledge hybridisation process. To explore the idea of innovation as evolving and emerging knowledge, a more detailed exploration of the role of individual actors is required.

The creation of the framework above, and the need to understand individual dynamics provides the foundation for the next chapter. Building on the case study networks, the following chapter employs a series of methodologies to uncover the framings of individual actors within the networks. These are then combined to form a series of core frames that can be used to characterise individual dyads in chapter eight. These dyads, and their unique attitudes and framings, will be mapped onto the dynamic-diversity matrix to explore how these attributes relate to processes of hybrid knowledge creation.

Chapter 6:

Exploring framings

Picture 15: Perspectives from within

Many of the narratives surrounding pastoralism paint a decidedly negative picture of community resigned to hardship. This chapter explores how perspectives from within communities may influence the creation of new knowledge. The picture above shows a recently-formed VICOBA group who see a positive future through self-funding start-up projects for their members.

6.1 Introduction

The latter half of the previous chapter drew on a series of case study networks to illustrate the range and diversity of knowledge sharing pathways occurring within the wider system. From these observations an analytical framework was proposed, a *diversity-dynamic* matrix, to characterise knowledge interactions within the networks.

The matrix was constructed from observations of specific network characteristics, emerging from collectives of actors. The concluding section of the chapter suggested that to explain knowledge hybridisation it was necessary to take a more granular view; a view that accounts for the role of individuals in shaping wider processes. This chapter is the first step in addressing this observation.

Using a series of methodologies outlined in chapter three, this section of the research details the findings relating to actor framings of innovation from within the system. Firstly, using Thematic Analysis, a series of endogenous Global Themes are identified, followed by the results of the Q-methodological section to locate endogenous- and exogenously influenced Factors. These two outputs, Global Themes and Factors, are then combined using Participatory Frame Building to create a series of internally-relevant core framings.

This chapter closes by reviewing the key findings of the framing research and sets out how framings will be used in the analytical framework to evaluate the dyads selected in chapter eight.

6.2 Thematic analysis

Respondents	Selection	Locations	Field Session	Data collection
32	Researcher-led	6 Nairobi 26 North Horr	2	Semi-structured interviews

Following the methodology outlined in section 3.4.2, Thematic Analysis was used in this section of the study to identify common threads that ran between the responses of actors throughout the system. Thematic Analysis allowed the identification of hierarchies of themes, from basic principles surrounding specific events, to super-ordinate Global Themes that reflected more abstract concepts.

The process of identifying these levels of themes used two strands of enquiry. In the first instance, open-ended questions were used to prompt respondents to talk about innovation in general terms, so as not to close down possible conceptualisations. More specific questioning followed that focused down on innovation exemplars and case study innovation histories to provide granular detail.

The following sections present a series of results that guides the reader thorough the theme identification process, and then develops each theme further to highlight specific aspects relevant to the processes of hybrid knowledge creation.

6.2.0.1 Abstract conceptualisations

Actors from all sections of the network found it difficult to provide a coherent definition of what innovation 'is'; an observation that was consistent with wider innovation literature. This confusion was explicitly recognised at both individual and organisation level, typified by statements such as: *"I don't have a quotable definition in mind, there is a lot of talk about innovation within (the organisation) but we don't have a very common or collective understanding. Depending upon who you ask you may get very different answers"* (D01). Whilst no clear 'soundbite' definition emerged, clear commonalities and differences were identified between respondents. The most common unifying theme was the 'novelty' of innovation*: "so this (example) to me is an innovation in the way of thinking, a way of doing something new"* (N01), *"trying new solutions, or trying new ways of applying old solutions"* (D01), *"something that has not been here before, a new thing for us and our culture"* (P04). Notions of novelty were almost universal, however unpacking these statements further highlighted subtle conceptual differences between respondents.

These more abstract ideas were then developed using innovation exemplars, where respondents would describe examples of innovative activity to provide context. The following section reports this analysis; respondents are categorised here by reference to their institutions for comparative clarity rather than inductive group formation, which will be discussed later.

6.2.0.2 Donor perspectives

Donor respondents visualised innovation as an adaptive process that emerges in response to (often pre-existing) programme obstacles; *"innovation is about new ways to solve old or stubborn problems, or new ways to get things that we know that work and applying them at scale."* (AD01). This position was like that of NGO field staff: *"we have to make changes, to innovate, all the time. We make changes in what we do so the project works, so that we do what we need to do"* (AF01). Problem-solving was common to both groups, however the problems differed significantly – 'donor problems' were persistent, often wicked, problems developing over years; 'field staff problems' were more immediate, often relating to project delivery.

Innovations described by donors were largely non-technical; where referenced, technology was either part of the innovation process, or an enabler of wider innovative aims: *"the innovation wasn't necessarily about the technology that would be pushed through, but supporting innovative ways of*

stimulating uptake", *"of course you have the hard-core technology; but the last mile or so, and getting science on the shelf[20] – a lot of innovation is more about how you make that happen, not necessarily about the product itself".* (AD01). This contrasts with donors' beliefs of NGO conceptualisations - *"there is a tendency (for NGO partners) to associate everything that is digital with innovative ways of doing things"* (AD01).

6.2.0.3 Nairobi NGO perspectives

NGO partners echoed the novelty aspects of donor definitions of innovation, however they tended to describe newness in terms of discreet approaches or techniques rather than at the system level. NGOs and donors differed significantly in their emphasis on the agency of innovation; donors talked about collaborative innovation more readily than Nairobi-based NGO staff. NGO operatives stressed ideas of ownership and utility: *"so we came up with what we now call participatory disease surveillance"* (AN01). Possessive statements such as these rooted innovations in terms of ownership – 'ours', 'mine' or 'theirs', terms echoed in pseudo-market terminologies surrounding NGO activities. 'Value' was a particularly common trait; *"I understand innovation to be doing things in a different way, in a new way, that can increase the value of what you are doing", "so we can see added value beyond (the NGOs) work in giving back to the community"* (AN01). Notions of value were commonly linked to the 'sale' of innovations to local groups; *"(the innovation) may not be very attractive (to local communities)", "innovative ideas should be combined with immediate input, to me that is key"* (AN01). Developing these ideas further, this respondent suggested a 'sale' was necessary to both donor and recipient, and timescales were key; *"innovations are really taking time to pick up, that much I know. Because in the same environment you have different actors who want to do things the same way, who want to do things an easier way, and that makes it attractive to the community and sometimes to the donor to see quickly the outcome"* (AN01). This idea of immediate return contrasted with donor beliefs surrounding evolving innovation processes; NGO perspectives tended to focus on how best to enable acceptance of pre-approved 'innovative' programming by target communities.

6.2.0.4 Field NGO perspectives

Comparisons between Nairobi-based and field-based NGO workers highlighted differences in understandings of local-level adaptation to overcome obstructions to programme implementation. Field staff did not see field-level work-arounds as innovations; the translation of national programming to local contexts was understood as being part of the job. This was typified by the

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[20] Science 'on the shelf' in this situation meant providing access to the end-products of scientific research and development to the general populace.

perception of longer-term local workers employed by NGOs who saw their primary role as *"making the community understand the project, and helping the project help the community"* (AF09). This respondent identified innovations within development programming and the community, but did not see adaptations to programming as innovative, *"innovation is something big, something new. Changes like you ask are little things that make big things happen better"* (AF09).

6.2.0.5 Pastoralist perspectives

Non-NGO pastoralist respondents also overlooked micro-level adaptations as innovations. When questioned on innovation in the local community, technological or skills-based innovations were most commonly suggested; for example, new motorbike equipment or further education facilities. Developing this further, respondents were asked about differences between now and their parents' generation; these answers were much more varied – collecting milk by motorbike, using community groups to access grants, and building links with the diaspora all featured highly. Respondents rooted these developments within the Gabra cultural norms that promote the routine sharing of new knowledge through *daimtu*. In contrast to NGO perspectives, this resulted in few innovation processes being 'owned'; the choice to employ or adapt was dependent upon the individual. *"Many things change, but this is our culture, and we may do what we need and want. If someone comes to our community and he is doing something different, we will come and see. We will ask. We will talk to others who know about his things and see if it is for us. If it is good or bad, the Gabra will talk. If it is good, herders may choose it; even if it is bad some may choose it still but do it differently, in his way. Like medicines for sick camels – you will talk to those who know, and choose to use them if you can find them and can pay"* (AP21). There were however differences between this more traditional viewpoint, and wealthier or more educated pastoralists who tended to focus on technological or market themes; *"innovation is good for the Gabra, it brings opportunity. Many things have been good – the internet, mobile phones and the MPESA. We have the abilities and can talk to other Gabra in Nairobi, Addis and America"* (AP08), *"by talking to Nairobi markets we can find the best prices and check that no one steals money from you. I can call my daughter (in university) and she can find out many things"* (AP03).

6.2.1 Global Themes

The previous section outlined the landscape of perspectives found within the network, but also highlighted variations between, and within, macro-level groupings. To explore commonalities and contrasts between framings the interview transcripts were coded and analysed to search for basic, meso-level and Global Themes; a schematic of the results is included in appendix 5. The key findings were the emergency of three Global Themes:

i. The role of *knowledge*

ii. The presence of *drivers and barriers*

iii. The impact and character of *risk and uncertainty*

The following section details these themes, providing context for further discussion.

6.2.1.1 Theme 1: Knowledge

All interviewees referenced knowledge and knowledge-sharing in their responses due to the question structure. In most cases the transfer of knowledge was described in inter- rather than intra-group terms. Discussion of knowledge themes in this section therefore follow respondent-defined categories of community-NGO, intra-NGO, inter-NGO, donor-field, and donor-Nairobi NGO relationships.

Community-NGO

Central to understandings of knowledge exchanges between NGOs and local groups was the perceived role of local knowledge. Superficially, Nairobi-based respondents suggest that knowledge about programme contexts, derived from field staff was central to innovation with comments such as *"innovation comes from programmes, this is where the ideas for programmes and projects are developed"* (AN01). Further clarification explored what respondents meant by 'programmes'; AN01 detailed how local knowledge feeds into programming: *"we are dealing with very different capacities, very low. For you we can read, for me, but for them (the pastoralists) to a very great extent they rely on you to pass key ideas so that they pick it and internalise it. How is a very important thing, how to do this is very important. Because they (pastoralists) may be hearing about planning or a disaster and their understanding, their way of doing it may not be up to the standard. So the 'how' of how to do it must come from you (the NGO) in a very simple way"* (AN01). Terms such as '*very low capacitie*s', a reliance on external agency for 'ideas', and their 'way' being '*not up to standard*' casts pastoralist communities as if homogenised, uneducated masses unable to progress without external help. Whilst AN01 is at the more extreme end of this spectra, his colleague AN02 took a more measured approach that stopped short of suggesting local communities offered no knowledge of use, but cautioned against the assumption that all local knowledge was worth considering *"I cannot say that because it is local, we support it. A lot of things local people do are wrong, many things"* (AN02)*.* He suggests that project innovations may come from local communities, but this was dependent upon the presence of specific skills and attitudes in development groups to identify and engage with this type of knowledge: *"I think often the ideas come from local communities and if you have good staff who can support it and have a broader view it is possible that the idea comes from local communities"* (AN02).

Both respondents are willing to articulate what they understand by local knowledge; for example, AN01 suggests Participatory Epidemiology; *"Local knowledge? They say that twenty animals have died in this place. Is this enough to get someone to react? When you are sending someone twenty animals, don't just send the alarm, collect all the facts on how these animals have died, say this, this, this. They …know… that when an animal dies you are supposed to report it. Building on the innovation"* (AN01). This conceptualisation of local knowledge as a reservoir of 'facts' or information is confirmed by a discussion about collaborative innovation: *"development organisations need to have an input (in innovation) … without development organisations it would be difficult. The development organisations are coming with resources in terms of money and vehicles and all that, the community have the resources of the human beings, they are responsible (for) telling you 'here and not here', 'if you did do it in this month and not this month' – that is a big contribution"* (AN01). AN01 was clear that local input was limited to the provision of information under the direction of the NGO, rather than the collaborative shaping of knowledge stocks. Other members of the Nairobi office held slightly different views, suggesting that local inputs could shape innovations to some degree; however, it is hard to locate a concrete example of when this has happened. NGO staff recognised that existing channels for moving knowledge from the field are not the easiest ways of transferring new ideas *"(knowledge moves from the field to Nairobi by) reports, many visits and of course Marsabit is a hardship area so people come out every three months and they have R&R and they pass the office and they discuss" (AN06)*. This transfer of innovative ideas from community to NGOs via ad-hoc reporting is a common feature across development organisations; when questioned about the other side of the knowledge-exchange relationship (NGO to the community) AN02 offered cautionary advice: *"I think exchange (of knowledge), if it is well done, then it may bring some effects that people talk and find out. It can also damage a lot of things with it. Oxfam in South Sudan brought these people from the farm in Nyvasha (low production area) to Denameria (high production area), I think you frustrate people. If you bring somebody that has a cow that gives you a little milk, and you bring him to a cow that is giving thirty litres, what should be like? He would say 'what can I do? I will never reach'. It is a different world. It is doing harm"* (AN02).

Nairobi-level staff largely viewed their role in the knowledge relationship with the community as one of top-down provision: *"we have a lot of knowledge, lots of information to give the community, but they have their own knowledge and that is good for them. We try and work together, but often the local people they do not know enough about our projects to help"* (AN06). Whilst AN06 acknowledged the presence of local knowledge, the idea that it was not somehow not useful, by not being 'aligned' with development aims, could prove a barrier to knowledge co-creation.

Examining the reciprocal perspective, local communities express a wide range of opinions about knowledge sharing with NGOs – primarily that knowledge-transfer - is limited: *"The things that the NGOs do can be very different to our culture. We can learn from them, but often they do not teach us. They may have an idea like banking, but we also learn from the community how to do banking. They use MPESA, but we learn from our children how MPESA works as well. The church (Catholic mission) has taught us with the school, but the NGOs, they teach us some things"* (AP12). When asked how members of the community do learn from NGOs, several respondents suggested that most of the learning happened through traditional Gabra cultural practices: *"the Gabra way is to talk, to discuss. If you see he is doing something new you will watch, you will ask. You will find others who know and see if it works"* (AP12), *"the NGO will often ask us what we want, like CMDRR (Community Managed Disaster Risk Reduction), and they will come and give water storage or building. This is not knowledge, this is help, but we know these things – or else how could we ask for them?"* (AP05), *"when the NGO goes in the evening, the men will sit together and say 'do you know this thing? Does it work?' And they will talk and decide"* (AP04). Interestingly this last observation was echoed by one of the Nairobi NGO staff who suggested: *"You are dealing with a community that is illiterate, maybe forty to seventy percent, they are watching to see, someone is watching, you know how they are very sceptical, you know I have worked with pastoralists, they talk in the night. They say "we agree, we agree" and then at night they come and they ask very pertinent questions; "this thing being told by this man, where has it worked. He's telling us to do this, do you think this man has done lots? That scepticism is key to if you succeed, it is very risky. So that is why I think taking risks is important."* (AN01). Where pastoralist respondents suggested a process of learning and knowledge sharing, AN01 framed this in terms of a risk of project rejection through scepticism and a lack of education.

Inter-NGO

Discussions on NGO-NGO knowledge transfer revealed evidence of entrenched disciplinary silos, accessed by NGOs through a series of relationships. No respondent described this knowledge-sharing as either universal or consistent: *"Some organisations say 'this is not our work', and for us it is true to some extent, some organisations block and say "we are not working in education" but some, like us, we take the information and share"* (AN01), *"Oxfam definitely comes from a different perspective than we do. We are veterinarians in the first case, we come on in the livestock sector, then you have ACTED, Solidarites, I think everyone has their own"* (AN02). The technical and specific nature of exchanges often worked to further entrench disciplinary silos; respondents referenced the importance and inaccessibility of 'expert' knowledge.

This did not mean that NGOs were altogether isolated. Examples existed of NGOs looking beyond their own consortiums and working groups, for example through engagement with the private sector. Breaking the NGO-NGO bond in this way did little to open up exchanges; NGO-private links focused on the provision specific skills or services rather than knowledge creation: *"when we get the money but we don't have the technical expertise in that we go to the private sector to train us"* (AN01). Exploring knowledge co-creation further, AN01 suggests *"No, we cannot go and ask them (the private sector, to work on co-creation), for example look at mobile technology, we use mobile transfer of money, so this is an innovation to the users. So we can go to the telecoms and say "this is the innovation you have, how can we use it?" or we can say "we want to use what we are calling e-vouchers" they are instead using this cash voucher used in development. So we want to use the e-voucher so we are approaching the communication technology service providers to say "how can we include our voucher"?* (AN01).

This exchange did possess innovative characteristics but differed in some respects from field innovations as less reactive and evolutionary. Private-sector engagement was typified as a highly deliberate process; but one that blurred notions of innovation as uniquely radical events. For example, the invention of mobile money transfer by telecoms companies was suggested as innovative, but NGO adaptations of this process for use in development activities were often not classed as such.

NGO-donor

Knowledge sharing between NGOs and donors seemed a lower priority for NGOs than donors, with NGOs suggesting consortium bureaucracy limited donor-NGO exchanges, *"on the ECHO consortium it is of course Oxfam that talks (to the donor), normally the lead agency is talking on behalf of the others"* (AN02). This often led to a pseudo-Chinese-whispers type effect, where NGOs believed innovative programming would not be accepted by donors without being able to speak to them directly, *"we know what donors like and do not like, as the consortium lead lets us know. They will put forward suggestions that we make, but often they do not have the technical knowledge to answer donor questions. But we can tell what the donor will like from what they have funded before"* (AN06). In contrast, donors saw a 'one-point-of-call' approach as providing easily digestible information, but at the possible cost of depth and context: *"I think the trade-off (of managing contact directly with donors) is that you lose unfiltered access to information but get an effective way of having information packaged to a way that you already decide is the best fit into your results or learning agenda"* (AD01). Donors believed NGOs came to projects with pre-existing knowledge networks, established prior to the commencement; it was often these links that were the reason the NGO was commissioned in the first place: *"partners, NGOs, usually belong to different networks…*

Concern, or Boma (both NGOs), they are quite linked into county-level networks to lobby, advocate or coordinate etcetera. At national level they belong to different platforms depending on what their main interests are for. We don't necessarily invest in the communication of these networks, I give priority to the partners in my programmes because they also have similar objectives" (AD01). Donors recognised that whilst NGOs may be directly involved in specific programmes, this does not mean that effective knowledge sharing occurs *"I'm really pushing them (the NGOs in the programme) to cross-exchange lessons"* (AD01).

Knowledge summary

These transcripts illustrated the range of perspectives on the role of knowledge in pastoralist development. It was clear that definitions are contested between actors; using the data, two polar architypes were developed to represent the most extreme views on the knowledge spectrum. This spectrum is used for subsequent analysis, and is represented graphically in figure 31 below:

Primacy of expert knowledge. A need for central coordination of knowledge silos, local groups provide information, not knowledge.

Knowledge is communally held. Experimental processes are shared. Knowledge are networks integrated into other processes
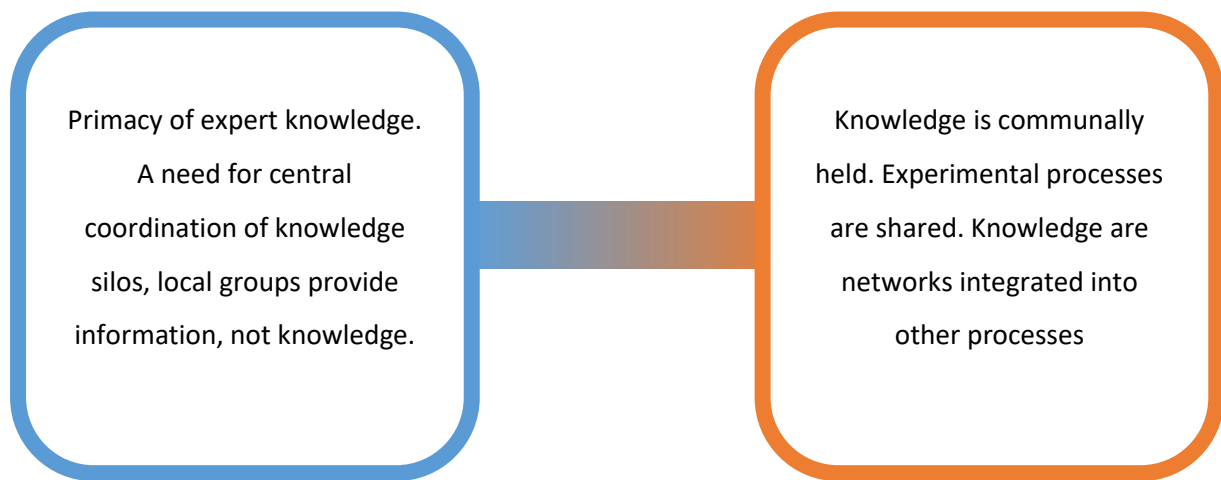
Figure 31: Thematic knowledge spectrum

6.2.1.2 Theme 2: Drivers and Barriers

Drivers and barriers were common themes in interviews; reasons why innovation could or could not occur were counterpointed with examples of the historical circumstances that promoted the development of existing innovations. The following section is divided into three parts outlining perspectives gathered from NGO, donor, and pastoralist respondents.

NGOs

NGOs often discussed conditions outside of the actors' control as limitations to innovation. For example, a Nairobi-based NGO actor suggested government-push and donor-pull were key to developing innovation: *"Has the innovation been approved by the government? Is it in line with what they are promoting or supporting? Is it within the government development initiative, you know, like in Kenya we talk about Vision 2020, we have got a strategic plan for development. Is it fitting*

anywhere?" (AN01), *"I think we are under pressure from the Government in Kenya. Kenya has traditionally a very strong government position, not necessarily a presence, but Kenya always has a strong opinion. To help or hinder."* (AN02). These respondents suggested pressures did not apply to local innovators; the further geographically and politically one travelled from Nairobi, the less pressure was felt: *"The pastoralists worry less about the policy. If you are in Marsabit you worry more, in North Horr less, in Llongyani even less, Illret even less. But for us since it is the government policy that we work within, the framework, we do like this but we need this government"* (AN01).

NGOs believed government guidance acted as a barrier to innovation and that donors were actively seeking out innovation: *"I think from the donor perspective they always ask for innovative ideas so yes, you try and pick up new things that could be done and try, I think that is right"* (AN02). *"Normally we are keen to see that we do what will attract the donor, attract donor as well as addressing existing needs. In the Kenya context, the work of humanitarian interventions is not new, (it has) been there a long time. When you look at things people do, they are more or less the same."* (AN01). This donor-led drive towards innovation came with qualifications, particularly the need to show impact, and work within project timescales. These limitations had the potential to reduce the scope for truly novel innovation; *"with many donors, they prioritise innovation that has worked elsewhere over that that has been generated from within. When a call comes, there is an already decided way of doing it"*; *"the other risk is also you may not generate the results as quickly as the donor may be looking for, someone may band you as a timewaster"* (AN01). The view that an innovation should be proven to be effective was shared more widely amongst non-field-based development respondents: *"innovations should be shown to be transformative before you invest in them. A lot of innovations never make it; KARI (Kenyan Agricultural Research Institute) is full of good ideas"* (AN02). AN02 goes further to suggest why *"I think you should wait (for evidence of impact) as you play around with the resources of other people, their work and time"* (AN02). Viewing resources limitations as a barrier to development activity in pastoralist regions was a recurrent theme, often tied to political will, donor frameworks, or monitoring and evaluation requirements; *"The highlands have benefitted far more from any type of knowledge. Politicians depend on votes. Where do you decide to put your hospital – if you can reach 100,000 voters or 10,000 voters – that is a decision politicians make. They look after numbers; donors do this also. You have to give them figures on target groups and this is (in the pastoralist drylands) per person a lot of money"* (AN02), *"the pastoralist communities are in a tough place that require a lot of resource to monitor and make the follow-up"* (AN01). AN02 felt the ability to innovate was not linked to resources, but the scale of innovation was: *"(With more resources) I don't think we would do more innovative work, we would have broader coverage because it is very limited where we are"* (AN02). When pressed on the

resource issue, many statements suggested pastoralists were without resources *"…development groups have the resources"* (AN02), *"we can afford to innovate where they (pastoralist communities) cannot"* (AN06); mirrored in part by the pastoralist belief that NGOs possess almost limitless resources for innovation: *"they (the NGOs) have very much with which they can work – vehicles, people, equipment. They can also talk to Nairobi for all of their questions, this is what allows them to bring very many new things here, new ideas and equipment. We (the community) can do much with what we have here, but they (the NGOs) have much, much more."* (AP09).

Donors

Donors were more explicit about innovation drivers and barriers – including government influence, private sector roles, and internal pressures, including a moral responsibility for spending tax-payer's money. AD01 linked innovation and knowledge sharing with the degree of government intervention and competency, believing that the relatively developed but non-authoritarian system in Kenya resulted in lower cooperation between NGOs than in countries with authoritarian systems or non-functioning governments; *"because development assistance is not as relevant in this country (Kenya) as it is in other countries so the government is not forcing partners like it is doing in Rwanda or Ethiopia to really align to the programme or objectives or sector priorities that they have. Coordination is really weak between donors so you have these nice structures that have no leverage or ability to influence budget allocation within ministries, and no teeth to keep partners' adherent to their commitments. It's even more challenging than operating in an environment like Somalia as you don't deal with the state as it is very weak, but at least you have a strong donor-cohesive environment"* (AD01).

AD01 further suggested donors could engage the private sector as an alternative to NGO programming. This approach had difficulties in both attracting and working with companies; *"I think the benefits of innovation are quantifiable or interesting even from a qualitative perspective to organisations like (donor) that has a mission with that kind of objective… for a private enterprise that has no social niche or vision you need to really elaborate the profit argument… which is fair enough as you expect the private sector to put in their money, they need to have returns. But you also need to find the balance of public good and allowing the private sector to crowd in with sustainable solutions. But yes, it is not an easy win"* (AD01). The private sector-public money tension was referenced on several occasions, especially when considering longer-term benefits and accountability; *"(private sector involvement) is a big headache, especially when you use public money into things that may generate patents or copyright. It is a big headache", "you need to have some sort of results accountability directly linked to your programmes, especially when you use taxpayers' money"* (AD01).

Pastoralists

The majority of pastoralists interviewed felt that the decision to adapt or alter practices came through a process of discussion and deliberation – similar to that mentioned earlier; *"you see a herder doing something new, or hear daimtu that a disease may be treated differently, and you will think of this. When you are with your friends you will talk of the new thing, and they will also have heard or you will tell them. You may send word to friends who know, or telephone a different manyatta (settlement), or ask an elder who is knowledgeable of these things. Then you decide, if it right for you, your household. And you may try it, but always you will talk of how it is, how it was"* (AP12). This process of discussion seemed to be related to even relatively minor changes in practice and was strongly linked to the maintenance of social networks, through which further knowledge could be accessed. Counter to NGO narratives, traditional practices rejected ideas of personal ownership, stressing instead the sharing of experiences and ideas. *"When something new is tried, like starting to sell a new thing in a shop, or trying a new stove, people will come and ask you, your family 'how is that thing'. It is important for us here to tell people, as they will tell us of more new things. It is important for our culture to share daimtu like this"* (AP06). This concept of communal learning did seem to be related to wider institutions allied with the moral economy, however where modern or financial considerations were central to the innovation, ideas of sharing seemed to break down: *"if you are rich you can try new things and become very rich. Livestock traders who own trucks make money by driving to Nairobi, and they bring back new goods and ideas. They may start new businesses very easily like filling stations or tarpaulins. These new things and ideas are theirs and only theirs, they benefit the community only by the goods they sell, not how to sell them"* (AP17). The sharing of knowledge and experience, including failures, largely circumvented the 'impact' and 'value' barriers suggested by NGOs. This is not to suggest that alternative barriers did not exist; the key differences between pastoralist and development-actor framings of drivers and barriers was in notions of opportunity and obstruction are communally held versus borne by the individual agent or agency.

Drivers and barriers summary

The discussion above illustrate the key beliefs and perceptions of actors surrounding the promotion or inhibition of innovations. As with the knowledge Global Theme, polar archetypes can be constructed using the full transcripts to give the following contrast, represented graphically in figure 32 on page 204.

Funding and regulatory guidelines shape innovation. Donors seek 'innovative' approaches. Local resistance to new ideas requires NGOs to 'sell' ideas.

Innovations undertaken at the individual level, decisions shaped by socio-cultural institutions. Social capital may limit or enable activity.
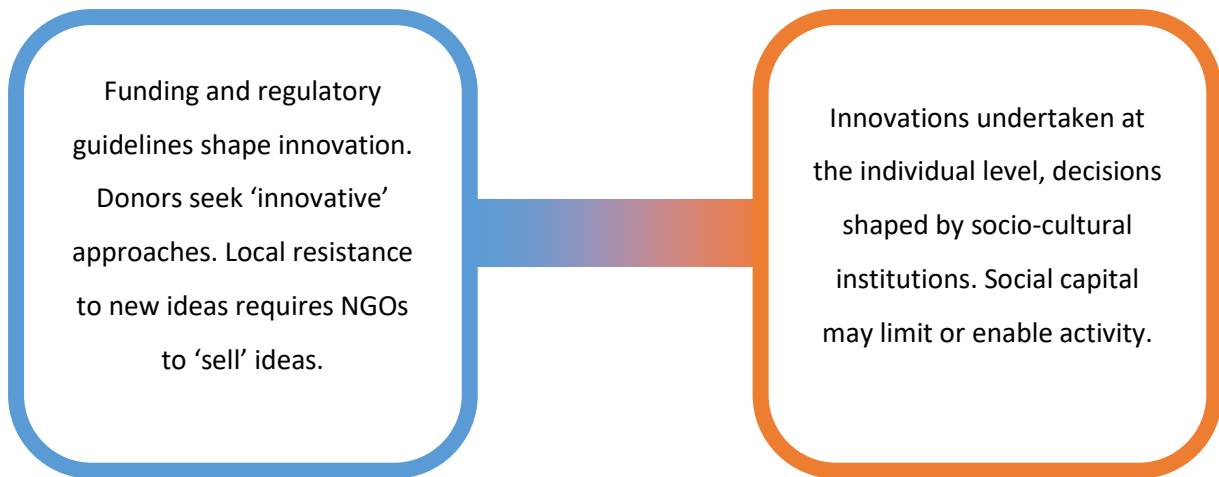
Figure 32: Thematic drivers-barriers knowledge spectrum

6.2.1.3 Theme 3: Risk and uncertainty

Both the knowledge and drivers/barriers Global Themes described above centre on the sharing, promotion, or inhibition of innovation. Common to these themes was the perception that an uncertainty of outcome surrounded innovative actions; notions of risk were developed into a third Global Theme to provide useful comparison.

Non-pastoralist perspectives were typified by AN02's comment *"innovative approaches always have a high rate of failure because you do not foresee what can go wrong"* (AN02). Further analysis revealed subtle differences in both the conceptualisations and mitigations of inherent risks associated with innovation. Many NGO actors saw the central risk as relating to project aims, for example: *"innovation in pastoralist areas is risk-taking; it is risk-taking because of the characteristics of the pastoralist areas. You are not sure if the thing you want done exactly the way you would like it to work, viable, because of a number of factors. Pastoralists are by nature very nomadic, if this innovation requires a lot of monitoring, if these people migrate because of climate change, will you get the same people? You cannot be sure. You may lose them, not because they hate your innovation, but because they have moved."* (AN01). Here AN01 framed risk in terms of project failure through poor evaluation, rather than any more abstract understandings. His colleague AN02 was equally pragmatic in suggesting risk is principally resource-based, which follows his earlier comments on evidence of impact: *"as you play around with the resources of other people, their work and time"* (AN02), suggesting mechanisms to share the risk of innovative approaches; *"poor people are very conservative, they don't pick up ideas very easily because they may risk too much and they know it. I like the farmer field school, we take the risk, you (the pastoralist) do it, but if it fails we as the donor have the capacity to compensate them, you don't risk your own existence"* (AN02).

The notion of risk-transference was echoed by donors at a more macro-level; *"How you can support households and community to absorb the risk, at what point can you transfer the risk to private sector or other bodies, and at what point does the risk need to be adsorbed by the wider international community when it gets like a regional 2011-type severity"* (AD01)*. Of all the respondents, only the donor AD01 equated risks to specific vulnerabilities, noting that shocks were heterogeneous; *"There are always shocks of different intensities, some are more relevant for markets, some are more relevant for health, others are disruptive for social systems"* (AD01).

AN02's assertion that 'the poor' do not wish to risk resources is contrasted with pastoralist responses that link innovation within the community to processes of discussion and deliberation. Relationships and networks reinforced by these discussions are linked to well-developed traditional loaning institutions common to pastoralist societies (Sweet, 1965), for example motorbike milk-collectors; *"Very few people in North Horr have bodaboda (motorbike), but those who do can collect milk from the fora (deep bush) for money. I talked to the old men, the families and those with bodaboda, I talk with my brother in Marsabit. He gives me the money for this, I take a little from my other family, my friends and I buy my own. Now I have the income, and people are asking how it works, so I tell them, I tell my family and the old men"* (AP14). By linking networks of loans to knowledge and social networks, potential investors were able to obtain information about possible outcomes and the repayments were both financial and knowledge-based.

Risk and uncertainty summary

It was clear that both the focus and nature of risks vary widely between actors. As with knowledge and drivers/barriers Global Themes, key differences emerged between project-led NGO conceptualisations, and communal, shared understandings of pastoralist groups. As previously, these archetypes were mapped onto a spectrum, presented below in figure 33 below:

Risks linked to resource availability, requires pre-established evaluation frameworks, risk may be transferred between actors, unwillingness to share failures.

Incremental innovation reduces risks, communal learning allows sharing of experience, existing cultural lending and experimentation institutions help.
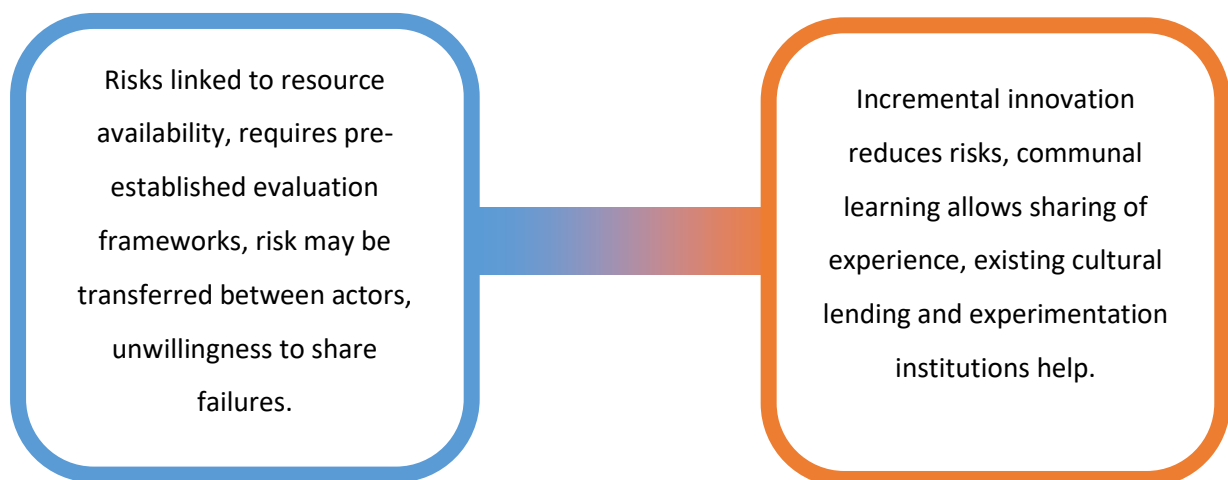
Figure 33: Thematic risk knowledge spectrum

6.3 Factor extraction by Q-methodology

Respondents	Selection	Locations	Field Session	Data collection
20	See *P-set* below	6 Nairobi 26 North Horr	2	Q-sort, Semi-structured interviews

The previous section explored innovation framings through Thematic Analysis. Those techniques illustrated the richness and diversity of framings contained within the system, but this approach has limitations as an analytical tool. Moreover, the techniques used above are rooted in researcher-led interpretations of themes and results.

In order to address these limitations and to increase the robustness of interpretation of the *diversity-dynamic* matrix, this study used a Q-methodological approach to capture wider themes not volunteered by respondents.

6.3.1 The Q process

The section above sets out the Global Themes identified through Thematic Analysis, representing endogenously-derived framings from across the network. Following the rationale in chapter three, it was decided that the influence of external attitudes on framings of innovation should also be captured. Using the methods outlined in the same chapter, a Q-methodological process was developed that integrated external and internal attitudes in the analytical process. The research method followed a conventional Q-process in constructing a concourse, generating a Q-set, selecting respondents (P-set), and choosing and implementing analytical approaches. These stages, and the Factors extracted, are set out below.

6.3.1.1 Collation of a pastoralist innovation concourse

A Q concourse is a population of statements that should represent the "*breadth and depth*" of opinions available surrounding a particular phenomenon (McKeown and Thomas 2013). These statements are typically drawn from everyday conversations, commentary, interviews academic and 'grey' literature that deal with the issue in question (Brown 1980, Stephenson 1978). In this study, statements were drawn from the wider literature available surrounding agricultural and development innovation (including blogs, comments and online discussions). This concourse was augmented with quotations from interviews and conversations recorded in the previous section. This process formed a concourse of 144 statements that were identified and coded in NVIVO.

6.3.1.2 Generation of a primary Q-set

The extraction of a Q-set from a wider concourse may be undertaken inductively or deductively (McKeown and Thomas 2013, Watts and Stenner 2012). The concourse statements were subjected to a two-stage selection process to identify thematic and replicated statements. Initial inductive analysis resulted in a 78-strong Q-set; these statements were recorded and returned to the concourse population. The concourse was then re-analysed using a deductive approach using existing innovation theories. This resulted in the set of 82 statements, of which 50 also included in the inductively-derived set.

This concourse of 50 was reviewed using a structured approach driven by qualitative data collected in previous sections to ensure representation of the wider discursive landscape (Dryzek and Berejikian, 1993); this process is detailed further in appendix 7.

6.3.1.3 P-set selection

Interviews from the previous section were used as the primary guide for respondent selection on the grounds of providing a unique insight into the diversity of perspectives. There were significant challenges to the use of the Q-sorting methodology within communities, principally consistency of translation. Where respondents had a basic level of English language (in these cases respondents are often also literate), the sort was employed. In these instances, great care was taken to allow respondents to question and explain aspects of the process that they found challenging. Whilst this did not resolve all issues, it provided significant insight into actor conceptualisation and evaluation of issues contained within the statements. Respondents who did not possess a sufficient level of English or were reluctant to perform the sorts were offered more open-ended interviews guided by the Q-statements as discussion points. In total 20 sorts were completed. The *p*-set is detailed in appendix 6.

6.3.2 Results

The 20 sorts were analysed using KenQ software, using both centroid factor and principal component analysis (PCA). Further details of the analysis are included in appendix 7. Three factors were extracted and cross-referenced with the qualitative data given during the sort process. The factor interpretations are given below:

Factor 1: A risky tool

"Innovation is good, but it is not certain. You must qualify how and why you are innovating to those around you, those who support you. You do not know at the start if these innovations will work well, or if at all, and that is a risk"

Innovation is a risky, often costly, tool in the armoury of development organisations. Innovative approaches should engage local populations in order to be successful, but this engagement should be in line with the aims and objectives as defined by the development organisation. Innovation is only of use if it is sympathetic to evaluation and evidence-gathering. Local populations are largely unable to innovate effectively; local innovation is best promoted by enabling local groups to contribute to development-led innovation as guided by the organisation.

Factor 2: Interconnected and emergent

"It is natural to look for new ways, new ideas, and new things. Everyone you talk to, everyone you see, everyone who you are told about has something new. You may choose to hear more, to do these things if you have the necessary ability and possessions. If you do not, you ask another to help, and another. You do it in your way though. These new things may not be new to them, but in your place they can be very innovative."

Innovation is the search undertaken by all actors for new ideas and opportunities. This is closely shaped by the extent of an actor's social network. Innovation may be part of active problem solving, or a passive identification of opportunities through chance meetings. Innovation can be fostered by increasing the number and diversity of contacts available to an individual actor; these contacts may provide physical, social or intellectual resources which can be drawn upon through diverse networks.

Factor 3: External and technical

"The old ways don't work – there is still drought and hunger, still violence. We need new ideas and new equipment; the locals don't have the money or skills for these things. The best way of getting that is through the development organisations."

Innovation is the search for technical solutions to old problems. Development organisations are best placed to provide these solutions through their wider experience across multiple countries, increased resources, and their contacts with other organisations and research groups. Local communities are either unable to innovate due to a lack of technical knowledge, or unwilling to do so as development groups will present them with more advanced options than they would otherwise be able to make themselves. The use of these technical innovations is not risk-free, however a need for monitoring or proof of impact should not preclude the use of innovations.

6.4 Participatory frame building

Respondents	Selection	Locations	Field Session	Data collection
68	See below and Appendix X for details	4 x NGO groups (North Horr and Nairobi) 10 x Pastoralist Groups (North Horr)	2	Participatory exercises

Thematic Analysis and Q-Methodology provided two different techniques for evaluating perspectives and understandings within the wider system. The Themes and Factors generated through these methods provide different insights but were of limited use in developing the diversity-dynamic matrix proposed at the end of chapter five.

To explore how framings influenced knowledge creation further, this study developed the Participatory Frame Building methodology detailed in section 3.4.4. This technique combined the Themes and Factors in a locally-relevant way to create Core Framings. These Core Framings could then be used in the following chapter as part of the wider analytical framework. The output from the Participatory Frame Building process gave the Core Frames below.

6.4.1 Core Frame 1:

Uncertainty and influence

Innovation is inherently risky, requiring significant resource investment with no guarantee of return. Innovation is a discrete activity, different from day-to-day behaviours, and as such is subject to more scrutiny from those involved both directly and indirectly. This translates into a greater burden of proof required before innovative activity can be considered worthwhile.

6.4.2 Core Frame 2:

Connections and relationships

Innovation is the day-to-day search to overcome obstacles and exploit opportunities. This search is greatly aided by the ability to mobilise new knowledge; new knowledge is most commonly accessed through contacts in personal networks.

6.4.3 Core Frame 3:

Modern and advanced

Innovation is inherently new; either new to a specific area, or new to the world. Technology both drives and is driven by innovation; traditional problem-solving approaches are of use, but technology is best suited to overcome challenges.

6.5 Conclusions

Building on the structural findings of chapter five, this chapter addressed the more subjective aspects of perceptions of innovation within the system. Using Thematic Analysis and Q-methodological analyses, sets of framings in the study population were identified and explored for their possible role in processes of hybrid knowledge creation. The Global Themes and Factors developed using these techniques were then combined through Participatory Frame Building to develop a set of three internally-validated core framings that represent key attitudes towards innovation.

These core frames provide an analytical tool with which to explore the perceptions and attitudes of individual actor-actor dyads, aspects of which may inform how these relationships shape knowledge creation. The following chapter employs the core framings to explore how they are manifested within each relationship using the methodology from chapter three. Once the dyads were characterised in this way the analytical framework developed in 5.7 can be used to explore how core framing features, in combination with other characteristics, may shape knowledge creation processes. Using the process of analysis outlined in chapter three the data gathered in this chapter employed to develop specific questions that can be addressed by the analytical framework.

6.6 Implications of framing data for the creation of an analytical framework

6.6.1 The role of relationship character in knowledge creation

The data contained within this chapter provides insight into more than just the framings of individuals and collective groups. Through exploring innovation exemplars and the links between actors, the categorisations of relationships set out in section 3.3.4 and used in section 5 did not capture the nuanced nature of knowledge transfer. Of the six categorisations described in these sections, only 'transfer' relationships recognised the movement of knowledge between two actors –

the focus of the study. The data gathered in this chapter suggested that a binary categorisation of 'knowledge transfer' was insufficient, as it overlooked the nature of knowledge and the strength of the bonds as discussed in chapter two.

For these reasons in the following sections this information should be further disaggregated. Instead of asking if a respondent has, for example, transfer, kinship, or formal links, instead open-ended questions would be used to explore the nature of knowledges transferred. The potential for bonds to carry multiple knowledge types is well established (Bright et al., 2012), but to avoid repeating errors caused by imposing external categorisations, this data would locate endogenously-defined, internally-valid categorisations of the *plurality* of knowledges that would allow more detailed analysis using the framework from section 5.7.

Further to the types of knowledge transferred, the data gathered in this chapter also suggested that the strength of any linkage may have significant implications for knowledge creation. Friedkin (1980) suggested that strong ties could be identified by 'mutual recognition'; the implicit suggestion being that non-mutual ties were weaker. The data collection process illustrated tight-knit relationships alongside looser, more ephemeral connections that may transfer the same types of knowledge (Granovetter, 1983, Krackhardt et al., 2003). Building on discussion from chapter two it was decided that the *strength* of connections should be evaluated and tested using the analytical framework as well.

6.6.2 The role of dyadic perceptions in knowledge sharing

Narratives surrounding innovation illustrated the key role of perceptions can play in knowledge exchanges. As with compliance and anti-variation inhibitions detailed in the network chapter, an individual's *belief* that another person will act, or react, a certain way was shown to have profound effects on knowledge dynamics; for example, donors often saw NGOs as possessing protectionist knowledge silos, NGOs felt some pastoralists were not interested in engaging in knowledge creation. The influence of these assumptions was deeper than the groups or institutional level; the data showed that perceptions could differ between individuals within organisations.

Uncovering this heterogeneity of perspectives had two implications for this research. Firstly, that respondents for framework testing should not be selected on the basis of broad organisational or cultural membership, as this was no guarantee of the possession of a shared framing. Secondly, that an ego's belief in an alter's framing could be as important as the actual framing possessed by the later (cf. Laing's *direct-* and *meta-perspectives*) (see section 2.9.2).

Using the Core Framings developed in this chapter presented an opportunity to analytically explore these various perspectives. Building on the theories of intersubjectivity discussed earlier, four related aspects of the ego-alter dyad are explored based on established literature:

1. *Dyadic framing:* What were the framings possessed by the ego and alter?
2. *Dyadic harmony:* How similar or different were ego's and alter's framings?
3. *Dyadic empathy:* What framings did the ego believe the alter to possess, and how did this relate to the alter's own?
4. *Dyadic projection:* As a sub-section of empathy, what was the effect of the ego's belief that the alter holds the same framing as their own?

Dyads can now be plotted into the Cartesian space of the diversity-dynamic matrix to explore how each of those four features relate to knowledge exchange dynamics, allowing the exploration of factors that shape the knowledge outcomes of these individual relationships. By understanding the individual steps provided by interpersonal knowledge creation, wider issues surrounding innovation pathway formation can be discussed. This is the focus of the next chapter.

Chapter 7:

Case study dyads

Picture 16: Time and depth

This chapter focuses on the way that relationships between individuals may shape knowledge creation processes. This required both broad and deep data collection; here, a respondent herder (right) stops to sit and talk after two days of working with him and his animals.

7.1 Introduction

Chapter five mapped the complex network of knowledge sharing relationships within the wider system, using this data to identify potential links between the diversity and dynamics of knowledge flows. Chapter six chapter focused on actor-level attitudes, developing three core framings that reflected the key perspectives contained within the study population. Chapter six closed with the suggestion that both the *strength* and *plurality* of knowledge features of actor-actor relationships could influence knowledge hybridisation processes. In addition to these, four characterisations of ego-alter perceptions were suggested as possibly relevant: dyadic *framing*, *harmony*, *empathy*, and *projection*.

The following two chapters set out the exploration and analysis of these features. This chapter details the process of case study dyad selection, drawing on the methodologies outlined in section 3.5. Following selection, this chapter introduces the individuals and background of each dyad to provide context for interpreting the data generated using the analytical framework presented in the following chapter, and an overview analysis.

The following chapter develops these analyses by using the analytical framework suggested in 5.7 to evaluate each dyad, mapping each actor pair in turn onto the framework using the data contained within these chapter. The findings of this section of the investigation form the basis for answering the central research question "*How are how are knowledge hybridisation processes shaped in pastoralist development*"?

7.2 Selecting dyads

The specific question at the heart of this study asks, "*how are how are knowledge hybridisation processes shaped in pastoralist development*"? These processes are conceived as stepwise acts of knowledge creation, influenced by interconnections between actors. The depth of data required to understand how actor-actor dyads are able to shape these processes, in combination with resource and time limitations set out in section 3.2.3 meant that it was imperative for this study to have a clear aim and robust methodology for selecting the dyads for inclusion in this stage of the study.

7.2.1 Population selection aims

Heterogeneity within a study population requires researchers to make explicit both the target population, and the criteria by which these sub-populations are identified. To this point this study has deliberately retained an open and exploratory approach to mapping knowledge

creation processes, choosing not to focus on particular sub-communities such as women or the poor in an attempt to capture the perceived realities of innovation as it happens within Gabra communities. It is important to recognise that this approach may overlook less vocal or empowered sections of pastoralist and development societies; this in turn focuses the data on the identification and explanation of what is currently happening, rather than giving preference to an exploration of why certain sub-communities may not be engaging in specific activities. In pastoralist communities it is often the poorest households that have been excluded from external and endogenous development activities (Anderson and Broch-Due, 1999); any decisions relating to the inclusion or exclusion of this population require careful consideration.

A primary focus of this study are points of knowledge articulation between development and community actors, to explore ways in which hybrid knowledges can be shaped. Given the paucity of existing literature on these processes it was decided to give preference to the deeper research of observed instances of interactions, rather than placing other actors' characteristics, such as engagement with development, first. This approach has the benefit of starting to map a new knowledge-exchange terrain, whilst risking the further exclusion of those who are not currently engaging in cross-community knowledge exchanges that may (though not a certainty) include poorer respondents. This decision was not taking lightly; however it was felt that a greater contribution could be made to addressing the communities' development needs by a robust exploration of the current system than recording the potential lack of exchanges in a specific sub-population.

7.2.2 Selection process

As outlined above, the primary focus of the dyad analysis is to explore incidents of cross-community exchanges. In previous sections the presence of multiple overlapping sub-communities was suggested, making dyad selection by the inclusion of a straightforward development-community linkage unhelpful. Instead a selection process was developed, adapted from work by George and Bennett (2005) on structured case selection that provides a robust and hierarchical method for identifying those dyads with likely cross-community and diverse relationship natures. The final protocol is given in section 3.5 of the methodology chapter. The key points of this process can be summarised in the following five steps:

1. Network calculations were used to identify actors with high betweenness and degree values

2. This population was cross-referenced for representation of communities of shared subjectivities (see sections 3.5 and below)

3. A shortlist of seventy-five possible actors was created using a rolling inclusion process until all framing populations were represented by at least three actors.

4. The ego networks of each of these actors was examined for linkage strength and plurality. This resulted in thirty-seven actors involved in forty-four dyads.

5. These thirty-seven actors were approached to participate in the study; of these, twenty-four actors were willing to participate. Due to time and resource limitations, only twenty actors were interviewed involving twelve dyads. These twenty were selected from the twenty-four on the basis of their ability to represent unique dyadic characters.

7.2.3 Communities of shared subjectivity

Respondents	Selection	Locations	Field Session	Data collection
36	Researcher-led sampling (see section 3.5)	3 Nairobi 33 North Horr	2	Semi-structured interviews

Having used calculated network metrics as an initial filter for dyad selection, step two of the selection process focused on the possession of framings that may be insightful for the study. It was not practicable to survey the subjective views of the entire network to identify a representative sample, instead correlations between actors' characteristics and framings were explored to inform the selection of a study population.

A series of thirty-six respondents, different from the dyad population, were selected and questioned following the process in section 3.5. Their responses on information on gender, wealth categorisation, education, and occupation are presented in appendix 4; each respondent was also presented with the three core framings given in section 6.4, uncertainty and influence, connections and relationships, and notions of modernity and advancement. Participants were asked to attribute proportions to each statement depending upon their degree of agreement using any scalar technique they wished.

To examine the diversity of framings within each group, heatmaps were created to graph the range of each framing by different population characteristics. The following diagrams map each of the thirty-six actors, the lightest colours represent the lowest loadings, the darker the

highest. The more homogeneous the colour distribution, the more similar the framings of each actor.

Key:

Framing	**Uncertainty**		**Connections**		**Modernity**	
Colour						
Range	*Lowest*	*Highest*	*Lowest*	*Highest*	*Lowest*	*Highest*

Uncertainty	Connections	Modernity
(*n*=36)	(*n*=36)	(*n*=36)
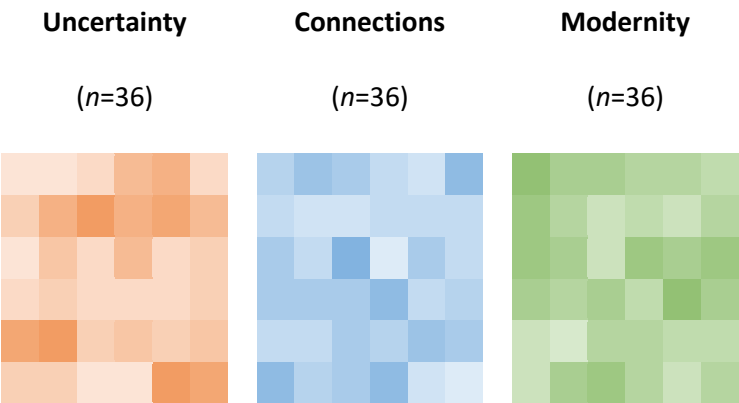
Table 6: Whole population framings

This diagram suggests a wide range of framings distributed across the population. Initial interpretation shows only a few actors load heavily on framing one, whilst more favour framings two and three. This display was used to investigate links between specific population characteristics and framing self-attribution. The following graphs disaggregate populations by gender, wealth, education, and self-declared occupation across all three framings to investigate possible linkages.

Female (*n*=9)   Male (*n*=27)
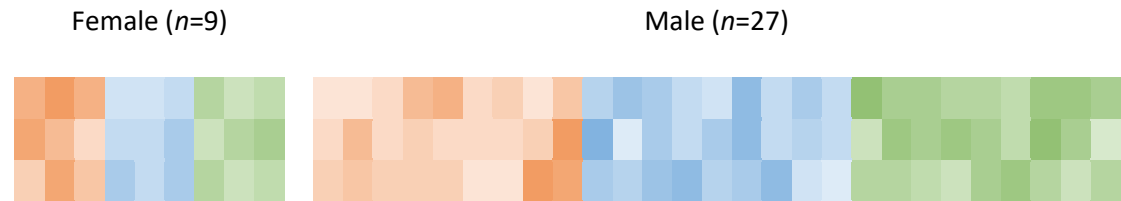
Table 7: Population framing by gender

This plot suggested male respondents tended to emphasise factors two and three more heavily, whilst female respondents favoured factor one. There are however a small number of male respondents that load on factor one, who were studied separately later.

It was also possible to examine distribution by wealth category. Assigning individual wealth categories across such heterogeneous groups can be difficult; in this case a four-tier

endogenously generated scale was employed based on who the respondent, and colleagues, considered a peer group. These scales were created from previous work undertaken in the area by the researcher during his MSc.

Poor (*n*=2)

Limited (*n*=7)

Comfortable (*n*=11)
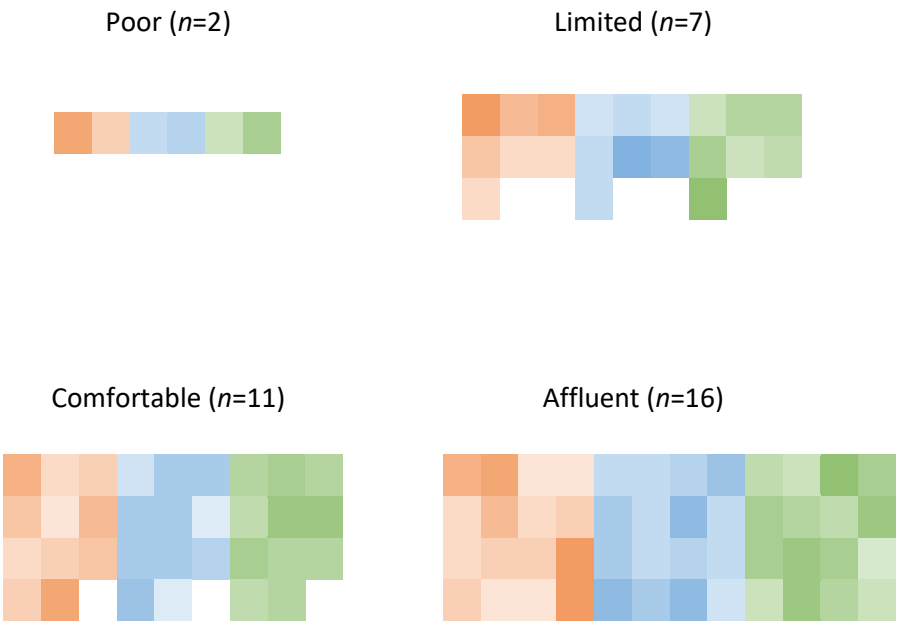
Affluent (*n*=16)

Table 8: Population framing by wealth category

This graph does not instantly suggest a thematic link; there are slight indications that less affluent respondents favoured framing one, whilst 'comfortable' respondents favour frames two and three.

The plot was repeated in respect of 'education', with four self-generated tiers once again employed.

No formal education (*n*=6)

Basic education (*n*=10)

Key competency (*n*=11)

Advanced (*n*=9)
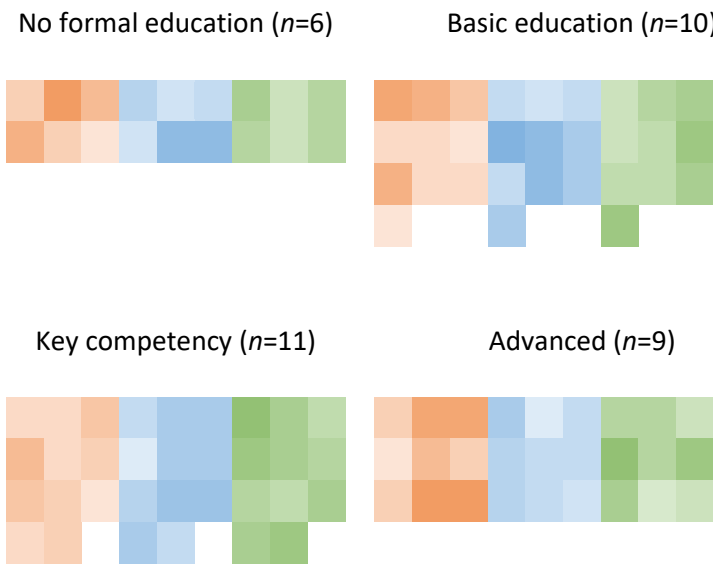
Table 9: Population framings by education

This last plot seemed to suggest that more educated respondents more heavily emphasised frame one, related to risk and uncertainty, whereas less educated (tiers one and two) associated more with interconnectedness.

Lastly, a heatmap was generated of self-defined occupations to identify links to framing groups. The occupations suggested by respondents were animal health, herder, NGO, and trader:
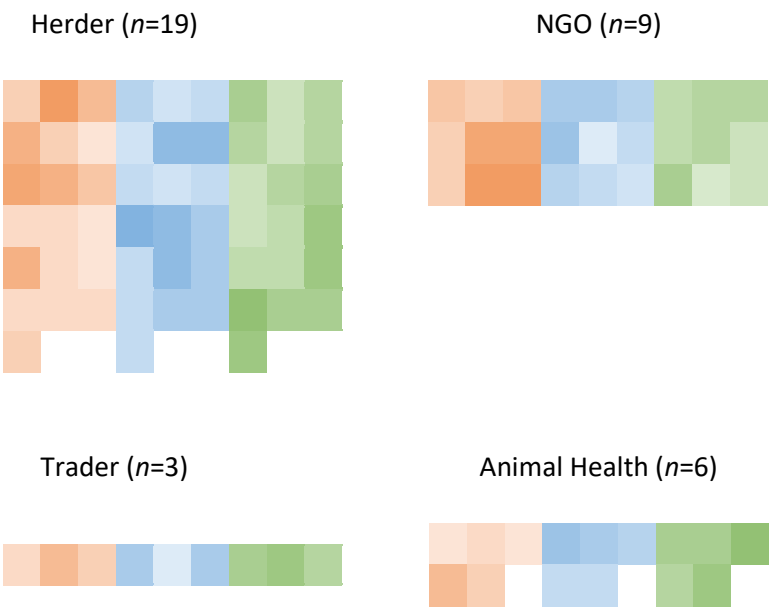
Table 10: Population framings by self-defined occupation

Of all the graphs, this plot indicates separate framings most consistently. There were however notable exceptions, particularly in the larger 'herder' population and the smaller NGO set. To explore these exceptions the variance of each population was plotted to produce the following graphs:
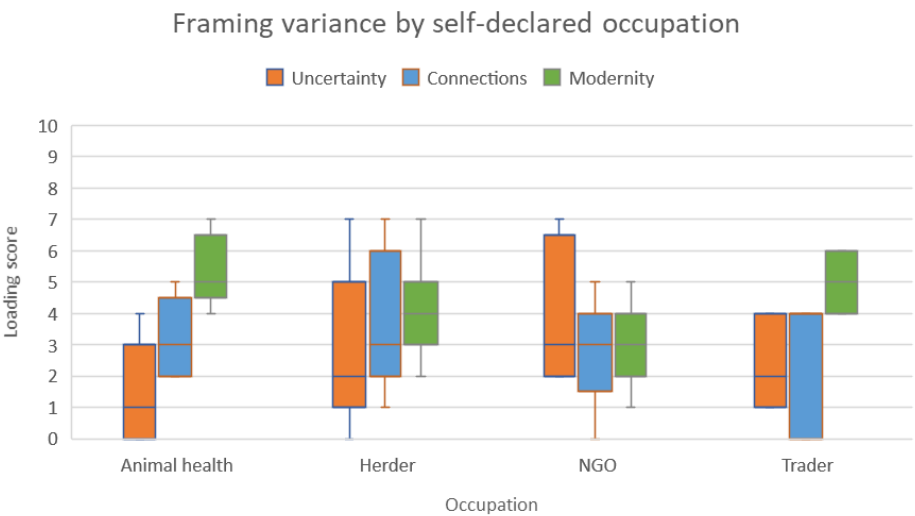
Table 11: Population framing variance by self-declared occupation

This illustration revealed significant variations within populations, suggesting that the original categorisations were insufficient to explain patterns of framing types. To examine these populations further, the transcripts of outlying sub-population actors were compared against those of the broader sample from which they were drawn. These observations were used to further disaggregate the four categories above into six researcher-generated classifications, giving ten in total: animal health, governmental, male herder, female herder, trader, traditional elite, modern elite, field NGO, Nairobi NGO, and pastoralist NGO. The heat maps are presented in table 12:

Animal health (*n*=3)   Government (*n*=2)   Male herder (*n*=5)

Female herder (*n*=5)   Trader (*n*=2)   Traditional elite (*n*=5)

Modern elite (*n*=4)   Field NGO (*n*=4)   Nairobi NGO (*n*=3)

Pastoralist NGO (*n*=3)
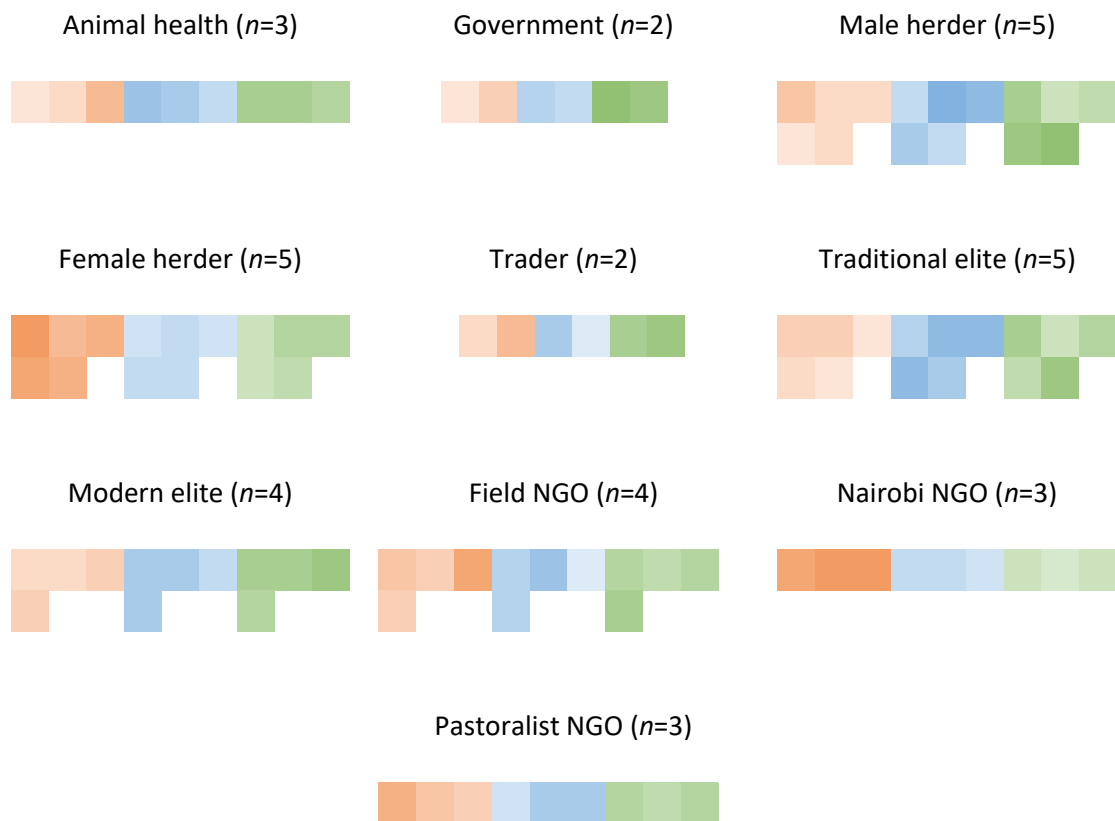
Table 12: Population framing by generated sub-group

Framing variance by generated occupation

■ F1 ■ F2 ■ F3
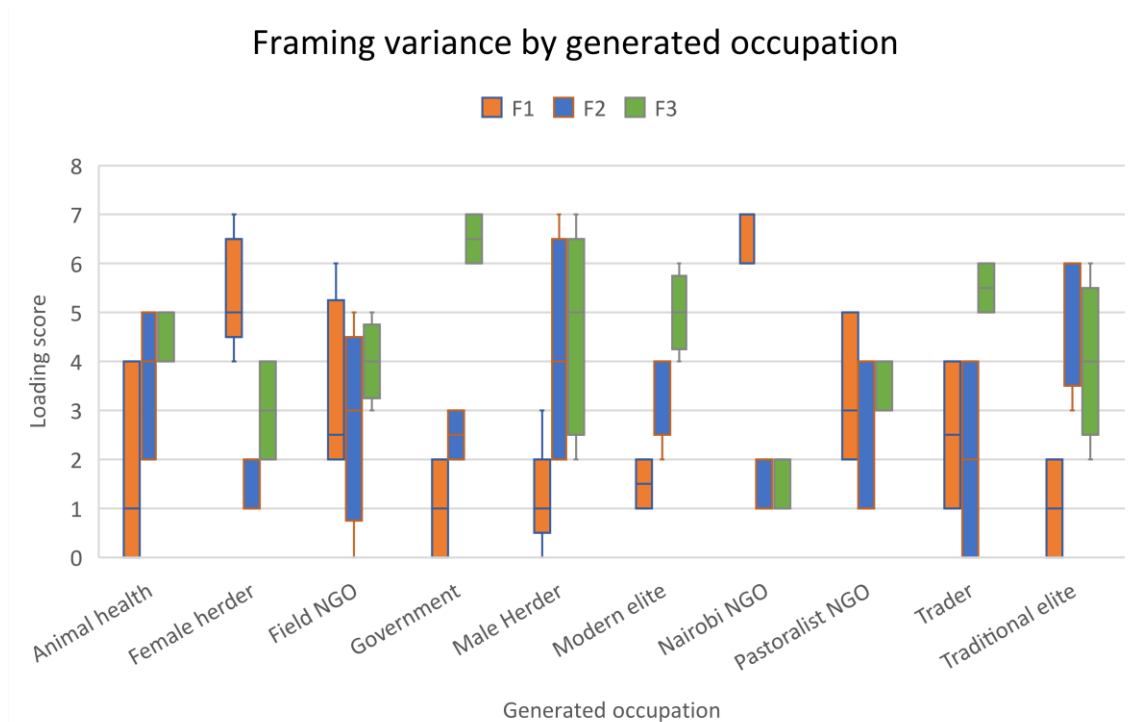
Table 13: Population framing variance by generated occupation

Table 13 suggested less variance in framing between these new populations than the initial four categories. Significant range still existed within field NGO and male herder categories, however the qualitative data did not support further differentiation.

This data was used in step two of the dyad selection process given in 7.2.2 to create the shortlist of seventy-five actors given in step 3. The details of the following steps that filtered this list using measures of relationship strength, plurality, and access are given in appendix 9.

7.3 Case study dyads

Respondents	Selection	Locations	Field Session	Data collection
20	See below	20 North Horr	2	Semi-structured interview and Frame Attribution

Section 7.2 above sets out the process by which twenty actors, forming twelve dyads, were selected for further analysis. Exchanges observed within each dyad provide insight into specific aspects of hybrid knowledge creation processes through various combinations of actor, relationship, network, or framing characteristics. The following section introduces each of the

dyads to provide context to the actors and relationship, followed by a more in-depth analysis of the exchanges between individuals. Following this more qualitative, contextual interpretation, data on relationship strength, plurality, and framing spectra are presented, establishing the foundations for the framework analysis that is the subject of the subsequent chapter.

1. District Veterinary Officer (DVO) and Animal Health Assistant (AHA)

The relationship was rooted in a professional animal health shared identity and an established hierarchical network based on employment.

2. Male herder (P33) and male herder (P34)

This relationship illustrated multiple channels for connectedness between two 'ordinary' pastoralist herders who shared common cultural institutions.

3. Solidarites International Project Supervisor (SIPS1) and traditional elite pastoralist (P77)

This relationship illustrated a well-developed set of relationships between an ethnically Gabra NGO intermediary (SIPS1), and an educated and engaged member of the pastoralist community (P77).

4. Agroveterinarian (AV1) and Solidarites International Project Supervisor (SIPS1)

This dyad illustrated exchanges between two socially, culturally and professionally connected Gabra, involved in the provision of development (SIPS1) and animal health (AV1) services.

5. Male pastoralist (P7) and Chilres (CHIL)

This dyad represented a more traditional animal health interaction than above, highlighting the roles of cultural institutions, power, and knowledge play in knowledge development.

6. Male pastoralist (P32) and modern elite pastoralist (P85)

This interaction represented the exchange of knowledge between a privileged community member (P85) and a less well-resourced pastoralist herder (P32).

7. *Community Disease Reporter (CDR) and District Veterinary Officer (DVO)*

This relationship illustrated a connection between an NGO-trained community member (CDR) and a government veterinarian (DVO), brought together through the PE programme

8. *Community Animal Health Worker (CAHW) and male pastoralist (P6)*

This relationship described mixed professional and personal exchanges between an animal health provider (CAHW) and herder (P6).

9. *Agroveterinarian (AV1) and agroveterinarian (AV2)*

This dyad illustrated a longstanding relationship between two professional service providers, operating within the same community.

10. *Community disease reporter (CDR) and male pastoralist (P4)*

This relationship explored exchanges between an NGO-affiliated herder (CDR) and a non-affiliated herder (P4), with limited contact outside the Participatory Epidemiology project.

11. *Livestock trader (LT01) and male pastoralist (P8)*

This dyad illustrated knowledge exchanges between a successful livestock trader (LT01), and a local regular livestock supplier (P8).

12. *VSF-G North Horr (VSFNH) and male pastoralist (P3)*

This dyad illustrated knowledge exchanges occurring through an NGO project between a traditional herder (P3) and the local NGO representative (VSFNH).

7.4 Initial dyad analysis

Those dyads were mapped onto the space defined by the diversity-dynamics matrix. Each dyad was placed into the matrix using data from in-depth interviews with the dyad actors; key characteristics of those dyads are summarised below and represented graphically in the matrix plot below.

1. District Veterinary Officer (DVO) and Animal Health Assistant (AHA)

The relationship between the DVO and AHA was primarily a professional one, with the AHA seen by both parties as subordinate to the DVO in matters of animal health. Knowledge flows were varied, but principally surround diagnosis and treatment of animal health diseases; the DVO 'dispensed wisdom' and the AHA enacted these wishes at the community level. Both

actors referred to this style of hierarchical power *"he is the vet, he has the qualifications and can call on many resources"* (AHA); *"of course he (the AHA) knows much, but he has not had the training (that I have)"* (DVO). Whilst appearing a superficially straightforward power hierarchy, closer inspection revealed a more complex counter narrative. Firstly, both actors recognised that as an ethnic Gabra, the AHA has cultural access and insight that the DVO lacked. The DVO was very upfront about the value of this: *"he (the AHA) knows the community well, they are his tribe, his family. When there are problems that are difficult for me to solve, then he will often know what the community are doing to address them. When things happen, an outbreak, he will know before I am told by the CVS (County Veterinary Services)"* (DVO). There were multiple examples of mutually-constructed solutions between DVO and AHA that drew on the privileged access to resources of the DVO in combination with the 'soft' skills of the AHA. An example involved the PE programme; under this scheme the DVO was required to provide confirmatory diagnosis of livestock disease but could not provide treatment for free. Through discussions between the DVO and AHA (in combination with project staff) the AHA sourced local treatment providers that accompanied the DVO on field visits, facilitated by NGO staff. These treatment providers were then able to supply medication under direct supervision.

Secondly, the overt power dynamics provided an assumed legitimacy for the AHA's interactions with other professionals. In community settings, the close relationship between the Gabra AHA and non-Gabra DVO was recognised by the population; the friendship of the DVO conferred a form of 'remote legitimacy' to the AHA. The community's perception was largely that the AHA had increased access to external resources through this relationship allowing leverage of greater power than similar animal health providers. Interestingly the contrary was not observed; among veterinary peers the close working relationship of the DVO with a local animal health provider was not commonly seen as a direct benefit. The mutual respect and strong relationship between DVO and AHA had allowed the DVO to subtly advocate for local framings of disease and treatments in professional debates, particularly on WhatsApp, where the pseudo-patronage of DVO provided the AHA access where traditionally there may have been none.

These exchanges, amongst others, demonstrated an active flow, with conversations developing thematically over time around sharing understandings of problems. There was also significant diversity of flow with the actors regularly discussing professional, personal, political and project-based topics.

2. Male pastoralist (P33) and male pastoralist (P34)

The two herders in this dyad shared several common characteristics; both were from the same age set, had comparable herd sizes (therefore occupying similar wealth categories), were active members of community and cultural gatherings, and shared membership of the church at which they met. The two men were however not close, their knowledge exchanges mostly revolved around widely-acknowledged community news and matters of livestock health. P34 was believed by P33 to have access to particular knowledge regarding camel herding: "*he (P34) has many Somali friends through his wife's family. They are good camel herders, they know much*" (P33). Similarly, P34 was aware that P33 sold his sheep to Ethiopian traders around the times of the *hadj*, and that they required particular stock to get the best price; *"the Ethiopians give a good price for sheep. But they use a scale (to weigh the animal), this is different to (the) Nairobi (markets). He (P33) knows how they do this"* (P34). These exchanges involved limited reciprocity, mainly surrounding follow-up questions rather than discussion. Similarly, the exchanges were largely limited to broad themes however it seemed likely that over time the two men may widen their topics of conversation should circumstances require or permit.

3. Solidarites International Projects Supervisor (SIPS1) and traditional elite pastoralist (P77)

This relationship linked two superficially different but highly interconnected actors. The origins of the SIPS1 and P77 dyad were unclear; both actors suggested the other was known to them through cultural channels for many years, but the relationship only crystallised more recently. P77 was a *Da'abela* of significant means who was culturally and politically active within the community. Despite an outwards persona of traditional adherence, he was remarkably progressive in his outward-looking nature and use of technology. SIPS1 was a Project Manager for Solidarites International, and a North Horr community member; well-connected and respected within the community in part for his NGO connections and in part for his overt engagement with Gabra traditional customs. The two actors conversed on a range of topics including NGO projects, Gabra cultural events, and at a social level. The pairs of discussions of how NGO programming could engage wider elements of Gabra society were illustrative of the fluid identities of both actors. P77 would sometimes use terminology distancing himself from the community, language to be more expected from a consultant than a cultural elder: *"they (the Gabra) need to be shown why it (the NGO project) works for them. As a community, we need to know how this will better us as a whole, not just his herd, his flock"* (P77). The blurred line between community member and objective advisor was demonstrated by both actors;

SIPS1 switched between NGO and community identities, often using *'they'* and *'we'* within the same sentence to mean both development and traditional actor groups. The bridging of identities and the slight outsider status this conferred in many ways unified the two actors. P77's use of WhatsApp distinguished and slightly removed him from other senior traditional herders, SIPS1's status as an indigenous Gabra influenced the perceptions of NGO project recipients and colleagues alike. These commonalities assisted the actors in exchanges and discussions of a diverse range of topics, and often helped in solving one another's problems

4. Agroveterinarian (AV1) and Solidarites International Projects Supervisor (SIPS1)

This dyad also included SIPS1, but this time to an agroveterinarian (AV1). P77 and AV1 differed most noticeably in individual aims and objectives suggested during interviews. In the previous dyad, P77 focused on community and cultural enrichment and discussions with SIPS1 tested ideas and concepts against these criteria. Exchanges between AV1 and SIPS1 were noticeably more pragmatic, bordering on opportunistic. There was a clear search for new opportunities or to solve existing problems; notions of access and obstructions permeated most conversations. Further questioning revealed different conceptual strata of opportunities/obstructions; for example, SIPS1 had questioned AV1 on multiple occasions about the best way to recruit remote herders for MUB feeding as *"they (more remote herders) don't think that the (MUB) block is of use. We show them how to use it, that it can provide good feed, and that many of us (Gabra) use it. But still, it is not popular"* (SIPS1). AV1's response was supportive, suggesting that traditional herders were more circumspect, taking time to evaluate possible changes. However, when questioned alone by the researcher, AV1 suggested that the use of MUB as a feedstuff *"is not going to be popular with them (remote herders). They like the foora, they walk far. If you wish to feed more, then you must stop the fighting (with other ethnicities) and open up land"* (AV1). This contrasted with conversations about supplying vaccinations to outlying settlements in which SIPS1 and AV1 were discussing practical difficulties such as the maintenance of the cold chain, more abstract concepts such as traditional understandings of herd immunity, and the ethics of NGO involvement in supporting large (and therefore richer household) groups of livestock. The key differences between the examples was that in the first case the problem was not shared; SIPS1 and AV1 framed the problem of feed shortage in very different ways. In contrast, discussions of treatments engaged AV1 far more, the two actors worked towards creating a mutual framing of the problem in the second case. This shared understanding seemingly led to richer discussions that could promote the creation of new knowledge.

5. Male pastoralist (P7) and Chilres (CHIL)

In this case the *chilres* was a culturally active senior male, with significant livestock assets. In contrast P7 was a relatively junior male herder with a modest herd. The relationship between *chilres* and P7 appeared decidedly imbalanced, with P7 suggesting a well-developed and intimate relationship – *"I know him (the chilres) well, he is a good man, a clever man. He and I talk about many things, he knows about animals very much; but also about families, women and children. And schooling. You may ask him many things that he can tell you"* (P7). In contrast, the *chilres* seemed to focus only on livestock knowledge and was passingly familiar with P7, boarding on the dismissive: *"I have many people come to me for help with their animals, and I tell them what I can. I have seen many things and from these things I learn, I pass on, and this way they learn… …Yes, I know him (P7), he has family in Gas. We have talked, yes, and I have helped him also"* (CHIL). The asymmetric nature of the connection in combination with a pseudo patron-client relationship, influenced by a strong cultural setting tended to focus knowledge exchanges on livestock issues through a very 'top-down' approach.

6. Male pastoralist (P32) and modern elite pastoralist (P85)

Similarly to the CHIL-P7 dyad, both actors in the P32-P85 relationship acknowledged an overt power asymmetry in the direction of knowledge flow. P32 was a young and aspirational Gabra herder interested in developing new livelihood strategies. P32's relationship with P85 developed initially through exploring educational opportunities for himself and his family. P85 was a well-connected, educated, affluent pastoralist who occupied a respected role in cultural institutions. Whilst an indigenous North Horr Gabra, he did not follow traditionalist codes of appearance and behaviour but retained a significant ability to influence and advise traditional institutions. He, and several Gabra like him – both male and female, were repositories of 'modern knowledge' that could be accessed by community members. Actors such as P85 were often framed in the community as both 'one of us', a North Horr Gabra, and 'other', members of a 21st-century technical society. This merging of identities cast P85 as a form of '*digital chilres*', a wise-man position who was able to draw on traditional and modern knowledge stocks. P85's relationship with P32 had evolved over time into a mentor-mentee model, through which P32 has sought advice and guidance about a wide range of issues. To date these exchanges had been largely directed from P85 to P32 however in their recent conversations it was clear that P32's ideas on importing plastic barrels had captured P85's interest. Whilst this idea was not yet being co-developed, both parties independently discussed the possibility of working together on the project and what they could contribute.

7. Community Disease Reporter (CDR) and District Veterinary Officer (DVO)

The relationship between the CDR and the DVO was established as part of the PDS programme in 2016. The programme was designed to train and empower local community agents through improving connections with wider county veterinary institutions. This style of engagement aimed for a notional equality between actors, but there was evident tension through existing hierarchies between herders and veterinary agents. Similar to the CHIL-P7 relationship, the existence of this power imbalance was only referenced by one half of the dyad. The DVO suggested that *"he (the CDR) is my ears in the community, he can see what is going on. He is trained to report the diseases, the outbreaks, and we (veterinary service providers) will work out what should be done"* (DVO). The CDR on the other hand suggested a far more equitable relationship, *"the (PDS) project is very good, as it uses the knowledge of the people. We (the CDR and DVO) are able to tell the government what we need doing, how are animals are sick"* (CDR). Questions of power and participation are not new to development, but the effect of these dynamics on knowledge sharing seemed to reduce exchanges to unidirectional information sharing, limiting capacities for iterative development across broader topics.

8. Community Animal Health Worker (CAHW) and male pastoralist (P6)

Superficially, the CAHW-P6 dyad mirrored the power hierarchies of the CDR-DVO and CHIL-P7 dynamics. The CAHW was respected within the community as a holder of animal health knowledge, and was a common point of contact when seeking livestock health advice. P6's relationship with the CAHW was slightly more nuanced than the previous two; P6 and CAHW's relationship has developed beyond a simple commercial exchange through a shared church and phratry contributing to an increased breadth of shared knowledges. Even in exchanges of non-animal health knowledge however a hierarchical 'dispensing of wisdom' dynamic persisted: *"he (the CAHW) advised me when IBLI came here. I talked with him about the best thing to do. Like with selling to the Somalis, we met, we talked. He is a good man"* (P6).

9. Agroveterinarian (AV1) and agroveterinarian (AV2)

As with the DVO-AHA relationship, AV1-AV2's connection was rooted in a professional relationship between to animal health service providers. Whereas the DVO-AHA relationship was associated with a pre-existing hierarchy, the AV1-AV2 linkage existed in a much more equal, often pragmatic space. Both agroveterinarians operated as competing businesses, neither could clearly distinguish himself from the other by reputation or service. On the surface, the relationship between the operatives is one of shared location, culture, profession

and business model. These simplistic categorisations masked far more complex knowledge sharing and creation relationships. Both actors claimed limited contact with the other, but contact tended to consist of focused exchanges discussed and debated in small segments over long periods. One example of this was the emergent (and as yet undiagnosed) camel disease entering the region; AV1 and AV2 discussed possible pathologies and treatments and called upon individual contacts to inform knowledge involved in exchanges. The primary difference between the AV1-AV2 model and the DVO-AHA dynamic was in the site of knowledge creation. Both agroveterians seemingly shared knowledge relatedly, including updates and developments, but the site of knowledge creation was internal rather than collaborative. Compared to the mutually constructed solutions seen previously, the knowledge generation of AV1 and AV2 was highly individualistic.

10. Community disease reporter (CDR) and male pastoralist (P4)

The CDR and P4 were indigenous Gabra, brought together through the Participatory Disease Surveillance project. Both men owned modest herds and had access to multiple sources of knowledge on animal health and disease. The exchanges between CDR and P4 fell into two categories; the exchange of societal news or information exchange under the PDS scheme. It was interesting to note that P4 volunteered multiple routes of disease reporting of which the CDR is just one, reflecting the pragmatic and limited knowledge exchanges occurring between the two.

11. Livestock trader (LT01) to male pastoralist (P8)

LT01 was a successful livestock trader based in North Horr, P8 was one of his regular suppliers. Contrasted with the CDR-P4 relationship above, P8 and LT01 sought one another out as a matter of commercial need as opposed to an inciting project or shared institution. This led to a knowledge dynamic in which both actors exchange very focused information surrounding business interactions and little else. Unlike the targeted exchanges of the CDR-DVO relationship, both LT01 and P8 tended to dynamically seek out knowledge from the other, integrating information such as market prices, stock levels, grazing conflicts, and transport logistics in personal business planning. These exchanges were reciprocal and evolved over time but as with the AV1-AV2 dyad the site of knowledge creation was located within the person.

12. VSF-G North Horr (VSFNH) and male pastoralist (P3)

The VSFNH-P3 relationship was one of the simplest linkages within any part of the network. The two actors were connected via involvement in a Community Managed Disaster Risk Reduction (CMDRR) programme, under which locally defined groups brought proposals to

NGOs to increase resilience. Contact between P3 and VSFNH solely revolved around the implementation of the CMDRR programme, exchanging specific knowledge where needed, with no further iteration or contact.

7.5 Dyadic relationship analysis

7.5.1 Introduction

The section above provides qualitative background details for the twelve dyads selected using the methodology outlined in section 3.5. The interviews and observations relating to the dyads also form the basis for specific analyses of dyadic relationships, focusing on the *plurality* and *strength* of the relationships as discussed in section 6.6.

7.5.2 Relationship plurality

As described in the initial chapters of this thesis, traditional network analysis techniques often locate either a presence-or-absence (*undirected*) or *directed* approach to relationships. The descriptive power of these types of analytics centre on the macro structure of the network rather than at the dyadic level, with knowledge exchange acting as proxy evidence for a relationship. However, when considering pastoralist innovation, it may be useful to dig further into the nature of these relationships by reversing this conceptual order. Once identified through questioning, the *diversity* of linkages and *dynamics* of knowledges flowing relationships could be mapped. This approach explicitly recognises the real-world effects of a relationships' potential to carry multiple forms of knowledge.

This section examines the types and context of knowledge transfer events, and the nature of relationships between actors. In most cases, actors' responses suggested a fluidity of definition surrounding the knowledge transferred and associated institutions; for example, a herder was both client, same age-set, and friend of an agroveterinarian. Describing their exchanges, he suggests *"he (the agrovet) is a good man, we talk often. He knows many things about new drugs and treatments, and he helps very much. He also helps me with my father as he has had the same sickness (the agroveterinarian's father). We see each other in the street and we say hello, and now we are talking on WhatsApp when there are bigger things"* (P38). This excerpt demonstrates the blurring of the type of knowledge shared, and the channel through which the exchange happens. Using the methods described in section 3.5.3 seven channel typologies were identified and mapped onto the dyads:

Exchange	Colour	Description	Example
Professional		Professional exchanges revolve around the transfer of knowledge relating to expert advice, either peer-peer or peer-client.	Veterinary advice, legal council
Commercial		Commercial exchanges focus on the transfer of economic or business knowledge.	Market information, trade routes
Traditional		Traditional exchanges centre on the exchange of cultural or societal knowledge, most commonly surrounding Gabra cultural events.	Dates for *barazza*, fundraisers
Religious		A smaller subsection; like traditional exchanges religious exchanges most often relate to upcoming events such as fundraisers or work parties.	*Harambee* collections, church aid
Project		Project exchanges share knowledge about a specific event, most commonly relating to NGO programming.	MUB training sessions, PDS exchanges
Social		Less well defined, social exchanges occur between friends and can cover a range of unrelated topics. Most easily defined as knowledge sharing outside other categories.	Family or personal news/advice
WhatsApp		Included as a discrete category, WhatsApp forum exchanges may carry information from any of the above categories but are unique in their public commentary.	Political opinion, job opportunities

Table 14: Plurality channel types

Drawing on qualitative data, channels can be attributed to each dyad as illustrated in the diagram below:
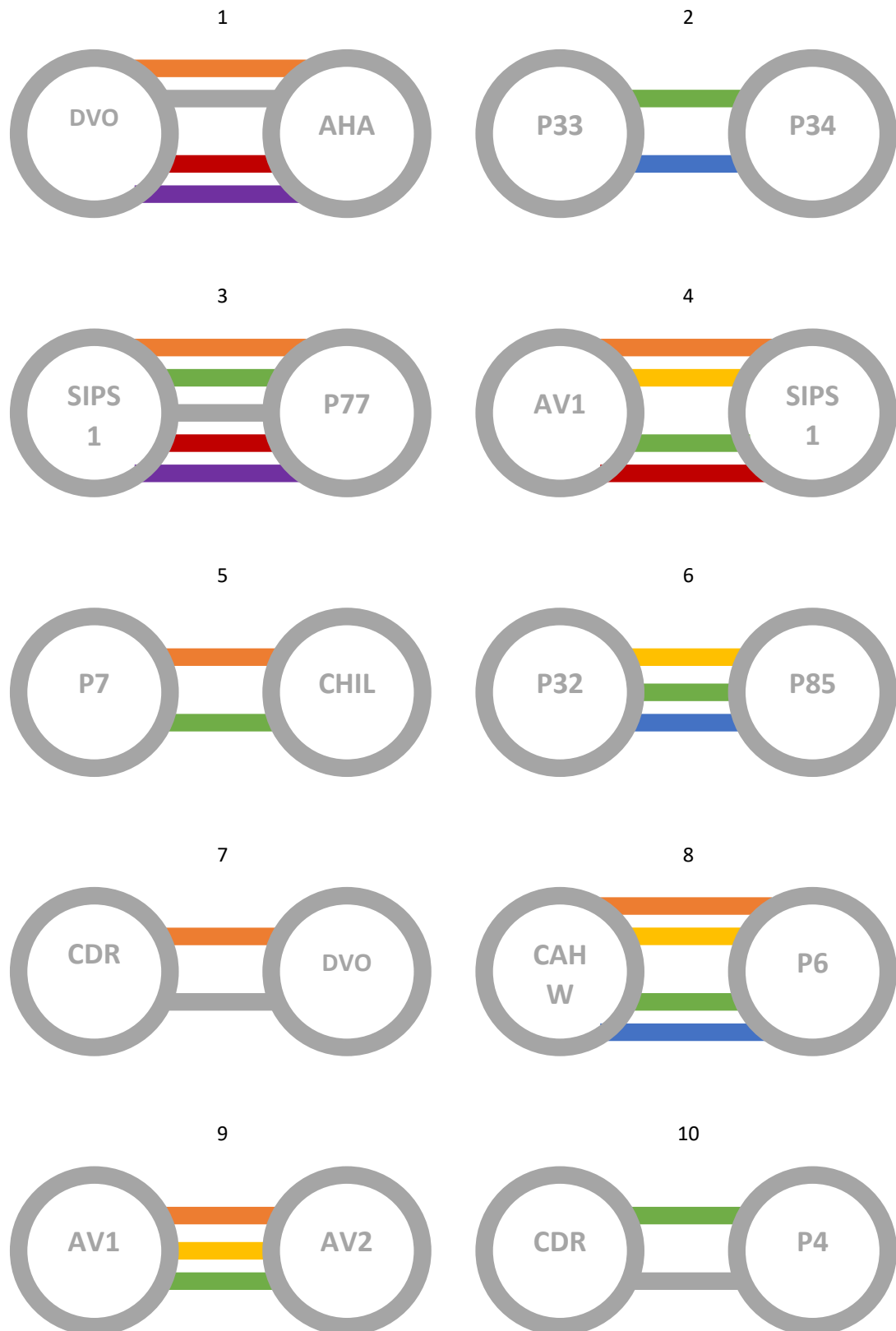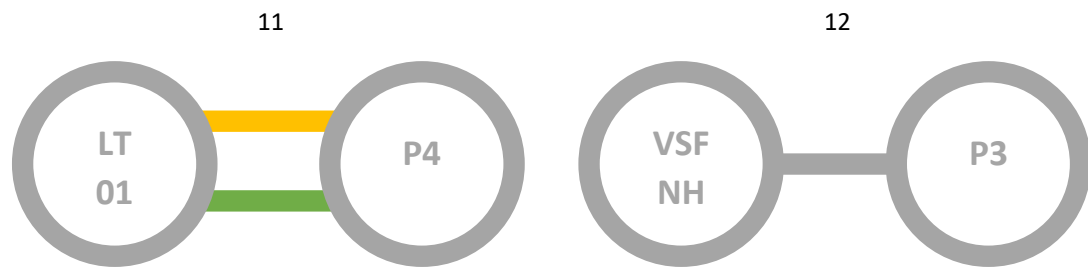
Figure 34: Dyadic bond types

7.5.3 Relationship strength

The previous section examined the *plurality* of the relationships by considering the number and types of relationships between two actors. The previous chapters also suggested the importance of considering the *strength* of the connection. Whilst acknowledging that bonds have strength, traditional SNA studies contest the best definitions and methodologies for evaluating this characteristic. This study followed the methodology suggested in section 3.5 to evaluate dyadic bond strengths; the data is presented in graphical format below in figure 35. The width of the arrow is proportional to bond strength, the colour indicates the category – **orange** for strong (>7), **yellow** for medium (4-7), and **blue** for weak (<3).
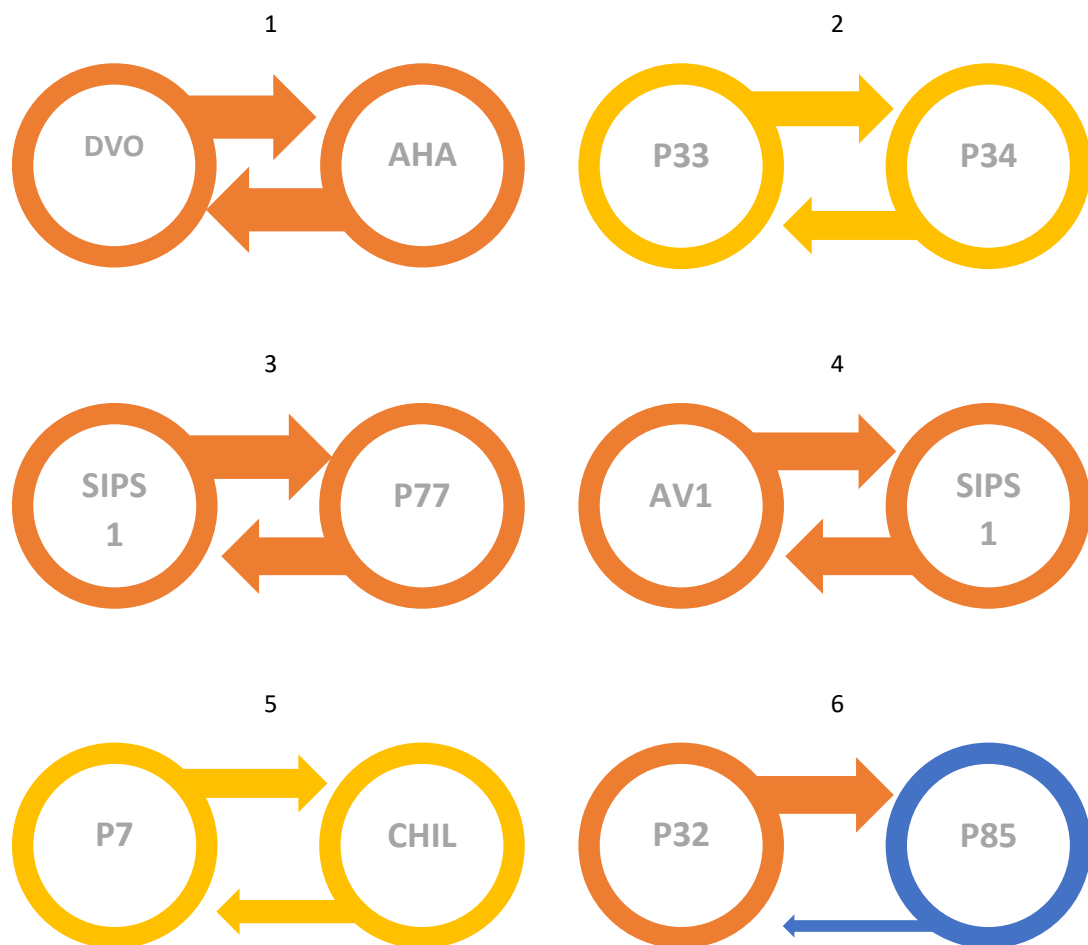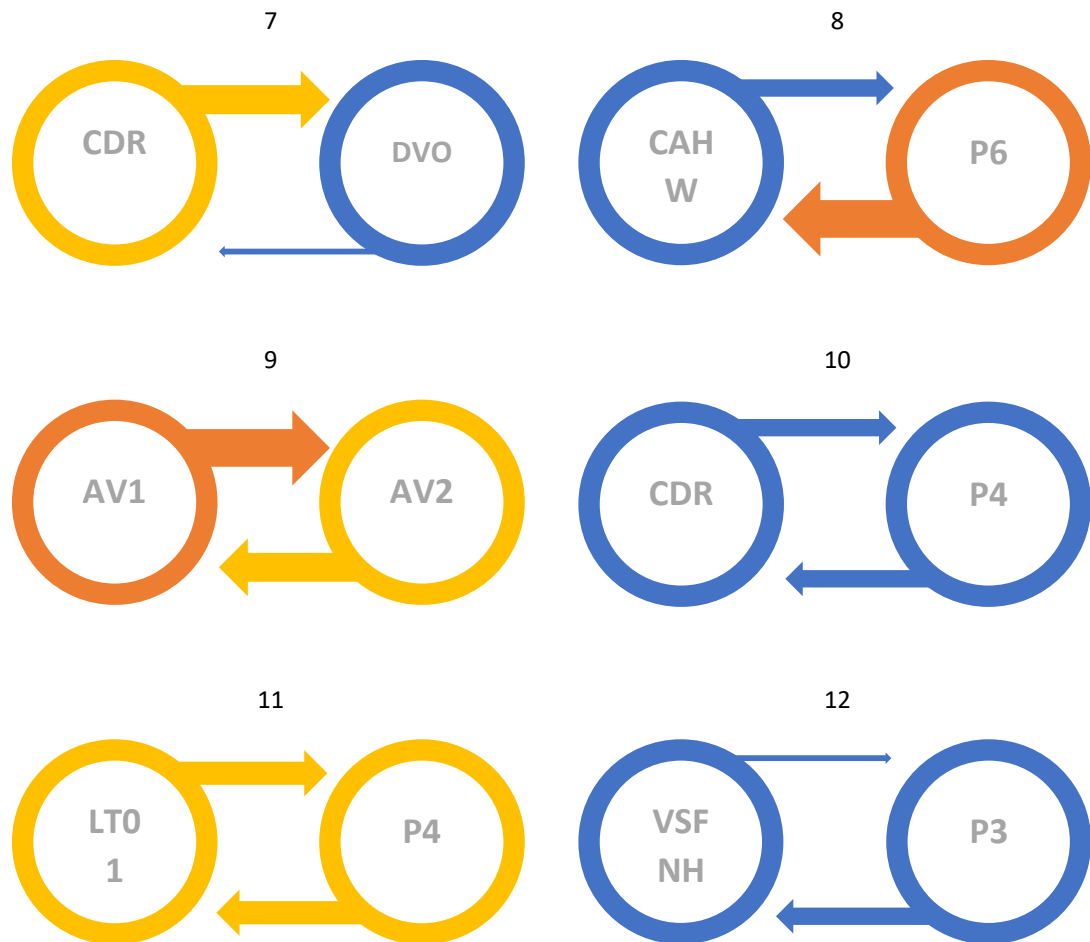
Figure 35: Dyadic tie strength

7.6 Dyadic framing analysis

7.6.1 Framing spectra

This section maps and evaluates how individual actors' framings of innovation may influence knowledge dynamics within the dyads. Each actor was asked to evaluate their own (*ego*) and their dyadic neighbour's (*alter*) framing using the three-factor Core Framings panel developed in chapter six. The relative splits of these Core Frames was used to construct a *framing spectrum* for each actor that represented the proportional distribution.. These spectra are displayed below as concentric circles, with the ego spectra outermost (the *direct-perspective*) and the alter's view of the ego innermost (the *meta-perspective*). Core Framing one (uncertainty and influence) is given in **orange**, Core Framing two (connections and relationships) in **blue**, and Core Framing three (modern and advanced) in **green**. The framing spectra for the twelve dyadic pairs are given in figure 36 below:
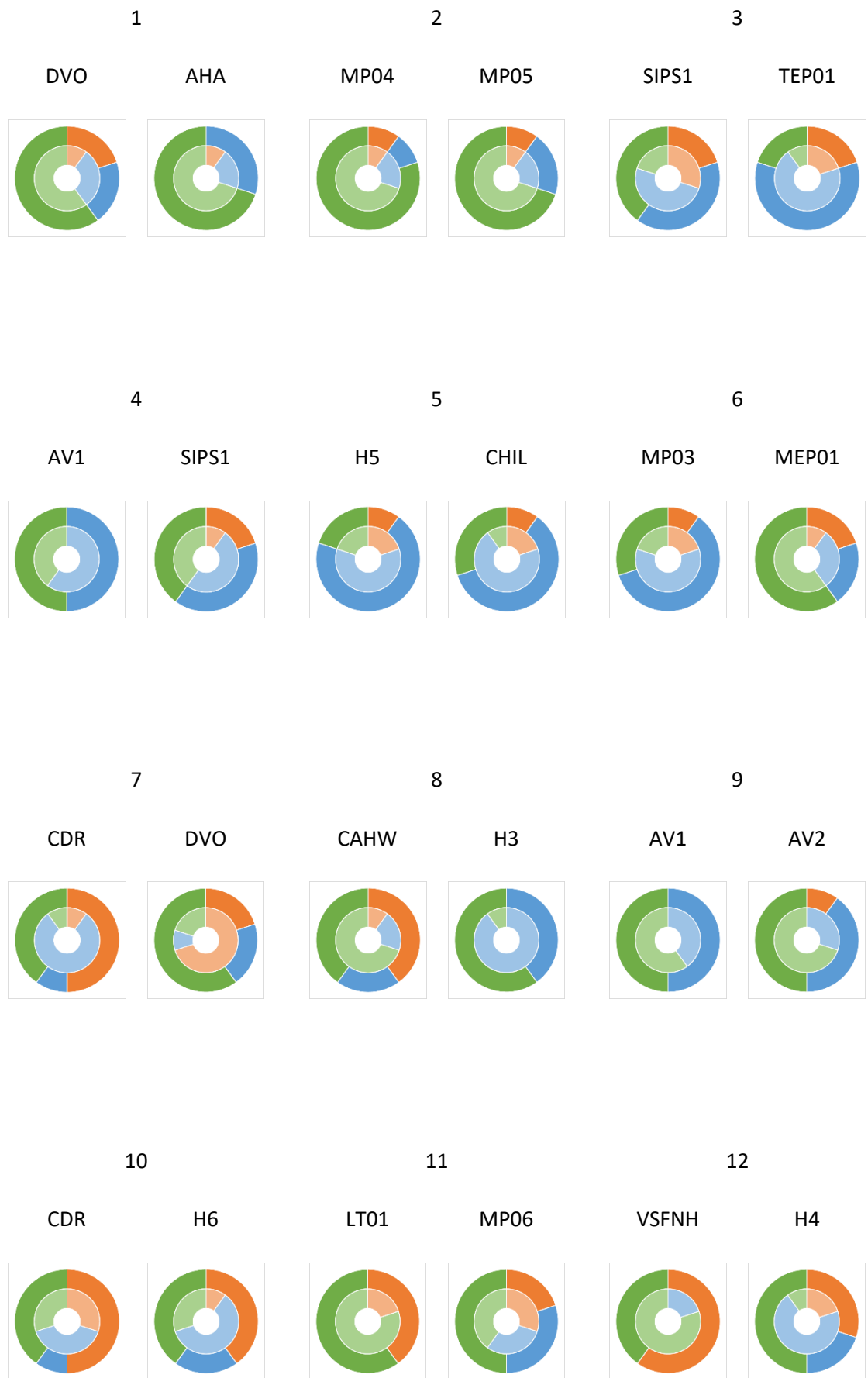
Figure 36: Dyadic framing spectra

These framing spectra were used as the basis to examine the four features suggested at the end of chapter six. These were the dyadic framings, harmony, empathy, and projection. A summary table of these features is given in figure 37 below.

Dyad	Actor		Framing	Harmony	Empathy
1	DVO	AHA	Technical	Similar	High
2	MP04	MP05	Technical	Very similar	High
3	SIPS1	TEP01	Mixed	Similar.	High
4	AV1	SIPS1	Connected/ technical	Similar	High
5	H5	CHIL	Connectedness	Very similar	High
6	MP03	MEP01	Connected/ technical	Dissimilar	High
7	CDR	DVO	Mixed	Dissimilar	Low
8	CAHW	H3	Mixed	Dissimilar	Low
9	AV1	AV2	Connected/ technical	Very similar	High
10	CDR	H6	Uncertainty/ technical	Very similar	Low
11	LT01	MP06	Technical	Dissimilar	Moderate
12	VSFNH	H4	Uncertainty/ technical	Dissimilar	Low

Figure 37: Dyadic features

7.7 Conclusion

This chapter built upon network data from chapter five and framing data from chapter six to focus on hybrid knowledge creation processes within individual dyads, specifically to select and evaluate these case study relationships for use in the analytical framework developed in 5.7. Using a structured selection process, dyads were identified through network metrics, communities of shared subjectivity, and representativeness for strength and plurality. This led to the selection of twenty actors, involved in twelve dyads, that will be taken forward into the framework analysis phase given in the next chapter.

Chapter 8:

Framework analysis

Picture 17: Unique perspectives on shared relationships

This chapter takes the relationships outlined previously and explores how the individual context and characters that make up each dyad can shape knowledge creation.

8.1 Introduction

The previous chapter set out the structured selection process for case study dyads. These dyads represent specific combinations of actor, relationship, network, or framing characteristics that the data from chapters five and six suggest as providing insight into the hybrid knowledge creation processes. As discussed in chapter seven, rather than relying on researcher-led interpretations of these observations, the framework developed in 5.7 explores how relationships between dyads and the six factors identified in section 6.6, namely relationship plurality and strength, and dyadic framing, harmony, empathy, and projection.

The first step in this analysis is to locate each dyad on the analytical framework based on data relating to their diversity and dynamics. This draws on the same qualitative data presented in chapter seven, using the structured methodology outlined in chapter three. Following the dyad placement, each of the six factors can be overlaid to suggest correlations between the matrix position and the variable in question.

8.2 Mapping case study dyads

As discussed above, the first step in the analytical process was to map each dyad onto the diversity-dynamic framework using qualitative data. Figure 38 on page 242 shows a plot of dyad positions with decreasing diversity traveling up the Y axis and increasing dynamics from left to right across the X axis. A fixed-sized circle represents each dyad, with the dyad number from section 7.3 placed below.

An initial review of the dyad placements implies an even scatter across all four quadrants, likely to relate to the selection process that aimed to represent the variety of dyadic types. The average dynamic position of the dyads is shifted from the centre slightly towards the static end of the spectrum, and the diversity slightly towards the narrow. Looking at the most extreme positions, wide-active (high diversity and dynamic, bottom right) and narrow-static (low diversity and dynamic, top left) dyads are more represented than narrow-active or wide-static (mixed diversity and dynamics, top right and bottom left). It is unclear at this stage if this is a sampling error, or if linkages exist between the axes characteristics; this questioned that will be addressed throughout the analysis.

Dyad position on diversity-dynamic matrix
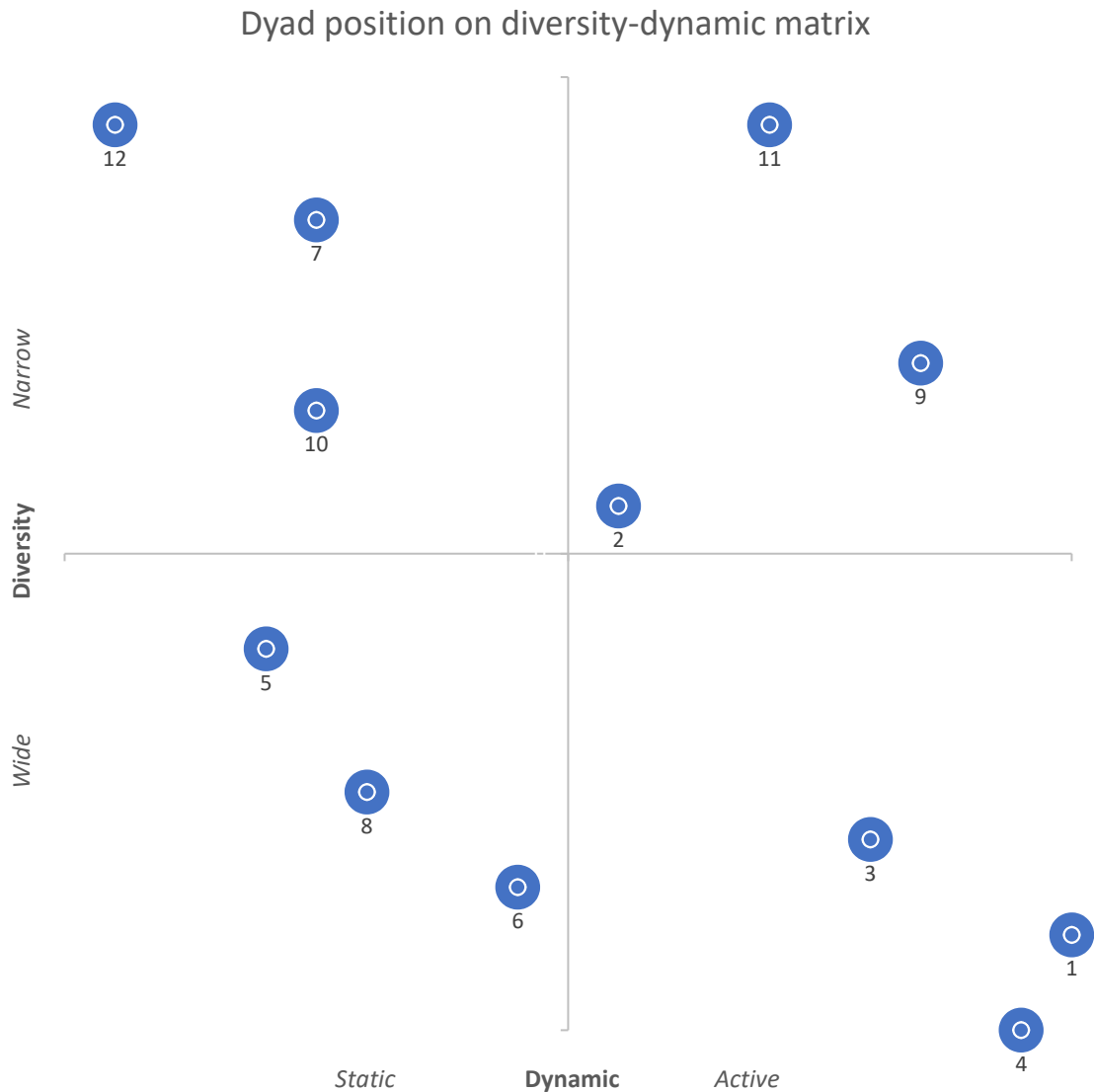
Figure 38: Dyad position on diversity-dynamic matrix

8.3 Relationship characteristics as drivers of knowledge creation

Having mapped the dyads onto their relative positions within the framework, it is now possible to use the matrix to evaluate the six factors suggested in section 6.6. These are presented firstly by relationship characteristics (plurality then strength), followed by attitudinal measures (framing, harmony, empathy, and projection). Each factors contribution is discussed following the relevant plot, with a summative account of the six analyses given at the end of this chapter. These six observations are synthesised alongside data from the network, framing, and dyad selection chapters (five, six, and seven) to propose a heuristic for understanding hybrid knowledge creation processes through use of the analytical framework.

8.3.1 Plurality

One of the six factors identified in section 6.6, plurality of knowledge within a relationship was derived from the 'transfer' relationship category proposed by McCulloh et al. (2013). Plurality disaggregates knowledge transfer into a series of seven internally-relevant categorisations given in section 7.5.

The plot follows the same graphical formal as table 30 on page 189, displaying dynamics and diversity on X and Y axes respectively. The icon for each dyad has been coloured to represent the plurality of knowledge types following the schematic used in section 7.5, repeated below in figure 40 for clarity.

Exchange	Professional	Commercial	Traditional	Religious	Project	Social	WhatsApp
Colour							

Figure 39: Relationship plurality key

Figure 40: Plurality matrix plot

As may be reasonably expected, those dyads with more channels available were found in the *wide* focus at the bottom half of the matrix. It is interesting to note that channel plurality is not universally linked to a wide diversity value; the 'widest' dyads (dyads 4, 1, and 6) only contain four possible channels as opposed to dyad 3 (which has five). Similarly, three-channel dyads exist in both wide and narrow quadrants (dyads 6 and 9 for example).

Drawing on these data and additional observations from dyad interviews it is possible to suggest ways in which the specific nature of types of knowledge plurality may relate to both diversity and dynamics, identifying four key themes relating to project knowledge, professional knowledge, a combined traditional-religious-commercial theme, and a social-WhatsApp theme. The specific influence of each is discussed below.

Project

Project-specific data can be suggested as having a narrower 'bandwidth' than other channels, providing limited links to other knowledge types. Project channels exist in diametrically opposed positions across the matrix, split between narrow-static (dyads 7, 10, and 12) and wide-active quadrants (dyads 1 and 3). The key differences between these two populations could be the presence of a strong power dynamic; in dyads 7, 10, and 12 there was a clear hierarchy which seemingly shut down reciprocal knowledge exchanges. This hierarchy did exist in dyad 1, but the presence of a social channel (lacking in dyads 7, 10, and 12) may have acted to open out the nature and dynamics of exchanges.

Professional

The professional channel mirrors the project channel in many ways. In the absence of a 'bridging' channel such as social contact, professional exchanges move from informal and open exchanges towards formal, closed communication as seen in dyads 5, 7, and 8. Where professional exchanges occur in wider contexts they could have acted to reinforce the 'expert' status of one actor (such as dyads 5 and 8), inhibiting reciprocity but enabling wider elite 'wisdom dispensing' exchanges. The alternative model for wide professional exchanges is inclusion as part of (as opposed to the whole of) an actor's identity (as with dyads 1, 3, and 4), either mitigated by other channels (dyad 1) or shared between peers (dyads 3 and 4). Professional relationships that do not facilitate this width of knowledge transfer displayed a marked lack of reciprocity, this could have been due in part to a professional-client dynamic (dyad 7). It is possible that dyad 9 mitigated this by the peer-to-peer nature of the relationship, bringing the possibility of reciprocal exchanges.

Traditional, religious, and commercial

These channels had little definitive effect on matrix positions. In all cases these factors acted as 'background' linkages, used as first points of contact between actors, but not inherently as utilitarian as the project channel or as free-exchange promoting as the social channels. The narrowest, least reciprocated exchanges (dyads 7 and 12) had neither traditional, religious, nor commercial links, suggesting that these may have acted as 'ways in' to build closer relationships.

Social and WhatsApp

Of all the channels identified, social and WhatsApp had the clearest correlations with *wide*, *engaged* exchanges. This is explicable, due to the nature of social contacts, but the interview

data on the origins of relationships origins it indicates that social linkages were often developed from other, prior linkages. The development of social network ties acted to moderate power hierarchies (dyad 1), bridged organisational boundaries (dyads 3 and 4), and fostered broad exchanges that could bring in and develop new ideas across both actors' networks (dyads 1, 3, and 4).

8.3.2 Strength

The previous plot described the nature and influence of relationship plurality on knowledge sharing. The other aspect of relationships proposed in section 6.6 related to strength, a factor assessed using the methodology outlined in chapter three that provided the data given in Section 7.5. These findings were plotted in a similar way to those of figures 40 and 41, with dynamics and diversity on the X and Y axes respectively, and the dyad icon relating to the perceived strength from both actors involved in the dyad. The strength categorisations are summarised in figure 42 below:

Figure 41: Relationship strength key
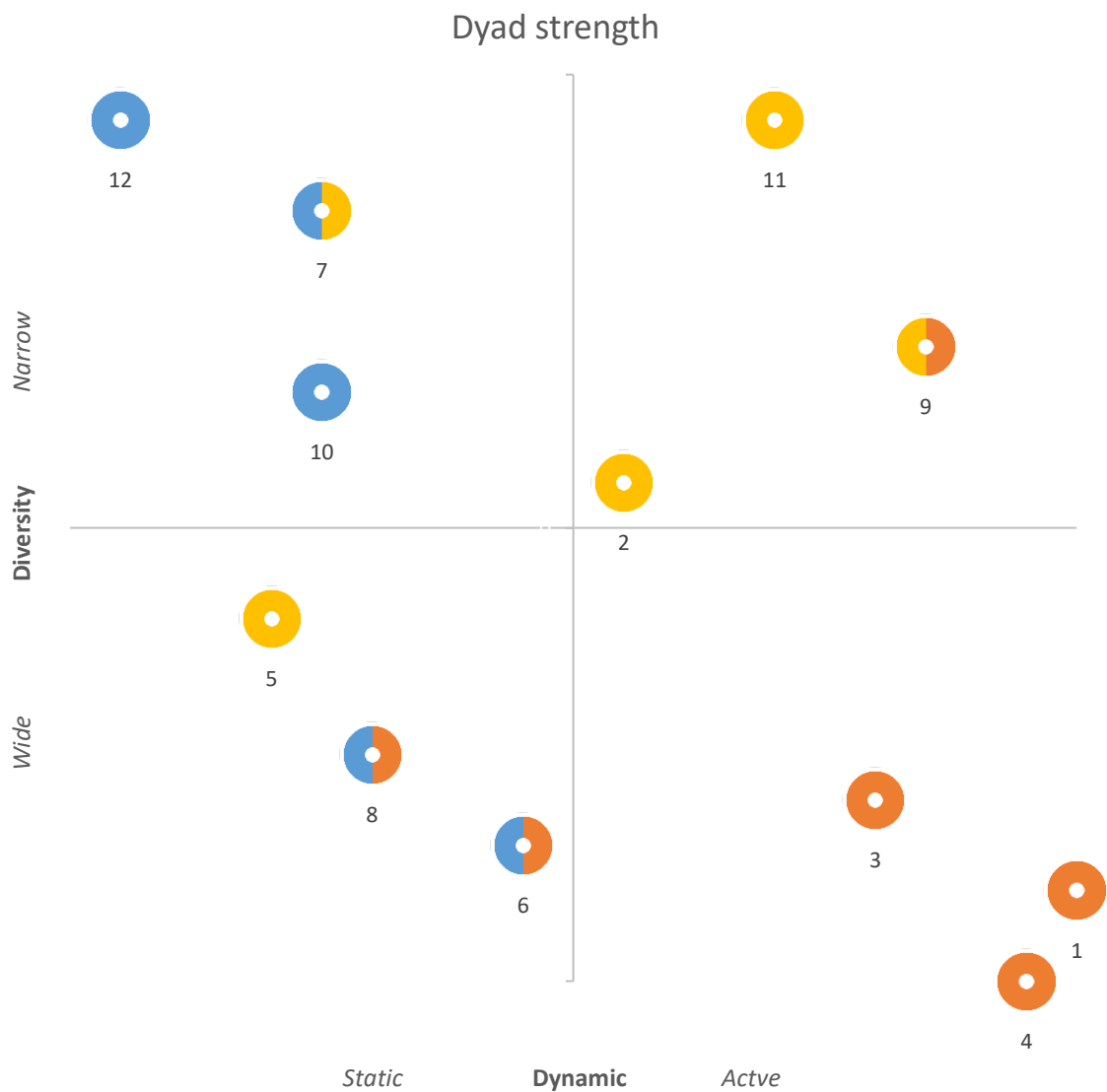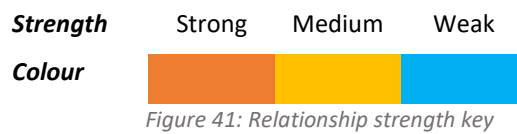
Figure 42: Strength matrix plot

The strength matrix plot suggests a link between dyad strength and position. There is a clear distribution across the matrix, with stronger bonds featuring in the lower right quadrant and weaker connections in the upper left. Looking beyond this distribution, bilateral strong bonds tended to have been linked to active exchanges; the only two strong bonds on the left-hand side of the matrix (dyads 6 and 8) were decidedly asymmetrical (strong-weak). That asymmetry could have reflected power imbalances and relationship dynamics within those specific dyads – the 'dispensing wisdom' model mentioned in the previous section.

An effect of asymmetry can also have shifted relationships towards a more static mode. The only outlier to this trend was dyad 9 (AV1-AV2), which was on the cusp of strong-strong and strong-medium; under these conditions it would not be unreasonable to consider this dyad as a 'pseudo-symmetrical' pair. At the other extreme of the strength spectrum, dyads 10 and 12 are both symmetrically weak-weak. This was unsurprising as little knowledge flow occurred between those actors; both actors had alternative (and preferable) sources of knowledge from which to draw.

8.4 Perceptions as drivers of knowledge creation

The previous two sections used the framework to characterise relationship factors. Section 6.6 suggested a series of four framing factors - dyadic framing, harmony, empathy, and projection – as also potentially relevant in processes of knowledge hybridisation.

This section sets draws on the framing spectra data presented in chapter even for use within the analytical framework, following the mapping and evaluation process used in the relationship analysis sections above. In each case a summary key of the characteristic in question is provided, followed by the plot, and a section discussing the analysis.

8.4.1 Dyad framing

The dyadic framing factor suggested in section 6.6 explored the combined core framings contained within the dyad, and the role of a specific framing, or set of framings, may have in shaping knowledge creation processes.

To attribute the several framing categorisations, the proportional values for each of the core frames (uncertainty, connectedness, modernity) given by both actors in the dyad were translated into numerical scales and summed. Cross referencing these values with qualitative data, a threshold of any value more than five points greater than other values was considered grounds for selection as a primary factor. The framing categories and analysis results are

displayed below in figure 44, with primary framings highlighted in the colours to be used in the later plot. Framing spectra values and calculations for the six framing factors can be found in appendix 10.

Core framing Colour	Uncertainty	Connected	Modern

Figure 43: Core framing key

Dyad number	Framing			Dyad number	Framing		
	U	**C**	**M**		**U**	**C**	**M**
1	2	5	13	*7*	7	3	10
2	2	3	15	*8*	4	6	10
3	4	10	6	*9*	1	9	10
4	2	9	9	*10*	9	3	8
5	2	13	5	*11*	6	3	11
6	3	8	9	*12*	9	2	9

Table 15: Core framing selection values

As previously, dynamics and diversity are plotted on the X and Y axes respectively, the dyad icons represent the proportional splits of core framings represented given in table 19.
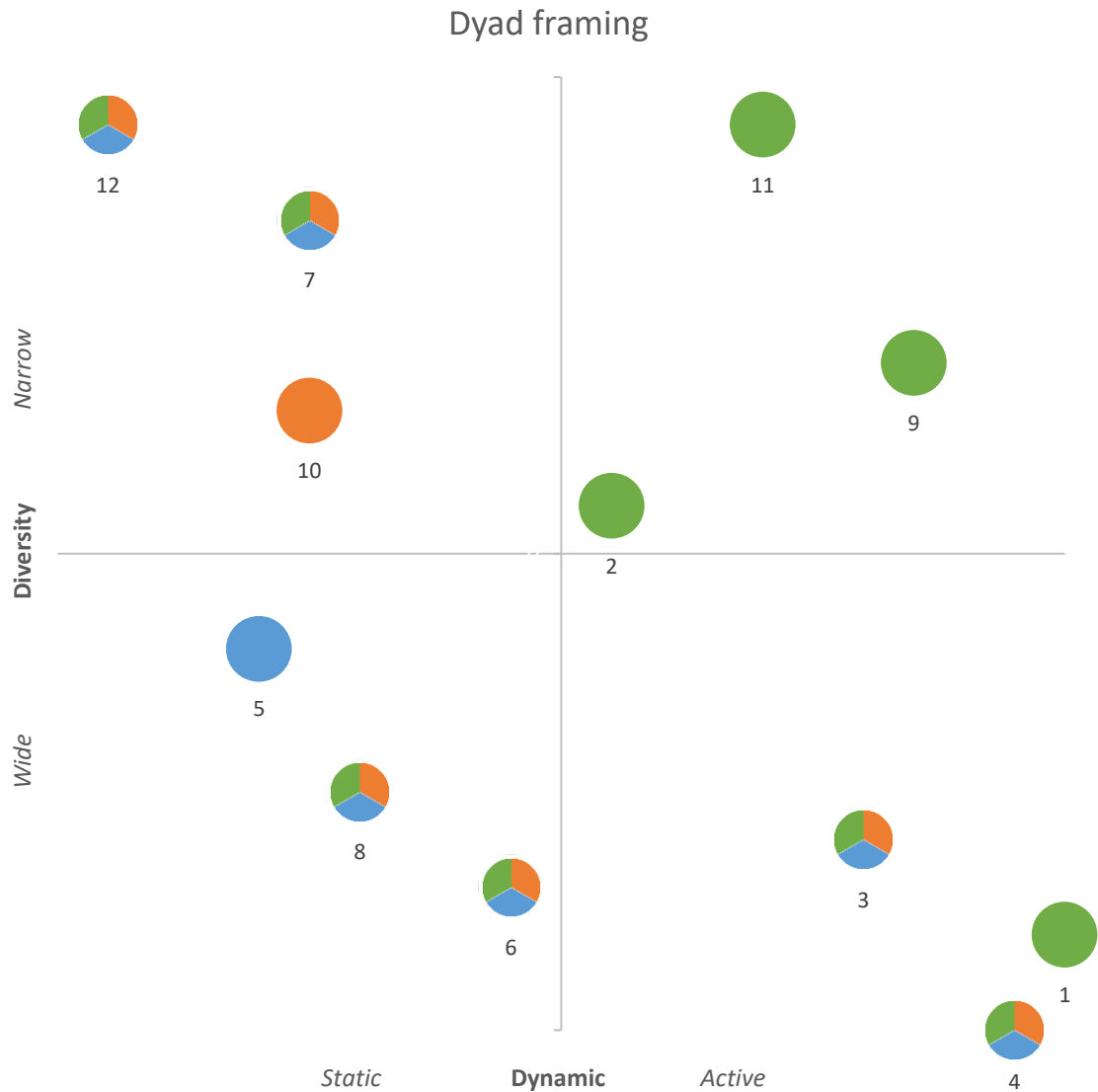
Dyad framing

Figure 44: Dyad framing matrix

This plot suggests that no single framing directly accounts for a matrix position, however it is possible to suggest limited relationships between specific sets of framings and locations in a quadrant. *Connected* dyads (Core Frame 2) were better represented across the wide section of the matrix, unsurprisingly given the focus of this framing is on bridging links between different actors. Dyads sharing *modern* framings were more likely than otherwise to have had *active* exchanges; respondents suggested that the skills and knowledge associated with technical exchanges required closer and more iterative relationships to develop, but only limited evidence supported this hypothesis. Some respondents suggested that technological innovations were associated with literacy and membership of elite groups; this may have been so but this matrix maps framings of innovation, not evidence of the types of innovation occurring. *Modern* framings occurred in all four quarters of the diagram, questioning an 'elite only' position. Homogenous technical dyads (dyads 1, 2, and 11 for example) do contain

significant numbers of formally-educated people, however P8 in dyad 11 only possesses rudimentary academic skills.

A *technical* framing had limited influence on the dynamics of the relationships, it did seem that a primary focus on uncertainty framing was more represented in the *narrow static* quadrant. Where uncertainty was combined with other framings (dyads 3 and 8), interview data suggested that actors recognised the lack of guaranteed returns of innovative activity but acknowledged benefits that innovation could bring. The three dyads in the *narrow static* region that referenced uncertainty (dyads 7, 10, and 12) suggested uncertainty was far more likely to have acted as an inhibitor to innovation rather than a moderator.

8.4.2 Dyad harmony

Dyad harmony uses the framing spectra to explore the similarity between egos' and alters' direct perspectives; put in other terms, harmony questions how similar actors' self-attributed world views are to one another. Literature provides evidence that people of similar experience and position communicate knowledge more freely and effectively (Black et al., 2004, Reagans and McEvily, 2003). Assessing framing harmony is in part a testing of this observation for similarity of framings, in this particular case study.

The sum of differences between ego and alter values for each framing was used as the basis for harmony analysis. This generated difference values ranging from 2 to 26; in combination with a data review, difference thresholds for categories of harmony were set as <4 – very similar, 4-8 – similar, 8-12 moderately similar, >12 dissimilar. The key for colours is presented in Figure 45, data are in table 16, and the analysis in more detail in appendix 10.

Similarity of framing	Very similar	Similar	Dissimilar
Colour			

Figure 45: Harmony key

Dyad	Difference	Category	Dyad	Difference	Category
1	6	Similar	7	14	Dissimilar
2	2	Very similar	8	24	Dissimilar
3	8	Similar	9	2	Very similar
4	6	Similar	10	2	Very similar
5	2	Very similar	11	14	Dissimilar
6	26	Dissimilar	12	14	Dissimilar

Table 16: Dyadic harmony analysis table

The plot locates each dyad on the same basis as in figure 46, with dynamics and diversity providing the X and Y axes.

Figure 46: Dyad harmony matrix

Key: **green** very similar, **yellow** similar, **orange** dissimilar

This harmonic plot shows a clearer pattern than the previous matrix. The most obvious link was the active-wide position of the *similar* group – actors who shared a proportion of the framing spectrum but differed in other ways (compared to the 'very similar' population). This group – dyads 1, 3, and 4 in the lower right quadrant – included diverse actors from across local, governmental, and NGO groups. These different origins may have accounted for the lack of 'full harmonisation' seen in the *very similar* group (dyads 2, 5, 9, and 10). What may have

been more important for knowledge creation were the ways in which these heterogeneous actors moved to co-create common framings within the dyad. This idea of a co-created framing was supported by the lack of harmonisation of dyads 7 and 12 in the top left quadrant, both crossing populations as with the *similar* group. Interviews with dyads 1, 3, and 4 revealed open and discursive exchanges with each actor recognising the contribution and roots of the other. Exchanges within dyads 7 and 12 acted to shut down dialogue through overt power structures and established hierarchies.

It was important to question why none of the *very similar* group occupied this matrix position, as they shared the common framing that the *similar* group may be working towards. The answer may depend on interpretations of the verb 'working'. *Very similar* dyads (2, 5, 9, and 10) had no need to co-construct framings – they were closely shared through either accident or design. The simple fact that a framing was shared was clearly insufficient to promote knowledge creation; what was seemingly required was the active sharing of frames and norms within a relationship that moved the relationship forward collaboratively. This suggestion that *very similar* framings did not necessarily drive knowledge creation was supported by the matrix plot; these dyads were found across the matrix, though not at the extremes.

Of the *dissimilar* dyads, there was a strong suggestion of favouring a *static*-type relationship over an *active* one. The exception to this was dyad 11, possibly explained by the fact that the actors' relationship was strongly rooted in commercial exchanges leading to very *narrow* but *active* interactions. The remainder of the *dissimilar* dyads (6, 7, 8, and 12) showed varying degrees of limited exchanges, from the *wide* 'wise man' of dyad 8, to the remote project-information exchanges of dyad 12.

8.4.3 Dyad empathy

The analysis of harmony is section 8.4.2 examined how similarity of direct perspectives within a dyad could influence knowledge exchanges. Empathy takes a contrasting view to explore how closely the meta-perspective of an ego matches the direct perspective of an alter; or how well an ego can intuit the framing of an alter. This feature of relationships is an uncommon subject of research but speaks to the conscious elements of knowledge sharing, exploring how beliefs in the position of a dyadic partner could be related to knowledge sharing.

The method of analysis used calculated the difference in each framing between the direct- and meta-perspectives for each actor in each dyad and summed these differences to create a numerical value for total difference. Using qualitative data in combination with these calculated values, the thresholds for dyadic empathy were set at <10 – high degree, 10-20

moderate, and >20 low degree of empathy. A key to these colours is given in figure 47, the tabulated values in table 17, and details of the calculations in appendix 10.

| Degree of empathy | High | Moderate | Low |
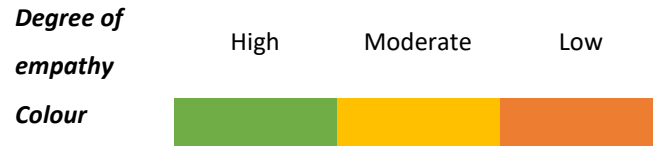
Figure 47: Dyadic empathy key

Dyad	Act 1	Diff	Act 2	Diff	Total diff.	Cat	Dyad	Act 1	Diff	Act 2	Diff	Total diff.	Cat
1	DVO	2	AHA	2	4	High	7	CDR	74	DVO	42	116	Low
2	MP04	2	MP05	0	2	High	8	CAHW	18	H3	50	68	Low
3	SIPS1	6	TEP01	2	8	High	9	AV1	2	AV2	6	8	High
4	AV1	2	SIPS1	2	4	High	10	CDR	14	H6	26	40	Low
5	H5	2	CHILR	6	8	High	11	LT01	8	MP05	2	10	Mod
6	MP03	2	MEP01	2	4	High	12	VSFNH	56	H4	42	98	Low

Table 17: Dyadic empathy calculations

Figure 48: Dyad empathy matrix

Key: **green** high degree of empathy, **yellow** moderate, **orange** low

The *empathy* measure represents the ability of an ego to correctly identify the framing of an alter. This plot is less consistent than the *harmony* matrix, but it may suggest links between a lack of empathy (shown in orange) and the *narrow static* category. The rationale for this may be more complex than initially thought. Whilst a lower empathy score was suggestive of limited understanding by the ego of the alter's framing, there is no obvious reason why a dyad should require empathy to co-create knowledge. It is possible that rather than being a driver of knowledge creation, *empathy* be considered an indicator of the closeness of a relationship. This supports the matrix distribution of higher *empathy* dyads towards the active- wide

quarters, and it is reasonable infer that both *width* and *activity* increase actor-actor exposures, allowing a greater chance of correctly predicting an alter's framing spectra.

8.4.4 Dyad projection

The four dyadic factors suggested in section 6.6 draw on direct- and meta-perspectives, concepts rooted in the field of intersubjectivity that explain the role of perception in shaping human action. In this study, projection refers not to the similarity between direct- and meta-perspectives from the ego alone; rather it refers to the degree to which the egos believe the alters to be like themselves. This differs from the other measures in that it is solely the conscious belief of the ego (unlike harmony) and does not relate to the alters' direct perspective (as with empathy).

This analysis follows a similar process to the previous two, calculating difference values between two sets of framing spectra, only this time the two in question are direct- and meta-perspectives from the ego alone. The key to the diagrammatic results is given in figure 49 below, the results in table 18, and the calculations in appendix 10.
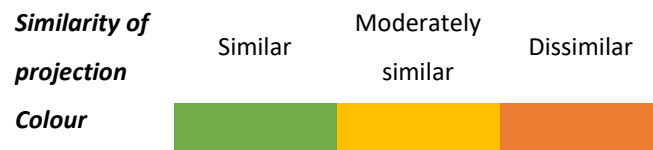
Figure 49: Key of dyadic projection

Dyad	Act 1	Diff	Act 2	Diff	Total diff.	Cat	Dyad	Act 1	Diff	Act 2	Diff	Total diff.	Cat
1	DVO	2	AHA	2	4	Same	7	CDR	8	DVO	62	70	Diss
2	MP04	2	MP05	0	2	Same	8	CAHW	74	H3	6	80	Diss
3	SIPS1	18	TEP01	2	20	Mod	9	AV1	8	AV2	2	10	Same
4	AV1	2	SIPS1	8	10	Same	10	CDR	42	H6	6	48	Diss
5	H5	2	CHILR	2	4	Same	11	LT01	14	MP05	18	32	Mod
6	MP03	18	MEP01	32	50	Diss	12	VSFNH	74	H4	18	92	Diss

Table 18: Calculated dyadic projection
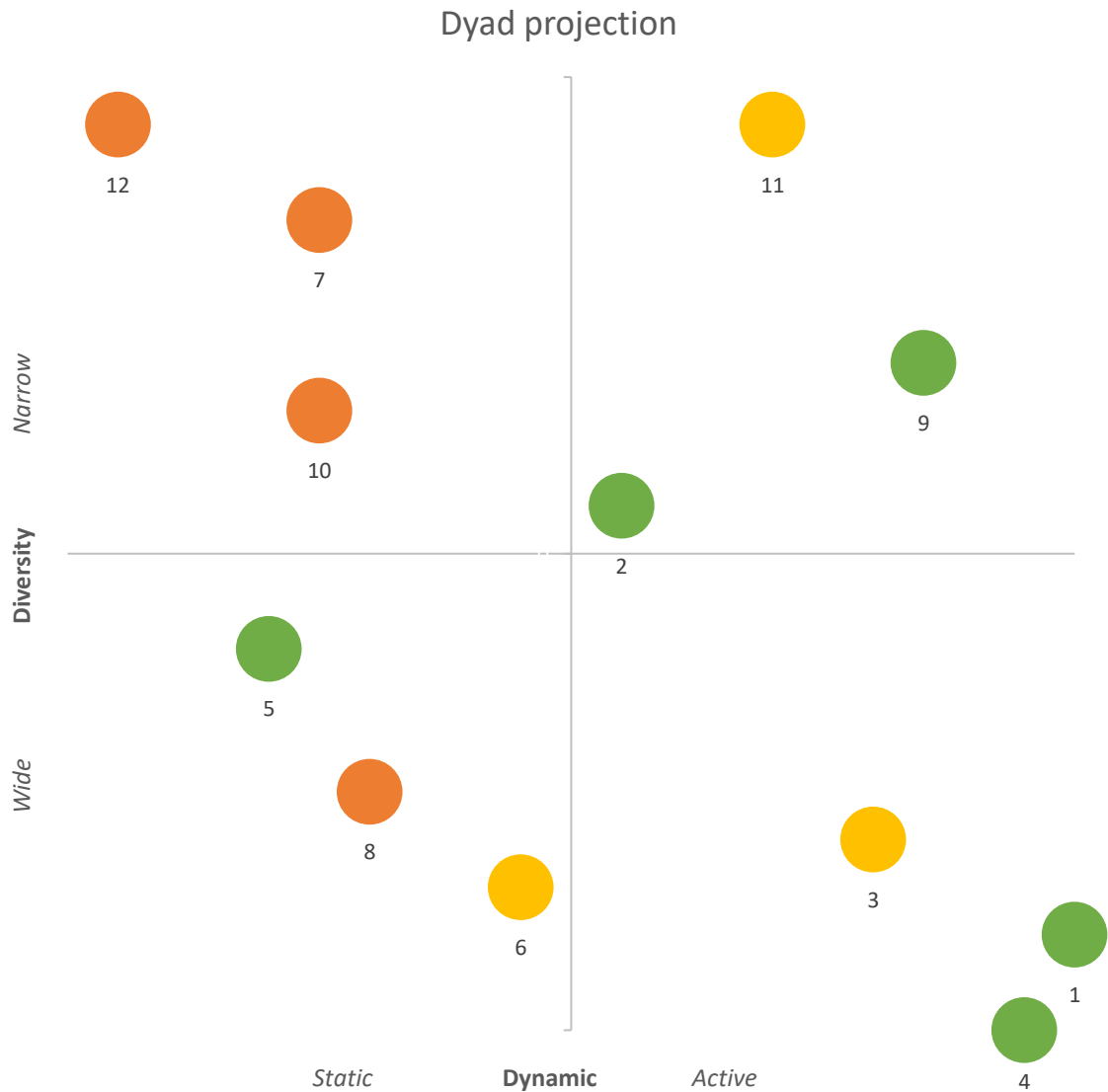
Dyad projection

Figure 50: Dyad projection matrix

Key: **green** similar projected framing, **yellow** moderately similar, **orange** dissimilar projected framing

As with framing empathy, projection compares direct and meta-perspectives, but this time the comparison is between direct- and meta- from the ego. Put another way, projection characterises the relationship between the belief an ego has about how similarly they see the world to the alter. In this matrix low degrees of belief in similarity occur within the *narrow static* quarter (dyads 7, 10, and 12) – supported by interviews that strongly suggest a view by the ego of the alters as 'other'. More unexpected is the higher *projection* values of dyads 1 and 4. These pairs have similar degrees of *harmonisation* yet believe the alter to be more like themselves than the data suggested. This is contrasted with dyads 2, 5, and 9 whose higher

projection scores accurately represented a high *harmonisation*, reflected in their higher *empathy*.

The other anomalies in the *projection* matrix included the higher *empathy* but lower *projection* score of dyads 3 and 6. These pairs understand one another's framing spectra (*empathy*) but believe the alter to be different to themselves to some extent. In dyad 3, interviews from both SIPS1 and P77 recognise the complex interaction of shared and non-shared identities and framings as central to the relationship.

8.5 Reviewing the analyses

This chapter characterised twelve diverse dyadic relationships using six factors developed in section 6.6, mapping each relationship onto the *diversity-dynamic* matrix proposed in section 5.7 to explore the influence of each aspect of the hybrid knowledge creation process. Each factor provided some insight into specific aspects of the knowledge creation process; the key points of these are summarised below.

Plurality

Building on established literature and empirical observations, this study suggested in section 6.6 that both the number and types of relationship channels between respondents could shape the outcome of knowledge interactions. The principal findings show that channels carrying highly focused knowledge exchanges such as professional and project linkages could act variously both to either open, and to close down the *dynamics* of the relationship. Broader, less formalised transfers as seen in social and WhatsApp channels promoted more *active* exchanges than more structured exchanges.

Strength

The role of relationship strength in shaping knowledge flows has been the subject of much academic debate. These data suggest that not only strength, but also symmetry may be an important consideration, with symmetrical and stronger relationships leading to more *active* exchanges. Asymmetries in strength can be indicative of 'wise man' type relationships, symmetrical weaker relationships predispose to *static, narrow* regions of the matrix.

Dyadic framing

The framing, microsociology, and intersubjectivity literature discussed in chapters two and three outlined how perceptions and attitudes can shape behaviour. In this study dyads that share a *connected* framing of innovation tend towards *wider* quadrants of the matrix, whereas

modern framings tend towards *active* regions. These effects were less pronounced than those of *uncertainty*, which contributed to making those relationships distinctively *narrow* and *static*.

Dyadic harmony

Dyadic framing characterised the nature of the frames, while harmony is concerned with similarities between the framings within a dyad. Measures of harmony strongly suggested that a full harmonisation of framings, the 'very similar' category, does not promote *active* and *wide* exchanges to the extent that those with moderate harmonisation did – possibly due to the increase in diversity of exchanges. A markedly dissimilar harmonic was an indicator for *static-*type relationships.

Dyadic empathy

Moving beyond comparing the direct-perspectives of each actor in the dyad, empathy concerns the ability of one actor to intuit the framing of another. Empathy was a less useful indicator for dyad dynamics than was harmony in this community; the sole clear connection was with low empathy and *narrow, static* relationships.

Dyadic projection

Projection measured the belief by an ego that the alter shared their views. The most relevant finding relating to projection was that *wide, active* dyads often believed themselves to be closer in framing than they were. This can be contrasted with two dyads (3 and 6) that were closer than they believed, tied to notions of 'otherness' in the alter

8.6 Hybrid knowledge creation and the analytical framework

The core research question of this study asks *how are knowledge hybridisation processes shaped in pastoralist development*? These dynamic processes were explored though the use of network and framing data, culminating in the development of the analytical framework proposed in chapter 5.7 that has provided a scaffold with which to explore the factors suggested in 6.6, and manifested in the dyads described in chapter seven.

The results of those analyses are summarised in the sections above. One key finding is that none of these six factors can alone provide a heuristic through which the actor-level steps in knowledge hybridisation processes can be explained. Drawing together all the data gathered throughout this process and building on the specific results in sections 8.3 and 8.4, the initial

analytical framework can be developed to identify characteristic archetypes for each extreme in the quadrants. These four character archetypes are presented below in figure 51.

8.6.1 Knowledge process archetypes

Using the data gathered throughout this study, an archetype of the knowledge processes occurring between actors can be suggested for each of the quadrants. These four aspects of hybrid knowledge creation are termed *communication*, *curation*, *construction* and *creation* to reflect the different roles each set of relationships has on knowledge exchange and shaping processes.

Knowledge dynamics

Static   *Active*

Communication   Construction

Narrow

Knowledge diversity

Curation   Creation

Wide
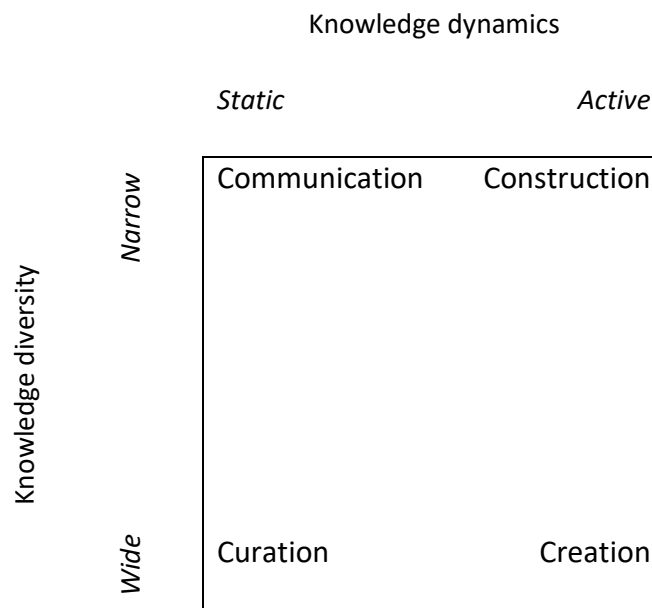
Figure 51: Matrix archetypes

The four cardinal points of the matrix represent four possible types of knowledge exchange and creation. Several of the four do not require or promote the generation of new knowledges – for example communication and curation – but are still relevant when trying to understand processes of hybrid knowledge creation in pastoralist settings. The four archetypes are described in more detail below.

8.6.1.1 Communication

Relationships throughout the network demonstrated exchanges in which neither party influenced or altered the substance of the knowledge in any significant way. The MUB case study (section 5.5.3) contains a prime example of the communication archetype; the diesel engine tuition for pastoralist MUB members by manufacturers provided information with little opportunity for reciprocated exchanges. Pastoralists did not question how to develop or adapt

the technology, neither did the technician seek additional information to help maximise their use of the machine. Looking beyond this example the majority of *communication*-type relationships were associated with patron-client hierarchies, closed 'question-answer' exchanges, or the exchange of focussed facts on specific narrow topics or issues.

8.6.1.2 Curation

The *curation* archetype mirrored knowledge *communication* in many ways through the 'dispensing of wisdom' from one actor to another. The most significant difference between *communication* and *curation* was the breadth and variety of knowledge transferred. *Communicative* relationships revolved around focussed sets of facts, such as project implementation or disease profiles, *curatorial* relationships typically spanned a range of topics such as livestock health, market changes, fodder availability, and grazing conflicts. In this study *curatorial* relationships were commonly embedded in social or cultural hierarchies – the 'wise man' or 'wise woman' of the group. Interestingly, within the Gabra these individuals may have limited personal ownership of the breadth of knowledge shared but are able to access and mobilise wider networks and knowledge reserves. There were significant interactions between *communication* and *curation*, however at their most extreme they showed very different characters.

8.6.1.3 Construction

In both *communication* and *curation*, the flows of knowledge were largely unidirectional and associated with strong hierarchical power dynamics. In the *constructive* relationships flows were far more reciprocal, with actors iterating around shared topics over periods of time. The sharing of multiple knowledges was key to the *constructive* relationship; actors helped to develop and evolve ideas around specific problems or opportunities, commonly limited to a single topic area or field. Examples of these types of relationship include accessing siloed knowledge between NGO staff; VSF-G were the 'go to' people for animal health advice. If SI have a livestock problem they seek out and develop relationships with a 'specialists' such as VSF-G. The same dynamic is observed between livestock brokers and animal transporters, pastoralist elites and technologically literate junior members. The 'co-worker' dynamic found here may have resulted in some new ideas and innovations, but these were commonly located within specific actors rather than shared; one actor will develop their own solutions with the input and help of another. It is interesting to note that although flows are often topic- or task-specific, a common understanding or framing of the issue between dyad members was not imperative.

8.6.1.4 Creation

Creative relationships were in many ways the polar opposites of *communicative* relationships. *Creative* dyads were typified by broad, open, discursive flows of knowledge drawing upon personal experiences and wider networks. Compared to the *constructive* relationship, *creative* dyads exchange significant knowledge breadth; these included NGO groups working on a wide range of topics, or in pastoralist dyads as combinations of personal, economic, cultural, and social conversations. Many *creative* relationships developed shared framings. Anecdotally, in the most *creative* dyads of this study the diversity of understandings between peers may have contributed to the dynamism of the exchanges.

8.6.2 Mapping knowledge processes

The characteristics of these four archetypes can therefore be mapped onto the matrix to provide a more complete heuristic for future discussion and use. This is given below in figure 52 on page 263 that sets out the relationship of each mode of knowledge interaction to one another, highlighting the ability of dyads to move within the space and in relation to one another.

Knowledge dynamics

Static   *Active*

Knowledge diversity

Narrow

Knowledge communication

Information transfer.

Sharing of specific facts.

A question-answer dynamic.

Few, weak bonds

Strong power hierarchies

Dissonant framings with little empathy

Knowledge construction

The development of focussed new knowledge

The iterative development of professional or commercial opportunities

Medium-strong bonds

More equal power structure

Shared framings and degree of empathy and projection

Knowledge curation

The 'wise man/woman'

A general source of wisdom on a range of topics.

Typical of mentoring relationships.

Multiple bonds based in formalised institutions

Asymmetric strength

Variety of framings and empathy values

Knowledge creation

Mutual development of new knowledge

Iterative and discursive approach to problem solving

Strong bonds acting through diverse, less formalised channels

Moderate harmonisation with a high degree of empathy and projection

Establishment of shared framings key to development

Wide

Figure 52: Matrix archetype descriptors

Chapter 9:

Understanding processes of hybrid knowledge creation

9.1 Introduction

This thesis began by suggesting the need for a systematic exploration of the creativity and adaptability of pastoralist and development communities, asking the question *what factors influence innovation in pastoralist areas*? Three key considerations informed the development of this study; a lack of empirical data, the possible inappropriateness of existing methodological tools, and the need to establish a theoretical basis.

In the light of those conditions, a knowledge-based approach was selected to explore innovation in marginal settings, rooted in ideas of innovation as an emergent, dynamic processes of knowledge combination between diverse actors. This recast the initial question as *how are knowledge hybridisation processes shaped in pastoralist development*?

This conceptualisation of innovation stresses the importance of knowledge flows and individual attitudes in shaping the direction and nature of knowledge creation and the consequent innovation. An integrated approach addressing knowledge networks and framings provided the theoretical basis from which methodological and analytical choices were made.

The later chapters of this thesis set out the data gathered using these tools, and presented the analysis using a framework developed specifically for the purpose. This chapter reviews the development of the novel methodological framework, then discusses the study findings to link empirical observations to literature relating to the three sub-questions set out in section 2.11 on networks, framings, and dyads. Bringing these three themes together, this chapter closes by suggesting an answer to the question of how knowledge hybridisation processes are shaped in pastoralist development.

9.2 Concepts and methods for researching hybrid knowledge creation processes

Themes of conflict, collaboration, and complexity permeate this thesis, reflecting re-imagined perspectives on pastoralism and innovation that require researching in new ways. Authors such as Krätli (2016) and Klerkx et al. (2012) have cautioned against the use of established methodologies and conceptualisations in the face of changing theoretical foundations, a suggestion compounded in this study by the limited empirical evidence available and industrial-focussed models of innovation.

This study responded by selecting a conceptualisation of innovation that might reflect the emergent, informal, and complex nature of innovation seen in marginal areas, synthesising network and perception-based lenses to create a novel research strategy for exploring the complex phenomenon of pastoralist innovation.

This chapter reviews the data relating to both networks and framings, then synthesises these in terms of the analytical framework. These results are interpreted in light of wider literature on each subject, concluding with the identification of three key features of knowledge hybridisation processes in pastoralist development.

9.3 The role of networks in pastoralist knowledge creation

The conceptualisation of innovation as processes of actor-level knowledge creation suggests the search for, and access to, knowledge through interpersonal ties could have a significant effect on the creative ability of individuals. In broad terms the findings of this study support this conclusion, echoing work by Galunic and Rodan (1998) and Nahapiet and Ghoshal (1998) who recognised networks as conduits to new knowledges from diverse actors.

Beyond this conceptual similarity, the study data add to work by authors such as Chan and Liebowitz (2005) who suggested that Social Network Analysis (SNA) is an appropriate tool for investigating these knowledge flows, particularly in informal settings. The use of SNA in this research was further informed by work from authors such as Emirbayer and Goodwin (1994) who advised on a focus on relationships concerning categorisations; a judgement supported by the findings of chapter eight around relational importance in pastoralist settings. The discussion in section 7.2 of communities of shared subjectivity cautions researchers against the use of established assumed categorisations in the study of perspectives. This study did however find specific internally-relevant categories such as matrix archetypes (section 8.6) useful for exploring processes of hybrid knowledge creation.

The rest of this section links back to chapter two to review and relate the empirical findings to wider literatures on network topography (specifically clusters and actor positions) and the nature of relationships. As specified in chapter two, the results of this study focus on individual-level exchanges; a discussion of the possible use of these data in organisational-level exchanges is provided in chapter 10.

9.3.1 Network topography

This study chose to represent the complex, layered interrelations between the diverse ranges of actors involved in pastoralist development using a Social Network Analysis approach. This representation of social structures as a set of relationships allows researchers to consider the topography of networks through multiple lenses. In this study empirical data were used, in this way, to consider how groups within the wider system could be located (cluster identification) and how an actor's position related to their ability to transfer and create knowledge (actor position).

9.3.1.1 Cluster identification

The exploratory nature of the study permitted and required an uncommon method of identification and bounding of within-system communities. Conventional inter-organisational or inter-institutional linkages in published network research often use explicit established boundaries between knowledge stocks; this study suggests that in pastoralist and development contexts such assumed boundaries may be inappropriate or even unhelpful for examining knowledge co-creation, as they risk Wellman's 'improper imposition' of delimitations described in section 2.8 (Wellman, 1988, p.26).

From a knowledge perspective, the pastoralist community of North Horr contained multiple networks of varying sizes, bounded by shifting and context-dependent criteria. Networks of cultural institutions overlapped with online forums, development programmes merged into traditional livelihood strategies. The use of a combined normative-realist/relational-attributional approach to cluster identification, proposed by Gillespie and Murty (1991), alongside a modularity-class computational perspective (Muff et al., 2005) enhanced the capture of data concerning multiple overlapping communities within pastoralist systems (Barrett et al., 2001).

The data gathered in this study highlight the importance of recognising overlapping and multi-membership groups as a key to understanding hybrid knowledge creation processes in pastoralist development. Development literature often portrays points of cultural intersection as points of conflict and contestation, narratives that typically imply dissonances and highlight differences (Galvin, 2009, Oba, 2012). The network data gathered for this study suggested a counter-narrative; links between disparate actors, and multi-group membership has highlighted the ways in which human interconnections can find pragmatic ways around abstract notions of 'us' and 'them'. This study observed a blending of artificial network divisions by actors who inhabit multiple identities a la Breiger (1974); examples included NGO

staff who were ethnically Gabra, traditional Gabra operating across virtual forums, and donors who engaged with private sector practices whilst operating as a public body. These examples demonstrate the ways in which studying network and traditional ideas of knowledge sharing can create barriers to understanding that are not experienced in informal settings, enabling transfers and collaborations, where outsiders may see division and obstruction.

9.3.1.2 Actor position

The previous section suggested ways in which the methods of identification of intra-system clusters could shape data analysis, providing examples where multi-group membership influenced processes of knowledge sharing throughout the networks. Multi-group membership of actors provides one means of cross-cluster knowledge transfer; an alternative channel relates to the position of an actor within a wider network to enable or inhibit inter-cluster knowledge flows. Two SNA measures of actor position were considered in this study, centrality and bridging. Empirical observations and related wider literature of both are discussed below.

Centrality

Centrality measures reflect the direct and indirect connections of any one actor to others within the network. Centrality measures of *degree* and *betweenness* were used in multiple parts of this study to identify actors occupying key positions within networks; positions that have been suggested by SNA scholars as conferring greater potential for knowledge creation (Burt, 2004, Ebadi and Utterback, 1984).

Much of the data gathered on centrality contributed to the creation of the analytical framework and associated archetypes set out in section 8.6. The diversity and dynamics of links speak to work by authors such as Singh (2005) who suggested that direct links may enhance the frequency and fidelity of information between actors. The data collected in this research highlight the need for clarity when using the terms 'frequency' and 'fidelity'; for example, frequency was less important for curation and communication archetypes, whereas fidelity may matter less for co-creation.

Singh's premise was based on work that suggested social cohesion (the number, length, and strength of paths) placed well-connected actors at central points of exchange, which allowed access to more timely, richer, and more diverse knowledge flows (Burt, 2004, Ebadi and Utterback, 1984). This was developed further by Perry-Smith (2006) who suggested peripheral bridging actors could be unencumbered by constraining influences. Observations from this study question some of these expectations in this particular pastoralist context. Due to the processes of dyad selection, many of the dyads contained actors with high centrality values.

From the outcomes of the dyadic analysis and knowledge creation framework in chapters seven and eight it was possible to suggest that centrality alone is not enough to link increased knowledge diversity with creation. In the informal networks reported here, an actor's possession of multiple knowledge linkages, reflected in measures of centrality, did not equate with knowledge access.

Beyond the centrality of an actor through relationships, this data also highlights the shifting centralities of actors by membership. By exposing the multiple and interrelated networks, the peripheral (in Perry-Smith's terms) nature of each actor can be questioned; a key consideration in future studies of knowledge creation, where actors may be members of multiple communities, is to ask, 'peripheral to what'? Through processes of inclusion or exclusion of network and actor data, researchers may unknowingly create peripheries by overlooking informal communities that have efficient and effective knowledge sharing capacities.

Bridging

Much of the literature in SNA relating to bridging revolves around two interlinked observations. Firstly, that higher network density increased opportunities for learning and transfer (Morgan and Soerensen, 1999, Reagans and McEvily, 2003); secondly, that a lack of linkages – structural holes – promote individual knowledge creation (Burt, 2004, Fleming et al., 2007, McFadyen et al., 2009). This established a theoretical dichotomy that structural holes promote creativity (McFadyen et al., 2009, Burt, 1992), but that increased tie strength (closely linked to a lack of structural holes) also promoted knowledge development (Granovetter, 1983, Louch, 2000).

The findings of this study speak to this debate by suggesting that in some cases density of linkages may be beneficial for creation and sharing (as with MUB groups or *barazzas*), and other cases structural holes may promote closer, stronger linkages as with the DVO and AHA, or with SIPS1. The variety of effects of density and structural holes on the context of knowledge creation is supported by wider literature (Morrison, 2002, Morgan and Soerensen, 1999) and echoed by Adler and Kwon (2002) who suggest that there was no single universal 'most-suitable' network form for innovation. As with all of the cases examined in this study, the inherent complexity of the phenomena makes this suggestion unsurprising.

9.3.2 Relationship nature

The section above suggests how network topography may influence knowledge sharing and creation through the identification of clusters and the position of individual actors. These

represent two aspects of the wider network; beyond structures, the substance of relationships also requires attention. Much of the work from SNA studies on relationship nature and knowledge transfer relates to how stronger ties (variously defined) can increase the transmission of complex and tacit knowledges (Centola and Macy, 2007, Reagans and McEvily, 2003) whereas weak ties are suggested as preferable when seeking knowledge diversity (Granovetter, 1983). This section draws on the empirical data collected to discuss these positions for pastoralist knowledge creation, and relates them to wider social dynamics and direct relationship strength

Social relationships

The pastoralist-development networks mapped in chapter five contain multiple clusters, cultures, and communities. Many of these sub-groups contain formal and informal hierarchies that were uncovered in the data collection process; these hierarchies often followed observations by Black et al. (2004) and Thomas-Hunt et al. (2003) who describe how knowledge sharing 'up' hierarchies is often desired by lower-status actors, and rejected by higher-status actors. This process is most evident in the *communication* archetype of the framework (section 8.6), for example with the DVO and CHR. Data on dyads such as SIPS1-AV1 and DVO-AHA provide an interesting counterpoint to this model of hierarchical flow surrounding the ability of a social tie to mitigate power imbalances, and the power of patronage to provide a status-boost in group discussions. These issues are considered further in chapter ten.

The increased knowledge transfer seen in these and other dyads in the *creative* archetype may have multiple contributing factors; all of these cases follow observations in established literature on the role of trust and respect (Allen and Eby, 2003), collaboration experience (Reagans and McEvily, 2003), and adaptable communication methods (Wang et al., 2009) in promoting knowledge transfer.

Relationship strength

Many of the measures and effects of relationship strength on knowledge sharing in the wider literature can also be found in this study's data. Improved knowledge transfers seen with strong ties (Lin, 1999) are linked to high frequency exchanges (Marsden and Campbell, 1984), an observation echoed in the dynamic scale of the framework from section 5.7. Self-attributed values of strength in this study did seem to provide a good proxy for the more quantitative observations used in much SNA literature; the granularity of the data on strength asymmetry in shaping knowledge creation does provide some useful insight to existing theory. Studies of

the effects of perceived strength asymmetries are rare, however literature on reciprocity and transaction-cost judgements by Appleyard (1996) and Kachra and White (2008) support the findings that mutually strong relationships are more likely to pursue effective and affective knowledge exchange. Bilaterally weak relationships, commonly found in the *communication* quadrant, had limited degrees of effective transfer; Jarvenpaa and Majchrzak (2008) suggest this may be a reflection of distrust. This study did not collect enough evidence to support or deny such a position, however the observation in the same paper that a distrustful relationship promoted the search for alternative sources of knowledge has echoes in CDR-P4 and CDR-DVO dyads.

9.3.3 The role of networks in processes of knowledge creation

The review and discussion above suggest that networks can influence knowledge creation in pastoralist settings, and that SNA is an appropriate tool for their exploration. This study's data supported many observations from wider network literature; where differences occur it is often possible to find alternative interpretations in literature to explain the observations.

This data further suggests a need to recognise nuance, diversity, and flexibility in the analysis of pastoralist networks. As mentioned earlier, actors in these settings can be members of multiple groups which may have profound implications for knowledge transfer and individual-institution relationships. Multi-group membership can be tied to the bypassing or mitigating of hierarchies and power structures at an individual level; again, how this relates to knowledge transfer and creation is unclear at this stage. Lastly with the granularity with which this research studied relationships, questions of asymmetry in relationship strength (and in the next section, perceptions) begin to be uncovered. These features are developed further in the wider discussions contained in chapter ten.

9.4 The influence of framings on pastoralist knowledge creation

This study proposed to use actor perceptions as a lens to explore the contexts in which knowledge creation occurred. The use of a framings-based approach was selected as a relational method to overcome the lack of cultural relevance and comparative ability common to traditional attitudinal studies, and to capture the creative development of individual perceptions in a social context (Snow and Benford, 1992).The benefit of a framings lens was in part the ability to evaluate interactions between different framings within, and across cultures

(Johnston and Klandermans, 1995, Sniderman and Theriault, 2004), particularly when combined with a SECI model of knowledge creation (Nonaka and Toyama, 2003). These evaluations were linked to theoretical understandings of how frames shaped individual (frame effects) and relational (intersubjective) actions as well as attitudes. The findings of this study are discussed below, firstly in relation to methodological observations, then to specific aspects of frame effects and intersubjectivity.

9.4.1 The use of framings in pastoralist research

In this study frames were used to uncover specific attitudes towards the relational context surrounding knowledge exchange (Entman, 2004). The use of the relationship as a common conceptual anchor between individuals provided a novel boundary object that produced suitable data for within dyad comparative analysis (Carlile, 2002). The idea of a common relational object was more problematic when discussing more abstract topics such as innovation as part of the Thematic Analysis and Q-methodology section due to a requirement to identify "*culturally available frames*" (Chong and Druckman, 2007, p.107).

Part of the data analysis discussed in section 9.3 suggests that actors could be involved in multiple networks, and inhabit multiple cultures at any one time. Given the suggestion of a dynamic reciprocal relationship between culture and knowledge (Jasanoff, 2004), the search for Chong and Druckman's 'cultural frames' becomes more complex still. A key wexample of this relates to the framing spectra used in this study. These spectra reflect the plural and competing nature of frames within individuals; few studies exist addressing how individuals internally rectify multiple competing frames to produce spectra (Sniderman and Theriault, 2004).

9.4.2 Frame effects and individual action

One section of the data gathered for the dyadic analysis in section 8.4 explored how specific framings may have been related to processes of knowledge creation. Comparing the three core framings – uncertainty, connectedness, and modernity (see section 6.4) – broad trends in knowledge creation could be observed. Dyads who preferenced the connected framing of innovation were typified by higher diversity exchanges whereas modern framings were closely linked to more active dynamics. The influence of both framings was less than the association of the uncertainty framing with narrow, static exchanges. Interestingly, in dyads where both actors had different framings, a static model of exchange was most likely. On the contrary, actors that had closely aligned framings were less represented in active, wide exchanges than

those with slightly differing perceptions; this may be linked to notions of diversity as a promotor of innovation (see, for example, Perry-Smith, 2006) discussed in the network results.

The variety of ways in which framings shaped knowledge processes above and in chapter eight, supports the view of frame effects as operating on both conscious (Eagly and Chaiken, 1998) and unconscious (Higgins, 1996) levels. Examining interviews that deal with the more unconscious understandings of key terms, many of the relationships within this study exhibited different, if not disconnected, meanings on topics surrounding innovation. For example, *daimtu* meant little to NGO actors and was not referenced, whereas donor accountability was largely unfamiliar topic to herders. These forms of inherent, subconscious cultural knowledge were demonstrated in the use of language and in participation in the research exercises. It seems reasonable to suggest that the disconnect caused by unfamiliar terms and concepts may have shaped different actor responses.

These semantic moderators acted through cultural and system norms. The influence of personal values and predispositions was also observed throughout the system between individuals inhabiting common cultures and possessing similar framings, who acted in widely differing ways. For example, Nairobi-based NGO respondents shared both organisational affiliation and framings but acted on shared attitudes in different ways. This effect was observed especially keenly in the more traditionalist cultural networks, for example in the well desilting case where shared perspectives were linked to widely differing actions, and vice-versa.

9.4.3 Intersubjectivity and the role of dyad perception

Intersubjectivity was used as a theoretical basis for explaining how the actors' perceptions of their dyadic partner may shape knowledge flows. The practical approach to using intersubjectivity was introduced in section 6.6 when suggesting factors for use in the analytical framework; the data relating to this framework was presented in chapter eight, specifically relating to observations on dyadic empathy and projection.

Intersubjectivity is often seen as a measure of 'social sensitivity' (Gage and Cronbach, 1955); the measurement and analysis of empathy in section 8.4 provides a novel insight into this approach. Specifically discussing the results of this study, the ability to intuit the framing of another was linked less strongly to knowledge creation than other measures such as harmony, an observation that supports work by authors such as Black et al. (2004) who suggest that a lack of understanding of an alter may limit a desire to engage with them. This lack of

understanding did seem to be a predictor for less diverse and dynamic relationships using the analytical framework.

9.4.4 The role of framing in processes of knowledge creation

The framing data presented in chapters six and eight suggests a range of perceptions of innovation, and recognises the nature of multiple, sometimes conflicting perspectives within each actor. The methods used to capture framings, Thematic Analysis, Q-methodology, and Participatory Frame Building, provided suitable data for integration into the analytical framework and investigation using theories of intersubjectivity and frame effects to explain many observed behaviours.

Using these data and techniques, it is possible to suggest multiple ways in which framings may influence processes of knowledge creation. Many of the observations point to a need to understand framings in relational terms; the possession of a specific framing spectra can influence knowledge sharing, but significant insight can be gained by examining interactions (both conscious and unconscious) between ego framings and alter, or between believed-alter (direct- and meta-perspectives).

In this study perceptions were used to evaluate the unique contexts in which knowledge creation was occurring (Meusburger et al., 2016). Part of this uniqueness is reflected in asymmetries in relationships and perceptions; the importance of interactions between differing perceptions follows suggestions on knowledge creation by Nonaka and Toyama (2003), discussed in section 2.6. The importance of understating relational perspectives, and specifically perspective asymmetry, links to many of the themes identified in the network data. These two paired aspects were synthesised using the analytical framework and are discussed next.

9.5 Using a framework to explore processes of hybrid knowledge creation

The sections on networks and framings above detail two key aspects of innovation as a process of hybrid knowledge creation. The data demonstrates an emergent common ground between networks and framings, synthesised through the analytical frameworks developed in section 5.7. Multiple observations can be made from the framework data, but the final chapters of this thesis stress the value of the heuristic presented in section 8.6. What this matrix shows is that knowledge creation and innovation are complex events, even under specific contexts.

Knowledge transfer and creation are non-binary processes as illustrated using variable scales for mapping dyad position. Communication, curation, construction, and creation are all important aspects of innovation for pastoralist development.

Whilst acknowledging this complexity it is important retain a focus of this research on understanding innovation as a process of hybrid knowledge creation. Bringing together all the theoretical and empirical discussion, this study suggests three core themes that in reply to the question *what factors influence innovation in pastoralist areas*? Innovation in pastoralist areas is relational and contextual, asymmetric, and emergent. These three findings are discussed in more detail below.

9.5.1 Pastoralist innovation is relational and contextual

Throughout this thesis, allusions were found in literature and respondents' speech to notions of immaculate innovation; new processes or technologies that somehow spring fully-formed from the mind of genius inventors. The data gathered here suggests that the processes of innovation, in pastoralist contexts, is far more complex and contested. Innovation contains aspects of experimentation, failure, rejection, misappropriation, reframing, and possibly even luck that chart a winding and unsteady course. This course is driven by contexts, real and imagined, that shape processes of knowledge sharing and knowledge creation. These relational sites of creation exist in unique contexts between individuals and institutions. Innovations may be enabled or inhibited in their progress along multiple evolutionary pathways; for example, perceptions of donors and governments by development actors can shape or freeze innovative programming, this medusan gaze petrifies evolutionary innovation processes through a belief in a donor requirement for structured evaluations and impacts, tied to narratives of funding and best practice.

One way of unfreezing this process is to set aside the search for products of innovation and look instead for acts of innovation. By recasting the innovation debate as one of individual level knowledge creation as opposed to artefact- or process-use, the suitability of current tools and theories to explore innovation in pastoralist areas can be more effectively questioned (Krätli, 2016). Understanding innovation as a series of micro-contexts and exchanges offers a new insight for development groups that will require careful consideration to engage with; some suggestions are given in chapter ten.

9.5.2 Pastoralist innovation embraces asymmetry

The previous section suggests pastoralist innovation as a relational, ongoing, and emergent process between different groups. The actors in this study were drawn from heterogenous backgrounds (see chapter four), reflected in the diversity and asymmetry of dyads. The data gathered in this study suggests multiple ways in which these different asymmetries can contribute towards acts of knowledge creation.

Asymmetry suggests positions of similarity and difference; the creation of lines of demarcation. The crossing of boundaries has been linked to acts of knowledge creation (Carlile, 2002, Bechky, 2006, Parjanen, 2012), developed in the theories of Nonaka and Toyama (2003), and the social, cultural, and ethnic asymmetries of Meusburger et al. (2016). These authors, reviewed in earlier chapters, all point to the positive role that asymmetries can have in developing hybrid knowledge. The data gathered in this study supports the position that negotiating asymmetries in framings knowledge stocks can have creation-enabling properties; these results offer further insight into other aspects of asymmetry which receive less attention in wider literature.

Along with the creative aspects of asymmetry, this study also located inhibitory examples whereby real or perceived power or cultural differences limited knowledge exchanges to communication archetype (or in some instances curation or construction). The framework analysis suggests that certain types of bonds, such as social linkages, have the potential to mitigate these imbalances, shifting an inhibitory asymmetry towards a creative one. These notions are discussed further in the following chapter, including the potential costs of not engaging with asymmetry.

9.5.3 Pastoralist innovation is dynamic and emergent

The previous two sections identify the interconnected and asymmetric nature of pastoralist innovation processes, processes that form interconnected chains of new knowledges, shaped by actor-level micro-contexts. In understanding processes of pastoralist innovation this way, it is important not to overlook the ways in which context can shape dynamic and emergent knowledge creation but to recognise the ways in which knowledge creation may also shape social, cultural, and knowledge contexts. The interrelated nature of context and knowledge creation, and the ways that knowledge also contributes to context can be seen throughout the study. From the development of a virtual forum for the Alganna age set, to the use of ethnicity

to access NGO resources, the work of authors such as Jasanoff (2004) highlight the complexity and interrelated nature of knowledge creation, context, and culture.

9.6 Conclusion

This study combined framing and network approaches to suggest pastoralist innovation as a complex, relational processes of hybrid knowledge creation, shaped by actor asymmetries. Much of the complexity surrounding the process of creation stems from the interrelations between the context of creation and the individuals involved; for knowledge hybridisation to occur one should not be considered without the other. The following chapter discusses the relational, asymmetric, and dynamic nature of pastoralist innovation in the light of wider literature on these topics, acknowledging the limitations of this study and identifying opportunities for further work.

Chapter 10:

Implications for innovation in pastoralist areas

10.1 Introduction

The closing sections of the last chapter brought together the various threads woven throughout this thesis to populate the dynamic-diversity matrix with knowledge creation archetypes, and to suggest a set of three core observations for innovation in pastoralist development; the importance of relationships and context, the role of asymmetry, and the dynamic and emergent nature of the processes. These characterisations and themes can speak to wider debates within, and outside, development settings. This chapter builds on these three conclusions to suggest links with wider academic debates that are set against some of the limitations of the study when making direct comparisons. The chapter closes with a forward-looking discussion of possible future routes of enquiry that build on the foundations identified in this research.

10.2 Parallels and links: Informal innovation and a history of participation

This thesis rooted itself in an open and emergent exploration of innovation and knowledge creation processes in pastoralist development. These processes have been distilled to form the typologies that populate the matrix given in section 8.6; typologies that use deliberate language to illustrate common threads and differences than run between and across them. Many aspects of this language and these characters are not new to development debates, most obviously links can be found between the description of the Creation quadrant and debates surrounding Participatory Development from the 1980s and 90s. It is therefore worth reflecting at this stage what parallels may be drawn between this study and wider debates on Participation, and to look at how the challenges faced by the Participatory movement may be reflected in attempts to better engage with informal types of pastoralist innovation.

The origins of the participatory movement were discussed earlier in specific relation to Participatory Epidemiology, however the opportunities and challenges to the use of effective participation to create a more inclusive, longer lasting, and more just development culture remain to this day. One of the more strident critiques of participatory methods was proposed by Cooke and Kothari (2001) in their text *Participation: the new tyranny?* which suggested (amongst other things) that participatory approaches overlooked the existing power structures, enabling elite capture of development processes. Responding to these criticisms authors increasingly highlighted emerging forms of participatory tokenism, whereby

participation by local groups was claimed to be central, but the true ethos of the participatory approach – the abdication of power and opening of minds – was absent (Anderson et al., 2012). Increasingly scholars and practitioners alike are becoming more vocal about the embedded misuse and misapplication of participatory approaches, with discussion of the role of development institutions in participation now featuring in donor literature and NGO briefs (Thomas, 2013). These new critiques form a useful framework to evaluate potential links, and impediments, between the matrix typologies developed in this research and wider development debates. Key themes included for discussion here are the role of administrative structures of development and access to the poor, research and evaluation, local expertise and capacity building, and inequality (adapted from Thomas, 2013).

10.2.1 Administrative structures and access to the poor

As mentioned above, in recent years donors have demonstrated an increasing interest in participation as an aspect of development programming. Despite this shift in focus, many authors suggest that existing bureaucratic and administrative structures within donor and partner organisations remain best suited to top-down linear models of development (Asmorowati, 2011). These administrative structures and patterns of working are further reflected outside of individual organisations; as a collective NGOs and donors may inadvertently act to block participation by local communities and governments by failing to relinquish control of programming (McPeak et al., 2013). These macro-institutions of development, interconnected partnerships between donors, NGO partners, and governments can also promote participation through the development of linkages and trust that is required for effective engagement of the poor.

These conflicting results highlight the ways in which individual and organisational networks can act to reinforce or undermine participatory effort in much the same way as can be seen in the matrix typologies. Refocussing our gaze into local contexts it is possible to observe how trust-filled relationships may promote more diverse and dynamic exchanges a la *creation*, whereas linkages built on enforced proximities that mirror linear and top-down program design (*communication*) may find it harder to develop reciprocity. Similarly, the persistence of institutional structures and perceived hierarchies can act to close down discussion and debate as seen in the *curation* type, blocking access to the knowledge and input of non-favoured actors in the dyads. This is mirrored by macro-level work that recognises that elites within communities may also provide barriers to accessing poorer or less disenfranchised members of

that society (Thomas, 2013); a feature that must be closely watched for when considering innovation from, and for, whom.

10.2.2 Research and evaluation

Much of the current debate surrounding participatory research and evaluation focuses on the mutual construction of research agendas and priorities (Stoecker, 2018). Many criticisms of the use of participatory research in development stem from the short-term nature of project-based interventions, overlooking the time-consuming nature of long-term development change. Examining the matrix typologies proposed here it is possible to suggest that informal pastoralist innovation offers an alternative perspective on this problem. Rather than considering how participatory research for specific problems or projects requires relationship building, informal innovation could suggest that relationships are placed first, then research agendas and plans developed in an emergent fashion. This position runs directly contrary to orthodox development methods where projects are often considered as stand-alone 'deliverables', moving onto another new theme once the old is completed. This approach can undermine nascent relationships that could lead to long-term knowledge exchanges, the matrix typologies highlight the importance of developing trust and insight not possible through short term interventions.

10.2.3 Local expertise and capacity building

Participatory approaches are often suggested as one method by which external development actors can link with Indigenous Knowledge (IK); a link which has often associated criticisms of one with the other (Cooke and Kothari, 2001, Mosse, 2005). Many of the narratives surrounding IK suggest forms of engagement that occasionally veer into the harvesting of local knowledge by external actors, which in turn is repackaged under the label of innovation. The matrix typologies may help throw light on the occasions where this is happening; by considering the diversity and dynamics of exchanges, it may be possible to demonstrate differences between tokenistic consultation (as with *communication*) and meaningful participation (more typified in *creative* relationships). The value of this approach may be seen where more subtle or inadvertent mechanisms act to undermine the participatory research process. Specifically, instances of this undermining can include the development communities' preferencing of Western knowledges over local technical capacities and supporting a lack of access to political representation; both issues that can disengage local capabilities and skills from development processes.

10.2.4 Inequality

Participation has a mixed record of engagement with marginalised groups, be they excluded by gender, income, or other characteristic (Mayoux, 1995). Even in at the height of participatory development, authors found it necessary to caution that including minority groups in the process did not guarantee that these voices would be heard. This has led to a redoubling of efforts to find ways to engage these minority groups, including a widening of community reach (e.g. to engage children and disabled people in participatory processes) and to search for new tools to facilitate this engagement (e.g. participatory video) (Plush, 2013). Criticisms of a blindness to minority groups may be fairly made against this study; as discussed earlier in this thesis a decision was made to focus on actors who were able to cross cultural barriers rather than those who were excluded. This does not mean however that this study cannot speak to those debates. What the matrix typologies do is suggest a framework for exploring the different types of knowledge-exchange relationships that may be found within marginal populations; typologies that may be applied to different populations and communities. By expanding this project further and mapping knowledge exchange networks within poor and excluded populations it may be possible to use the matrix to identify how and why access is denied to alternative knowledge sources, and to locate alternative channels that work around such impediments.

10.3 Moving beyond the margins: informal processes of hybrid knowledge creation

10.3.1 Exploring relationships and contexts

The findings of this study highlighted the relational, contextual nature of knowledge creation processes. The most obvious literature on which to draw here is SNA and associated studies of innovation. One significant concept that this study did not directly engage with are ideas of innovation diffusion; significant literature exists to suggest multiple strong ties to prior innovation adopters promote adoption by individuals (Strang and Tuma, 1993) and that larger networks enabled swifter information sharing (Morrison, 2002). This study did consider factors such as tie strength and network size, however the role of diffusers was not specifically examined. It can be suggested that communication-type relationships in section 8.6 could act as channels of diffusion, but many dyads in this quarter either did not demonstrate the presence of strong ties, suggested by Strang and Tuma (1993) as necessary for diffusion, or the strength was low-to-high status, which Thomas-Hunt et al. (2003) and Black et al. (2004)

suggest as not conducive to diffusion. The most likely position seems to be that diffusion occurs in the other three quarters (curation, construction, and creation) but to different extents and in differing ways. What this could suggest is that much diffusion (as defined in SNA terms) could actually be considered as an act of micro-creation through the eyes of Nonaka and Toyama (2003), whereby the barriers crossed in diffusion act to shape the knowledge itself, rather than transfer with fidelity.

This interrelated model of creation and diffusion raise further questions around the centrality of actors within a network. Much of the literature on high-centrality positions suggests that innovators possess positions of certainty and trust (Nerkar and Paruchuri, 2005), with greater power to influence others (Burt, 1982) and to promote the adoption of innovations (Ibarra, 1993). North Horr provides a useful counterpoint to the (normally industrialised) contexts of these studies. Within this study, by identifying the diversity and dynamics of knowledge flows and identifying sub-networks, conventionally 'central' actors can be shifted to 'the periphery' by changing the relational perspective and network construction. This observation may explain in part how the 'innovation' of PDS failed to replace traditional disease reporting channels; within an NGO-network the CDR is a central figure, through a cultural lens he became a bit-part in a wider knowledge exchange network.

The movement of actors from centres to the periphery may be both an artefact of an SNA approach, and an aspect of the conceptualisation of an innovation system in general. The example above shows how an actor may be central in a PDS sub-network, but peripheral to cultural, social, technical, and professional networks to name but a few. Without a tightly defined research question and system, researchers may begin to doubt measures of centrality through questions such as which network, or what system? Much of the network literature 'black boxes' questions of multi-network membership that would expose issues of trust, power, and agency in knowledge creation (see, for example, Burkhardt and Brass, 1990). The question therefore remains of how best to explore contexts of knowledge creation in pastoralist settings.

Conventional measures of time, space (Hayek, 1945) and action (Suchman, 1987) used to define contexts of knowledge creation can fail to fully capture the social and cultural 'streams of meaning' that accompany contexts of knowledge creation (Bohm, 1996). Many theorists have tried to identify suitable ways for bounding these complex interplays of context and creation, most notably associated with communities of practice (Lave and Wenger, 1991). Communities of practice reference communications between task, culture, and history, but in

the case of pastoralist innovation this paradigm does not, and cannot, account for the rapid unfolding and interconnection of multiple communities necessary to trace emergent processes between cultures. Instead this study suggests that for the pastoralist setting future studies draw on the work of Nonaka and the development of 'ba'. Ba (Nonaka 2003) describes a fluctuant, evolving context that serves as a site, action, and community for knowledge creation. Ba is by necessity evolutionary, including those that need including, and redefining boundaries of the creative space as required. For the study of pastoralist innovation in particular Nonaka's suggestion of plural interacting and overlapping 'bas' may be relevant for the multiple interacting sub-networks of this study.

10.3.2 Embracing asymmetry over heterogeneity

The section above identified the importance of relationships and context for knowledge and suggested the use of alternative conceptual definitions such as ba as tools for future explorations of the phenomena of pastoralist innovation. This study suggests that the relational nature and contextual setting of knowledge creation shape knowledge creation between individuals in pastoralist development. It is important however to question how any research identifies and explores relationships and context through the pragmatic use of categorisations.

Suggested early on in this thesis, the use of categorisations has been problematic in pastoralist development, with inappropriate homogenisation leading to conscious and unconscious harm (Little et al., 2008). Starting out by trying to identify heterogeneity, throughout the course of this thesis the study moved towards recasting this as notion of asymmetry. These semantic differences are important; heterogeneity is associated through multiple disciplines with notions of diversity of character and incommensurability. Asymmetry on the other hand assumes commensurability but a lack of equality or equivalence. This notion of a variant sameness is useful for highlighting the common ground between actors in pastoralist innovations, rather than rushing to subdivide and isolate.

Notions of commonality and difference are important to this study. Developing the ideas of informal multi-group memberships suggested earlier this section explores the effect of hidden commonalities as well as overt differences between actors. Authors such as Wellman (1982) and Alba and Kadushin (1976) note increased knowledge sharing and creation between individuals who shared social groups and, or, emotional support. Reviewing literature from SNA, it is often hard to find reference to the role of informal shared identities; it may suggested that a genuine lack of commonality between two actors across all fields – a true

heterogeneity – may lead to the creation of "*ontological ills and fallacies*" (Nonaka and Toyama, 2003, p.3). Whilst this study cannot support this claim with empirical certainty, it does not seem unreasonable to suggest links between a lack of shared context and the deliberate or accidental generation of harmful narratives visited upon pastoralist communities in the past that were set out in chapter two.

This suggests ideas of asymmetry may be of use for prompting the consideration of shared ground between different communities, whilst acknowledging the variance between actors. The conceptualisation of knowledge creation suggested by Nonaka and Toyama (2003) used in this study embraces asymmetry, suggesting that the synthesis of contradictions is central to building creative processes (Nonaka and Toyama, 2003). This position conflicts some other SNA literatures on knowledge creation on strength and framing asymmetries. Friedkin (1980) suggests that strong ties could be identified by a symmetrical 'mutual recognition', implying that non-mutual (asymmetric) ties were somehow weaker. Asymmetries in relationship strength have been further suggested as being markedly deleterious for knowledge creation (Swann, 1984) as fundamentally strong relationships are seen as linked to trust and reciprocity which increases expectations of cooperation and limits opportunism (Bouty, 2000, Levin and Cross, 2004, Uzzi and Lancaster, 2003). The positive value of a simultaneously strong relationship for knowledge creation is well documented; however hierarchical asymmetries are more complex. The lower-status push and higher-status rejection model outlined earlier was found to exist in this study (Black et al., 2004, Thomas-Hunt et al., 2003), but not uniformly or consistently applied.

In this study, moderate (not strong) framing asymmetries were more likely creative; one answer may be that power asymmetries moderate the trust, respect, and expectations of alters and egos (Dwyer and Walker Jr, 1981). This could explain how socially-connected actors overcame existing hierarchies such as the DVO-AHA dyad. An alternative view could be in the very notion of 'trust' and 'respect' itself. Trust and respect have a long history in literature on intersubjectivity (Gillespie, 2007, Seemann, 2009), but much debate surrounds how these terms can be culturally rooted (Correa-Chávez and Roberts, 2012). In their work, Correa-Chávez and Roberts (2012) suggest that *respeto*, translated into English as 'respect', refers in that study to a culturally-relevant mutual consideration of wants and needs based on community-led understandings. Whilst this can be considered an academic, semantic difference, if it truly does reflect a different cultural form and valuing of empathy, then this may explain differences in the response to asymmetries of framing and power that reflect different understandings between pastoralist and development actors.

10.3.3 Dynamism and emergence as deliberate shaping or evolutionary change

This study highlights the role of context and contradiction, but neither of these aspects of pastoralist innovation alone capture the dynamic and evolutionary nature of the processes itself. Relationships exist between combinations of actors and institutions - the context - all of which are shaped and reshaped by the ongoing processes of knowledge creation. These elements can be considered in states of ongoing evolution, shaped deliberate or unconscious processes. In engaging with questions of knowledge creation in pastoralist development, it is important to consider the effects of this relationship.

Processes of system co-creation may be non-deliberate, emergent and reactive; STS literature provides many examples of the evolutionary interconnectedness of knowledge and culture (Jasanoff, 2004). These processes are not however always unguided. Actors who create knowledge across cultures may leverage inferred respect and prestige (Brass and Burkhardt, 1993, Thye, 2000), traits which enable the actor to influence the shaping of possible futures. Some actors may choose to attempt to maintain social order (Wilkin, 1997). Others may attempt to destabilise incumbent institutions through "*net-like organisations"* of informal power (Foucault, 1980, p.98). This suggests that for pastoralist innovation it may be worth recasting the adage 'knowledge is power' not as much as "*pouvoir-savoir*" (power-knowledge) (Foucault, 1980), but as "*no power without knowledge, no knowledge without power*" (Meusburger, 2015, p.19, quoting Kammler et al. 2008). Put another way, considering the deliberate reshaping of knowledge creation contexts, the exercise of power itself could generate knowledge, and that the deployment of knowledge may coincide with effects of power. Regardless of how the relationship is conceptualised, suggestions by authors such as Nietzsche (1968) and Foucault (1979) agree that "*power releases energies, creates, invents, generates*" (Meusburger, 2015, p.31); this creative energy goes hand in glove with the generation of knowledge and the shaping pastoralist innovation processes.

10.4 Considerations and limitations

The previous section built upon the findings of the study to suggest links between the empirical observations and wider theoretical literature. The process of collecting and analysing data in complex situations and on subjective themes introduces multiple possibilities for interpretive difference; a variability that could have implications for engagement with wider

debate. This section sets out a series of practical, methodological, and theoretical limitations that were considered whilst discussing the wider applicability of the study results.

10.4.1 Practical limitations

The two primary practical limitations faced by the study relate to researcher position and population access. The origins and impacts of these are considered here.

10.4.1.1 Researcher position

This research deals in depth with subjectivity and opinion, qualitative factors rooted in unique contexts. The researcher's position as a non-native speaker, white, British, male veterinarian was a source of potential bias (Chenail, 2011). These positions may have influenced respondents' replies, despite the use of translators, open-ended questions, and exploratory techniques (Sofaer, 2002). Of note was the use of the researcher's previous job as a veterinarian to provide access.

Throughout their recent history, the Gabra had been the subject of multiple reviews and assessments by development groups resulting in little perceptible change. Initial approaches to the community were often met by feelings of apathy and indifference, potential symptoms of *"research fatigue"* (Clark, 2008). After engaging in conversation, the researcher's 'day job' as a veterinary surgeon often surfaced, commonly leading to a perceptible switch in attitude by most respondents. Among NGO actors this was most commonly observed as a relaxing of conversational norms as the interviewer fell into a familiar category of expertise, while recognising that the researcher was from outside the organisation. Among Gabra actors there was little attempt to curry favour for information or resources, instead the conversational tone switched from a non-specific friendly distance to one surrounding the value of animals and pride in husbandry. It could be suggested that these new relationship forms shifted the researcher towards a dual 'insider-outsider status' (Mehra, 2002, Unluer, 2012, Adler and Adler, 1994), the implications of which are discussed below.

Researching from this marginal position provided advantage and disadvantage. Specifically for this study, it was possible to gain a limited insight into the 'foot in both camps' existence of many of the actors such as the Gabra-NGO linked SIPS1, or the community-government AHA. Bonner and Tolhurst (2002) suggested that the key benefits of being an 'insider' were understanding the culture, not interrupting social flows, and the possession of an intimacy that allowed truth-judging. None of these were particularly evident during the study; the 'insider-ness' in many ways provided more of a familiarising interpretive 'hook' to put respondents at

ease, rather than a unique position of insight. The contrary disadvantages however were felt less, without cultural familiarity it was easier to retain objectivity, and with limited knowledge it was possible to question assumptions commonly made by insider researchers (DeLyser, 2001).

10.4.1.2 Population access

The study explored interactions between multiple actors and groups at a variety of levels, drawing in where possible views and attitudes from the extremes of the network. Whilst efforts were made to capture as many perspectives and voices as possible, the data analysis and review highlighted several key omissions from the population.

One of the most conspicuous omissions were Government and alternative macro-level donors. NGO staff suggested that the assumed agendas of donors and governments were significant influences shaping innovation choices. It was impossible to capture all these individual influences during the course of the study; many requests for interviews were declined, or time and resources were insufficient to allow data collection of sufficient depth to be included in the research. These limitations do not preclude the ability to reliably discuss the influence of non-surveyed organisations; the key feature of those relationships was the belief by actors concerning the way in which macro-level groups acted.

 This research chose, early on, to focus on innovators that walked a path between institutions. Macro-level influences on development thinking by governments and donors could be considered to have been part of the 'institution of development' in Northern Kenya. Of note was the problem trying to engage with traditional female respondents. From previous work in the area, Gabra women were known just to engage in women-only networks of resource exchange. Female community members fulfil specific cultural and community roles that were not captured by this study, largely due to cultural prohibitions on male outsiders interviewing them. Despite the issue of female translators, this study was unable to record the depth and nuance of data required. Consequently, women engaged with the study only in so far as they were members of formal VICOBA groups, or as gender-incidental innovators. 'Female innovation' undoubtable exists; respondents referred to multiple all-women WhatsApp groups that dealt with issues such as education and female genital mutilation (FGM). To further explore the nature of innovation in Gabra society it would have be necessary for some of the research to be conducted by a woman.

10.4.2 Methodological limitations

The methodological approaches used in this study inevitably have both specific limitations that relate to the research topic, and more general limitations linked to qualitative methodologies in general.

10.4.2.1 Topic-specific methodological limitations

This study's use of a traditional network model as connections of nodes and edges (Wasserman and Faust, 1994) seemed appropriate for the study of marginal and informal networks. Two significant limitations were present to the use of networks in this research. Firstly, considerations of bounding. The decision to include or exclude actors in a network is highly dependent upon the research question. In this study, networks were used as both exploratory and analytical tools; actors' inclusion was predicated on the possible relevance to the research and practical considerations of access. Leaving aside non-responders (see above), it was often impractical to trace entire networks of, for example, WhatsApp groups. This resulted in networks being constructed through pragmatic but subjective researcher-led choices surrounding relevance; a difficult situation when considering exploratory techniques and this may have led to voices being overlooked.

Secondly, the inclusion of 'local knowledge' as a node with ramifications for 1- versus 2-mode analysis introduced further methodological complexity. The use of networks as an exploratory tool (as opposed to deep-analytic) and the ethnographic justifications acted to minimise adverse impacts of this choice.

In addition to methodological network factors, the study engaged with issues of power in the shaping of networks. The study of power is a complex and evolving field that offers multiple positions and approaches to potential researchers. Studying the application of power as regards issues such as race, culture, and identify can be particularly complex (Gunaratnam, 2003). Research into power provides great opportunities for uncovering and exposing inequality and injustice, but the qualitative approaches used in this study required close attention to issues of positionality on behalf of the researcher, and awareness of possible abuse of the results. The use of triangulation was borne of an acute awareness of the need to represent all actors fairly to avoid any 'hijacking' of published results by parties with vested interests. All too often communities (pastoralist groups in particular) have had narratives imposed upon them by national and international actors (Scott-Villiers, 2011).

10.4.2.2 General methodological biases in qualitative research

Outside of context-specific limitations, the choice of methodologies can, in and of itself, provide limitations to qualitative research through the introduction of biases (Podsakoff et al., 2003). In a study such as this that deals with both thoughts and attitudes, often linked to historic recollections as with innovation histories, consistency was an abiding concern. Consistency is both a theoretical (Heider, 1958) and observed (McGuire, 1966) phenomena, whereby respondents may align their behaviours to beliefs – often creating relationships where they may have been none. This effect may have influenced respondents to retrospectively attribute actions to contemporary causes such as new framings or emerging contacts that may not have been the case at the event itself.

In addition to the (possible) effects of consistency motifs, the influence of both social desirability and complexity biases should be acknowledged. Normally separated, these concepts can be linked in this research context due to the centrality of innovation as the topic of study. Social desirability was suggested by Crowne and Marlowe (1964) as a tendency to portray socially acceptable items in a favourable light. In the case of this study, it was possible that 'innovation' was considered socially desirable by NGO actors and some Gabra but may have been less embraced by some more traditionalist pastoralist elements.

The use of innovation as a common reference point may have also introduced further response modification through complexity bias. Complexity bias (also termed ambiguity bias) suggests that respondents may struggle to engage fully with terms that have either multiple, unclear, or colloquial interpretations (Peterson, 2000). Usually attributed to deficiencies in question formations, this study actively engaged with issues of ambiguity, but the possibility of incomplete identification could not be avoided.

10.4.3 Theoretical limitations

Having addressed some of the pragmatic and methodological limitations faced by the study, it remains to highlight some of the theoretical limitations of the study. The research design draws on multiple, often newly-emerging theoretical positions to develop understanding of innovation pathway formation. Central to these are notions of power, subjectivity, agency, and action. Many of these theories were developed in industrialised or Westernised contexts. Where locally-sensitive conceptualisations of processes do exist, they often draw on historically exotic schools of thought. The lack of indigenous theory is not necessarily a failing, however when trying to maintain sensitivity to local culture and voice it is important to recognise that these phenomena are filtered through a conceptual architecture not drawn

from the same foundations. This concern permeates practical, methodological, and theoretical aspects of the study, and must be recognised when developing the results of this research further.

10.5 Implications

The study highlights many aspects of innovation in pastoralist regions that may be of use for multiple actors involved in the field, particularly in light of the difficulties often faced by development groups detailed in earlier chapters. The first part of this section discusses the research findings focusing on the practical implications for practitioners and communities, followed by a discussion of the results as they relate to wider themes in pastoralist development. This is followed by a wider discussion of key methodological and theoretical contributions of the work.

10.5.1 Practical and policy implications

This study's most relevant findings for practitioners and communities may be to help in finding new ways of engaging in knowledge transfer within and across perceived cultural divides, and to highlight the ways in which assumptions and perceptions may be shaping innovation at a field level.

This study uncovered multiple potential new avenues for knowledge exchange, however a key finding relates to the use of online and virtual forums in aspects of pastoralist development. As discussed earlier in this thesis, the impact of mobile technologies on pastoralist livelihoods are being increasingly recognised by researchers and practitioners alike (Krätli et al., 2016). Despite rapid uptake (Rutten and Mwangi, 2012) and impacts on knowledge sharing (Shrum et al., 2011), none of the NGO groups involved in the study were using virtual or online platforms to promote knowledge exchanges with pastoralist groups. Most NGO respondents considered mobile interactions to be limited to MPESA transfers, often informed by a fear of elite capture; community members with the skills and resources to engage with mobile technologies were not high on the lists of beneficiaries. This study uncovered a subtly different model of online- and virtual-forum use. The third case study suggested that traditional pastoralist cultural institutions such as phratries – which do engage with less advantaged members of society – are increasingly establishing a presence in virtual spaces. Virtual spaces such as WhatsApp were able to use existing cultural structures to engage pastoralist actors across a range of sub-communities including those who did not have technological literacy through family members, and to reach an international diaspora. The reflection of traditional structures into a virtual

medium provides new opportunities to maintain and develop existing networks; with these new networks have come questions of cultural identity and social practices that are still being explored and created alongside new knowledges – following in many ways the classic co-productionist idiom (Jasanoff, 2004). What these new forms of Gabra identity offer development actors are new and potentially exciting ways with which to engage with previously inaccessible aspects of pastoralist culture. NGOs are able to access these new forms of 21st century Gabra identity; multiple examples of informal NGO staff membership of local WhatsApp groups were identified, and the findings of this study suggest that this emerging method of knowledge exchange offers potential promise for future collaborative knowledge creation by an open and culturally legible engagement across pastoralist communities. The openness of multi-member forums, in combination with reducing North Horr's geographical remoteness, could allow NGOs to facilitate pastoralists' access to an increased range of knowledge stocks. This access should be weighed against the potential negative impacts of inappropriate narratives of 'modernity' and the primacy of scientific knowledge (Agrawal, 1995); more work is required to see where this may lead.

Secondly, the findings of this study challenge the practice of development innovation from a policy and planning perspective. Many actors reported that their belief in the unwillingness of macro-level actors to accept unproven change, limited their likelihood of experimentation and innovation in field delivery. These concepts were closely tied to notions of relationships and understanding (see compliance and anti-variation in sections 5.5 and 6.6); anecdotally donors with whom NGOs had a strong relationship permitted more variation and failure than those donors that specifically asked for innovation, but whom required a prescribed and unchanging process for delivery once funded. By developing more learning-based relationships with NGOs and accepting the need for adaptation and failure in innovation, policymakers and donors alike may be able to promote engagement between local groups and development actors.

10.5.2 Implications for debates in pastoralist development

Contemporary pastoralist development remains a contested and evolving field. Often debates around the success and direction of pastoralist development contribute to and are influenced by wider intellectual movements including contemporary questions around decolonisation and climate change to name but two. To explore how the results of this study can contribute to ongoing discussion around the effectiveness of aid and development, this section revisits the original critique of pastoralist development through the lenses of the conflation of settled

agriculture and pastoralism, the homogenisation of pastoralist communities, and the role of narratives and power in shaping the future of pastoralist areas.

10.5.1.1 Settled and unsettled agriculture: tensions between farming and pastoralism in development

The conflation of settled agriculture and pastoralist livelihood systems has been a consistent challenge to pastoralist research and development (Gardner and Lewis, 1996, Sillitoe et al., 2006). Agrarian areas have historically been better understood by governments and researchers who could more easily engage with a command-and-control style of development, which has led to giving preference to those areas over pastoralist regions in development planning (Sandford, 1983, Baxter, 1991). It has only been in recent decades that the complex plurality of pastoralist livelihoods has come to the forefront of academic debates (Baxter, 1991, Khazanov and Schlee, 2012), prompting a recognition of the increased importance of relationships and flexibility when compared to conventional agriculture (African Union, 2013, Mortimore and Adams, 1999, Scott, 1998). These new perspectives on pastoralism have called into question previous research methods and conclusions, suggesting the use of techniques more suited to settled agriculture may have blinded researchers to pastoralist practices (Pica-Ciamarra et al., 2014) leading to a distorted reporting of wider pastoralist systems (Krätli and Swift, 2014).

At the heart of these debates lies a rethinking of pastoralism, and the necessary questioning of established research and development techniques. This research may speak to those issues in a range of ways; principally through the exploratory techniques employed and the emergent nature of the findings. The selection and use of methodologies in this study were informed by a desire to keep an open ear, to remain sensitive to plural and conflicting interpretations of real-world phenomena. This was particularly relevant when questioning the suitability of an incumbent narrative such as settled architecture. The use of exploratory methods such as networks and perspectives help to combat researcher- or system-based assumptions of the answers that may be encountered; several examples illustrate the potential benefits of this approach. Rather than defining pastoralism as a feature of household income generation, as many studies do, this study considers pastoralism as an identity that provides access to differing forms of capital. This view moves away from a livelihood, often market-based perspective, and engages with populations that have, or may exit pastoralism, and those who may be trying to re-enter – all of which may make valuable and diverse contributions to knowledge sharing and creation. Likewise, exploratory networks are able to capture emergent

system features that have yet to make significant direct agricultural impact but may shape the future of pastoralist production in more subtle and potentially profound ways; the use of motorcycles is one such way. In North Horr several of the innovation histories referenced the recent use of motorcycles to collect milk from the camels of multiple families in the close *foora*. This collective action both frees up (the predominately female) labour involved in trekking to collect milk, opens revenue streams, and shifts the migratory dynamics of herds. Such changes may have limited impact on household incomes at this stage, and represent a small proportion of households, but may provide a potential direction of travel for future livestock practices and development interventions.

10.5.1.2 Homogenisation of communities

The application of settled agricultural thinking in development for mobile communities is often cited as an example of a lack of appreciation of contextual detail from government and non-governmental actors. The failure to appreciate local cultural, social, and livelihood systems can be seen on other levels and in other disciplines where the endogenous diversity of perspectives, capabilities, and vulnerabilities within pastoralist groups are lost in the homogenisation of 'the pastoralist' (Barrett et al., 2001). This conscious or unconscious failure to appreciate internal differences can undermine local coping strategies (Lind, 2014, Markakis, 2003, Unruh, 2005) with impacts upon wider socio-cultural systems (Clapham, 1996) with the potential to do significant harm (Little et al., 2008).

This research may make two principal offerings to this situation. Firstly, the findings of this research support a growing body of work that recognises the complex heterogeneity within pastoralist societies (Barrett et al., 2001) that in turn adds weight to a rethinking of pastoralists-as-failed-farmers (Gardner and Lewis, 1996, Sillitoe et al., 2006) and even pastoralists-versus-development narratives (Krätli et al., 2016). The recognition of multiple and unequal pathways of knowledge exchange within marginalised communities, and the further internal differentiation and power sequestration that accompanies these variations gives an insight into the inequitable nature of resource use and acquisition in pastoralist settings. If pastoralist development is to succeed in reducing poverty and vulnerability, then these endogenous inequalities must be recognised and engaged with, for those aims to be successfully attained.

The second contribution of this research relates to the characters of this heterogeneity. Many of the recent texts discussing internal diversity of pastoralist populations relate to variations in wealth, political power, and development engagement. Whilst these aspects provide strong

indicators for heterogeneity, this research suggest a how factors such as power and wealth may be seen through a network lens; a perspective that highlights the inequalities of emerging forms of interconnections seen in 21st century pastoralism. The first chapters of this thesis set out evidence for the productive and dynamic potential of the Horn; using locally-derived, pastoralist specific methodologies such as those developed here may aid in understanding and engaging with this potential.

10.5.1.3 Narratives and power

The previous sections cite research suggesting a diversity of perspectives and attitudes within pastoralist communities (Barrett et al., 2001), work that is supporting a re-conceptualisation of pastoralism that involves a plurality of livelihood strategies and complex interconnect webs of relationships (Baxter, 1991, Khazanov and Schlee, 2012). These new ways of thinking about pastoralism are one important part of a struggle to recast dominant narratives that may do harm to pastoralist communities such as those that implicitly link transhumant herding with a destitute way of life in 'wilderness areas' (Scott, 1998); a common solution to this problem is to tame these 'wild borderlands' through the imposition of a government-imagined 'order' (Herbst, 2014, Young, 1994). Quoted earlier in this thesis, Little suggests that "*perhaps no other livelihood system has suffered more from biased language and narratives than pastoralism*" (Little, 2013 p. 244); a language which has been used to support further narratives surrounding the types of development to be used in these areas – from a focus on settled agriculture (Sandford, 1983, Baxter, 1991) to a pressing need for external technological solutions (Garnett et al., 2009, Todd, 1995).

This study can contribute to those debates by highlighting counter-narratives to development orthodoxy, and through an exploration of what happens at points of contact between differing world views as we see in pastoralist development. This study found multiple alternative narratives to conventional technology transfer and innovation studies conceptualisations. Innovation in pastoralist areas can be seen in dynamic, hybrid combinations of external and internal knowledges; combinations that are highly contingent on the context and perspectives of the creators. Not only do these innovations have the potential to provide novel answers to old problems, in many cases they ask questions that the development community did not realise were worth asking – for example about the importance of elite cultural recruitment in well desilting. Many of the failures to co-create knowledge seen in the *communication* section of the matrix may be attributable to a fundamental mismatching of narratives around these problems that highlights a lack of common understanding – echoing Nonaka and Toyama's "*ontological ills and fallacies*" (2003, p.3). The results of this study propose to go further than

simply highlighting the presence of multiple differing world views to challenge conventional models of cultural intersection that focus on dissonance and difference (Galvin, 2009, Oba, 2012). Both the methods used in this study and the findings uncovered suggest it is possible that points of cultural and narrative contact provide dynamic friction, the overcoming of which can produce a creative spark that ignites potential chains of acts of knowledge creation.

10.5.3 Methodological implications

Krätli (2016) suggests that new conceptualisations of pastoralism may require new methods of investigation. This study aligned itself with the dynamic and adaptable view of pastoralism presented in development at the margins (Catley et al., 2013), leading to a questioning of the suitability of established methods for investigating the creative capacity of pastoralist communities. Existing methods for evaluating innovation were also explored, and their industrial focus suggested as possibly problematic for exploring emergent and informal processes of knowledge hybridisation. This drove the creation of an internally-relevant analytical framework (see section 5.7 and 8.6), constructed from observations gathered as part of the study. The dynamic-diversity framework draws on established literature from SNA and intersubjectivity, providing a novel method for exploring informal innovation in marginal settings. This framework supports the conceptualisation of innovation as a process of micro-level knowledge creation steps, drawing attention to the ways that relationships and context may shape the outcomes of knowledge interactions. The novelty of this framework makes it difficult to rigorously assess its suitability for use elsewhere, but the rigorous process of generation, and the presence of links with established literature suggest that it may have further use beyond the remit of this study.

10.5.4 Theoretical implications

Building on the implications above, this study made three theoretical contributions relating to networks, communities and cultures, and to knowledge.

From a network theory perspective, the data gathered in this study supports work that investigates the characteristics of tie strength (see, for example, Phelps et al., 2012). The main contribution of this research surrounds the interrelated nature of diversity (or 'multiplexity') and dynamics, a link which has not previously been well explored or documented. These concepts are further linked to notions of dyadic asymmetry and frame effects, though at this stage more work is required to develop these ideas further.

This research further challenges much of existing network and innovation literature by considering actors as members of multiple communities, cultures, and networks. The findings of this work show marked influences on knowledge creation through the nature of linkages, culturally-linked moderators and mediators on frame effects, and the mixed inhibitory-enabling role of multi-culture memberships and identities.

Lastly, this work has implications for the continued development of new understandings of Indigenous Knowledge (IK). Just as modern literature challenges archaic and romanticised narratives of pastoralism, so too this study suggests a recasting of IK debates to move beyond assumptions of a modern-traditional divide, instead treating IK as situated, ethno-based knowledges that exist within all cultures and communities. More specifically, this research suggests that IK be recognised as permeating and flowing between and around the myriad overlapping and intersecting cultures described above.

10.6 Looking forwards

The limitations and implications sections of this chapter highlighted many aspects of the study that could be developed or recast. Many of the possible avenues relate to practical research in similar contexts, however some wider theoretical progressions are also suggested.

10.6.1 Practical developments

One of the most frustrating aspects of the study was the lack of a temporal component. Work by authors such Burk et al. (2007) suggests that many social networks undergo significant evolutionary change over time; it is possible to suggest that the emerging and evolving communication infrastructure detailed in this study would make this aspect particularly relevant. Tools such as the Simulation Investigation for Empirical Network Analysis (SIENA) make the simulation of longitudinal network analysis more straightforward than previously; understanding possible evolutions and growth of networks from the margins outwards could provide unique insights into non-industrialised knowledge sharing and innovation processes.

Few robust whole-network studies exist; where they do, findings suggested that increased density increased diffusion, fidelity, and awareness (Abrahamson and Rosenkopf, 1997), with a knock-on effect on member innovativeness (Ebadi and Utterback, 1984). The term whole-network was complex to apply in this study due to the exploratory nature of the mapping process, but the findings above were reflected in the closer, typically community-centred sub-networks found throughout the system.

As well as considering a longitudinal view, further data on groups and institutions would enable an interorganisational analysis to be completed. This study focused on two NGOs, selected for their geographical proximity and activities in the study site. Multiple interviews with development actors however suggested that NGO-NGO relationships were founded on far different lines; high employee mobility, a results-driven mentality, and a pseudo-protectionist siloing of knowledge suggests that expanding the study to evaluate inter- and intra-NGO knowledge sharing could provide a very valuable insight into the creation, establishment, and diffusion of innovation in pastoralist development.

10.6.2 Further empirical research

Chapter two suggested that pastoralism is currently undergoing a process of reconceptualisation, based on new understandings and new perspectives from a range of disciplines. Authors such as Krätli (2016) have called for new methodological approaches to be developed alongside this theoretical reckoning; both theory and method drawn from empirical observation. This study opens multiple new avenues for collecting further empirical data. The replication or expansion of this study to address wider networks, better engage female innovators, evaluate alternative pastoralists ethnicities within and outside of the Horn of Africa would all provide valuable insights to better understand pastoralist innovation processes. Many of these topics are of primary academic interest at this stage, but it is possible to suggest specific topics that may be of more direct practical use to development agencies and pastoralist communities.

Pastoralism is increasingly recognised as a viable system of livestock production for dryland areas, capable of supplying increasing demands for meat from major urban centres such as Nairobi (Catley et al., 2013). Formalising access to markets and systems producer integration have not met with huge successes in and around North Horr, but market-led strategies for pastoralist development remain a focus for many donors (Gesare et al., 2017). The novel methodology used in this study could form the basis for exploring how networks of access and perception of markets could point to future models of development. Network research has been used to explore the integration of smallholder and agricultural producers into wider systems across the globe. These networks are not limited to tracing supply channels; studies suggest that networks fulfil multiple roles, including access to alternative funding streams (Okello and Ngala, 2017) and to facilitate the transfer of upgrading knowledges through intermediary organisations (Ramirez et al., 2017).

10.6.3 Further theoretical research

Whilst the two projects above build upon the practical observations uncovered in the research, more theoretical developments also present themselves. Primary of these could be to continue to explore the roles and relationships between framing, frame effects, and power. In the context of this study frames were developed and shared within and between groups; these frames often contained opposing or contradictory views. Little research exists surrounding how actors react to receiving competing framings (Sniderman and Theriault, 2004), particularly in situations whereby frames do not directly reference one another such as with propaganda but may act more insidiously to alter attitudes and behaviours (Chong and Druckman, 2007). Through understanding how conflicting framings are reconciled by individuals and within dyads, and especially through the creation of alternative framings, it may be possible to understand the creative spark that allows actors to shape innovation pathways that cross out of established systems.

Picture 18: Perspectives on creativity

This picture was taken on the last day of the final field session, and has served as a useful metaphor for the study ever since. When showing this picture to pastoralists, NGO actors, researchers, and students each person has ventured, unprompted, an individual description. From the importance of human relationships in barren places, to the immense potential of the open blue sky, every interpretation, every perspective, speaks to one or more aspects of knowledge creation encountered in this study. All are true – depending on ones view.

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Appendices

Appendix 1: Network mapping interview guide

A. How would you describe your role in the organisation/community?
B. This organisation/community contains many groups.
  i. Could you identify the key ones for me?
  ii. With which of these are you a member?
  iii. With which of these are you associated?
C. Tell me about yourself and what you do.
D. I'm also speaking to people who do things differently to normal. Can you suggest any ways that you may do things that someone else like you would suggest as out of the normal?
E. What are the biggest differences between things you do and how your grandparents/the organisation from a decade ago did things?
F. Can you suggest any examples of these new things or practices that you are, or are not, involved with?
  i. Tell me more about X
  ii. How did X come about?
  iii. Who was/is involved with X?
  iv. Can you tell me more about how Y was involved with X?
  v. What is your relationship with Y?
G. Who else should I talk to about new things or practices?

Appendix 2: Discourse analysis interview guide

1. How would you describe your role in the organisation/community?
2. Tell me about yourself
    a. What level of education do you have?
    b. What are the things in your life that you have learnt from the most?
3. I'm also speaking to people who do things differently to normal. What do you think this means?
4. Can you suggest any ways that you may do things that someone else like you would suggest as out of the normal?
5. What are the biggest differences between things you do and how your grandparents/the organisation from a decade ago did things?
6. Can you suggest any examples of these new things or practices that you are, or are not, involved with?
    a. Tell me more about X
    b. How did X come about?
    c. Who was/is involved with X?
    d. Can you tell me more about how Y was involved with X?
    e. What is your relationship with Y?
7. Who else should I talk to about new things or practices?
8. Are there any other people who you think would be important to talk to about these topics?

Appendix 3: Innovation exemplars

The following table contains details of forty-one innovation exemplars identified during the data collection process. The 'name' refers to the researcher coding, 'actors' to the main protagonists, 'scheme' to any closely associated institution or organisations, 'details' a brief outline of the activities or object.

Name	Actors	Scheme	Details
Milk collection	Pastoralist women	Household collective	Grouping together 8-10 households to rent motorbike and rider to collect milk from fora
Car Wash	Male pastoralist	n/a	Increasing numbers of vehicles, esp. motorbikes require de-fouling of chains. Start business
Tuk-tuk	Male pastoralist	n/a	Purchase vehicle for small deliveries around town, milk collection
Motorbike courier	Male pastoralist	n/a	Motorbike for carrying elderly around town/between settlements or deliveries
Group formation	Any pastoralist group	Register with county government	Form self-help groups to access government development funds such as Uweza
Selling livestock to Ethiopian brokers	Livestock owners, livestock traders	n/a	Ethiopian traders come at time of Hadj, groups assembled by Gabbra traders
Barter shoats-camels from Rift Valley	Livestock owners, livestock traders	n/a	Camels swapped for shoats and moved to rift valley
Development framing	Transparency International, ECHO consortium	ECHO Consortium	Shifting attitudes of NGOs from development privilege to rights
Accountability forum	Transparency International, ECHO consortium pastoralists	La Nina V	SMS-led reporting mechanism for complaints to NGOs
Charging external livestock vehicles	Livestock traders group (LTG)	n/a	Levy on vehicles of external traders attempting to purchase animals in North Horr, split LTG/community:/government
Charging external livestock vehicles	Livestock brokers	n/a	In response to North Horr LTG now purchase from other communities
Limited marked access at Olerot	Livestock brokers	n/a	New Olerot market requires travel through Turkana group (unsafe), brokers make this trip
Returning of money from Nairobi	Livestock traders	n/a	Options include carry cash, wholesale goods, bank transfer and collect in Marsabit
Lack of Gabbra agents in Nairobi	Livestock traders	n/a	Now trade with any ethnicity but have a stable of 4-5 'choice' brokers
Government promotion of private sector vets	AHA, S/C VO, Pastoralists	n/a	Gvt Vets buying personal drug stocks to treatment with at point of diagnosis

Government promotion of private sector vets	AHA, S/C VO, SINH, VSFNH, CAHW, Agrovet, Pastoralists	SI Animal Production Programme, CMDRR	Gvt Vets using NGOs to bring CAHW/AgroVets to site of Dx/Tx and NGOs subsidising Tx under direction
Vaccine acceptance	NGO, Gov't Vet Service, Pastoralists	Various AH	Pastoralists now accept vaccine, but only during wet season as believe that some vaccines led to animal death when underweight, especially goats due to increased stress
Worming	NGO, Gov't Vet Service, Pastoralists	Various AH	Pastoralists seek out worming from NGOs and attempt to access unused wormers from programme
Disease reporting	SINH, VSFNH, AHA, S/C VO, chiefs, police pastoralists	PDS	Novel means for reporting disease through CDR to AHA to S/C VO
Disease reporting	Pastoralists, CO, CEO, S/C VO	n/a	Disease reporting directly to CO/CEO to obtain quicker response
Disease reporting	NGO, AHA, S/C VO, expert vets	WhatsApp Vet Forum	Disease reporting, data, professional exchanges and referrals made through WA forum allowing images. Mirrors FAO-led Epicollect
Disease treatment	Pastoralists	n/a	Alamycin now ubiquitous, all Txs start with Alamycin sourced from *fora*
Community mobilisation – Horr Horr Gutha	Pastoralists, diaspora	WA NHW, WA GPA, WA GYA, church and mosque	Mobilisation of community action to desilt wells, contributions for *haram-bei* through diaspora
Community mobilisation – El Beso	Pastoralists, diaspora	WA NHW, WA GPA, WA GYA, WA 3rd eye	Mobilisation of community action to provide books for El Beso primary school through diaspora
Algaanna *Haram-Bei*	Pastoralists, diaspora	WA AF	Moving traditional Algaanna *haram-bei* into digital forum to engage with diaspora
Kitchen garden	SINH	n/a	Experimental gardening using soil from M'bit in scheme taken from Nairobi slums
Police accident reports	Pastoralists, transporters	NHW WA	Following accident on road to Maikona, transporters put pressure on local MPs and assembly to ensure report was in their favour
Energy-saving Jiko	VSFNH, Pastoralists, FHK	CMDR	NH selection through CMDR process. Aware through previous projects of FHK
Water catchment project	VSFNH, Pastoralists, District Water officer	CMDR	Use of rooves as water catchment device, stored in tanks, accessed for fee, topped up with water trucking
VICOBA	VSFNH, Pastoralists,	CMDR	Small group savings-and-loans, activities mainly based around small goods selling and livestock
Milk production plant	SINH, LTG, Pastoralists	?	Fund milk collection facility and handling facility, unable to ensure *brucella* free
Multi-Urea Blocks (MUB)	SINH, KALRO, Pastoralists	SIPFS	PFS recognise need to supplement feed, have had limited experience through gov't sources, SI MUB knowledge from

			Somalia, work with KALRO to develop. Trialled through PFS
Multi-Urea Blocks (MUB) Molasses adaptation	SINH, KALRO, Pastoralists	SIPFS	Molasses hard to source so local adaptations suggested by pastoralists. Blocks now being sold
Prosopis juliflora encroachment & charcoal	SINH, pastoralists, NEMA	?	Pastoralists recognise as a problem with encroachment due to teeth rotting, toxic spines and reservoir for wildlife. In response a management and cutting programme implemented to burn charcoal which is now for sale (wood is in short supply)
Gala goats cross breeding	SINH, VSFGM, pastoralists	PFS	Aim to increase resilience of goats to disease and droughts by using Somali-breed cross breeding. Each PFS given 4 male Galas
Milk handling	SINH, pastoralists	PFS	Training on clean milk handling and given metal containers as can be cleaned more. Not yet led to commercialisation or wider replacement of plastic containers
IBLI Scheme	APA, Pastoralists, SINH,	PFS	Trailing index-based insurance through PFS on small scale
IBLT (Index-Based Livestock Takaful)	Takaful Africa, Pastoralist, SINH	PFS	Sharia-compliant IBLI
Fodder from Huri Hills	Pastoralists	n/a	Cattle owners too expensive to use maize so import grass from Huri Hills to give to milking herds
Grazing goats inside communities	Pastoralists	n/a	As herds move deeper into *forra*, milking herds remain closer as feed scraps more available. Consequential perceived change in the taste of meat
Water users using hosepipes and storage	Pastoralists	n/a	Water is accessed from a kiosk maintained by the water users' association. Typical access is once every three days, and traditionally by hand using jerrycans/containers. People have taken to purchasing hosepipes and large drums and storing water in a larger scale.

# Appendix 4: Communities of shared subjectivity population selection

The creation of communities of shared subjectivity required participant recruitment so that each gender, wealth, education, and occupation category (in red below) was represented by at least three actors. The 'category' and factors one to three (F1-F3) in green in the table below relate to the derived values (see section 7.2.2) and core framings (see section 6.4).

Actor	Gender	Wealth	Education	Occupation	Category	F1	F2	F3
AHA	M	3	3	Animal health	Government	0	3	7
AV1	M	3	2	Animal health	Animal health	0	5	5
AV2	M	3	2	Animal health	Animal health	1	4	5
CAHW	M	3	3	Animal health	Animal health	4	2	4
CDR	M	1	1	Herder	Pastoralist NGO	5	1	4
CHIL	M	3	1	Herder	Traditional elite	1	6	3
DVO	M	3	3	Animal health	Government	2	2	6
P19	F	2	0	Herder	Herder	5	1	4
P11	F	1	0	Herder	Herder	7	1	2
P13	F	3	1	Herder	Herder	5	2	3
P15	F	0	1	Herder	Herder	6	2	2
P17	F	1	0	Herder	Herder	4	2	4
P6	M	2	1	Herder	Herder	0	4	6
P3	M	1	1	Herder	Herder	3	2	5
P7	M	1	1	Herder	Herder	1	7	2
LT01	M	2	2	Trader	Trader	4	0	6
LTRAN	M	3	1	Trader	Trader	1	4	5
P85	M	3	2	Herder	Modern elite	2	2	6
P87	F	2	2	Herder	Modern elite	1	4	5
P88	F	2	3	Trader	Modern elite	2	4	4
P89	M	2	2	Herder	Modern elite	1	4	5
P32	M	1	1	Herder	Herder	1	6	3
P34	M	1	2	Herder	Herder	1	2	7
SIFCNH	M	3	3	NGO	Field NGO	2	3	5
SIFSCN	F	3	3	NGO	Nairobi NGO	6	2	2
SIPMN	M	3	3	NGO	Nairobi NGO	7	2	1
SIPS1	M	2	2	NGO	Pastoralist NGO	2	4	4
SIPS2	M	2	2	NGO	Field NGO	3	3	4
SIPS3	M	2	2	NGO	Field NGO	2	5	3
SIPS4	F	2	2	NGO	Pastoralist NGO	3	4	3
P74	M	3	0	Herder	Traditional elite	2	6	2
P77	M	0	0	Herder	Traditional elite	2	3	5
P83	M	3	1	Herder	Traditional elite	0	4	6

P84	M	3	0	Herder	Traditional elite	0	6	4
VSFNB	M	3	3	NGO	Nairobi NGO	7	1	2
VSFNH	M	2	3	NGO	Field NGO	6	0	4

Appendix 5: Thematic analysis

The three global themes identified in section 6.2.1, knowledge, drivers and barriers, and risk and uncertainty, were developed in line with established methodology from local- and meso-level themes. These are summarised below. Local themes are lightest, meso-themes middle, and global darkest.
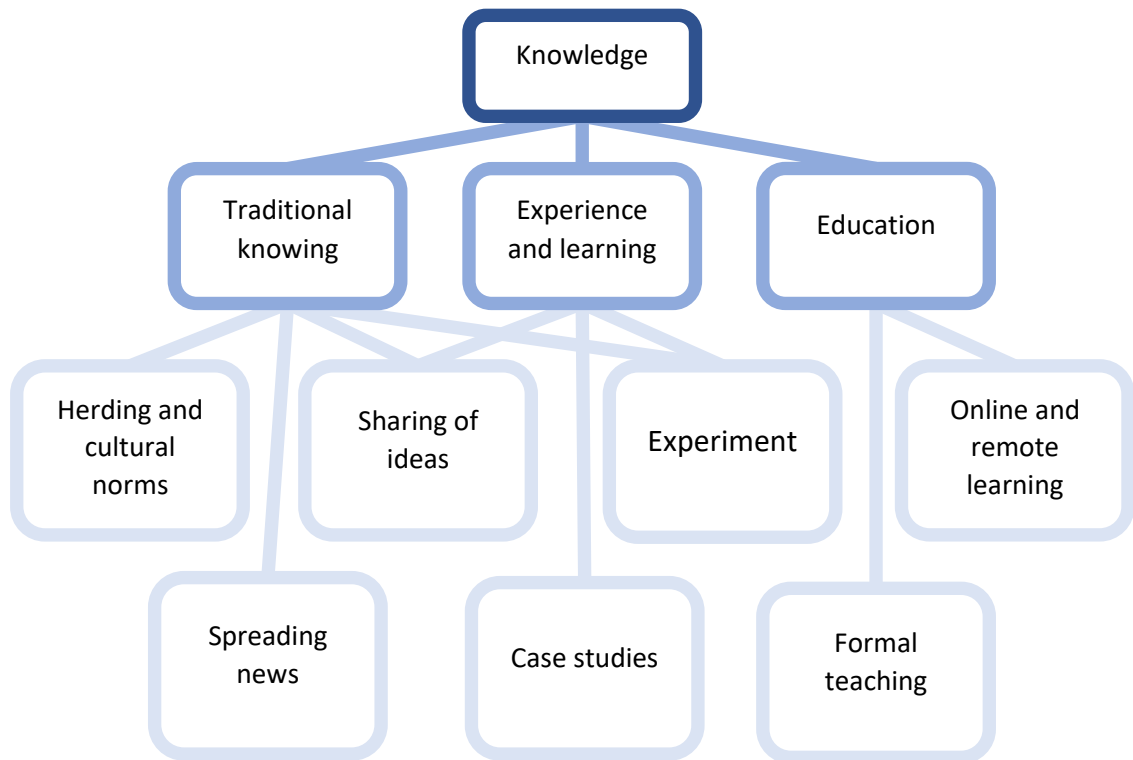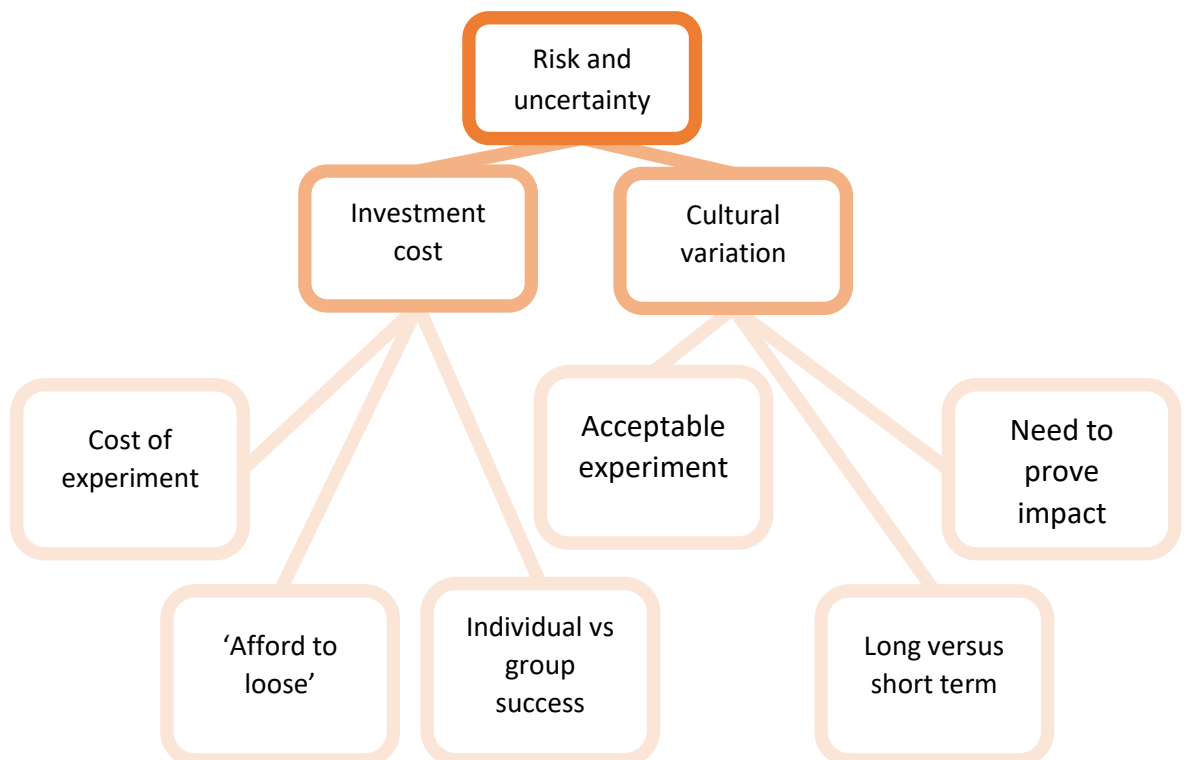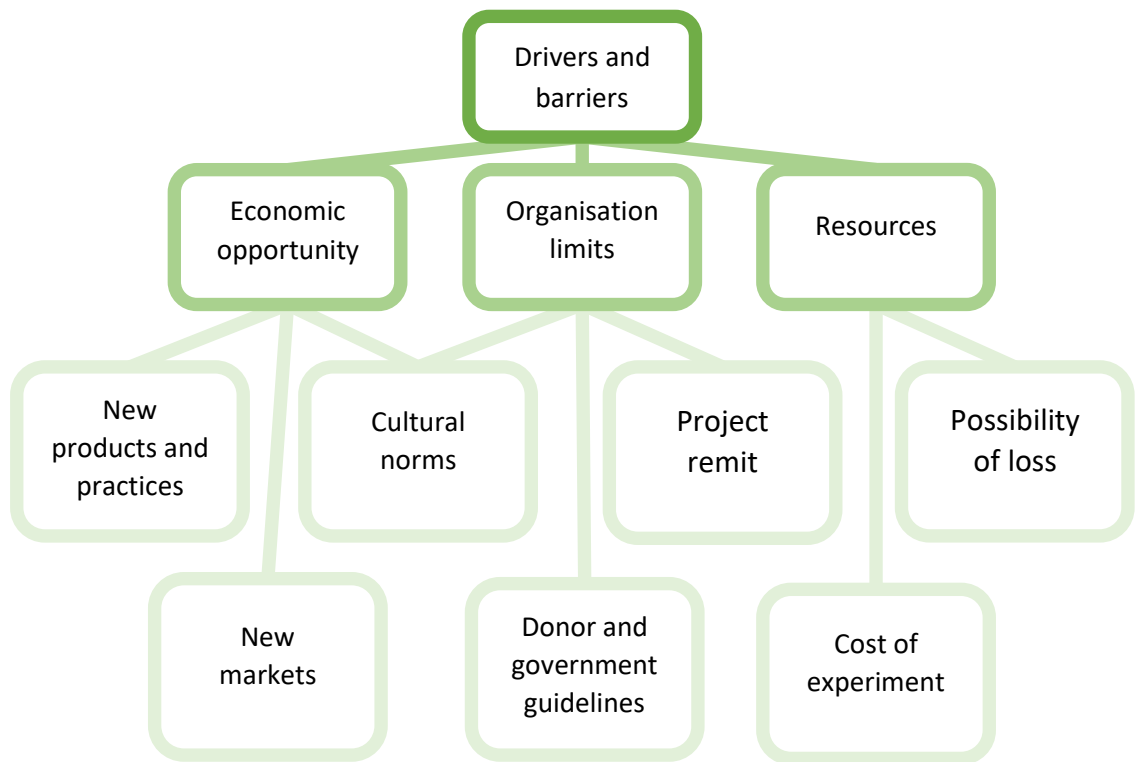
Appendix 6: Q method P-set

The *P-set* is drawn from individuals that represent the diversity of perspectives (Setiawan and Cuppen, 2013) rather than for representativeness or quantity (Eden et al., 2005). The following actors were used as the *p-set* for the Q method described in section 3.4.3 and 6.3

Actor	*Code*	*Notes*	*Actor*	*Code*	*Notes*
Donor	DN1	Nairobi	NGO project manager	SH2	North Horr
Government employed animal health worker	GH1	North Horr	NGO project supervisor	SH3	North Horr
Government employed veterinarian	GH2	North Horr	NGO Project supervisor	SH4	North Horr
Government employed researcher	GM1	Marsabit	NGO project supervisor	SH5	North Horr
Pastoralist elder	PH1	North Horr	NGO project supervisor	SH6	North Horr
Agroveterinarian	PH2	North Horr	NGO Food security supervisor	SN1	Nairobi
Community Animal Health Worker	PH3	North Horr	NGO deputy Country Director	SN2	Nairobi
Female pastoralist	PH4	Also a trader	NGO Project manager	VH1	North Horr
Male pastoralist	PH5	Mobile	NGO Programme Head	VN1	Nairobi
NGO field coordinator	SH1	North Horr	NGO Country Director	VN2	Nairobi

Appendix 7: Q method process

Generation of a primary Q-set

The extraction of a Q-set from a wider concourse may be undertaken inductively or deductively (McKeown and Thomas, 2013, Watts and Stenner, 2012). For this study it was important not to 'close down' discussion of other conceptualisations; the concourse was therefore subjected to a two-stage selection process. Initially the statements were coded and analysed inductively using NVIVO, resulting in a 78-strong Q-set. These statements were noted and returned to the concourse population. The concourse was then re-analysed deductively using a framework drawn from existing innovation theories and the novel framework proposed in this thesis. This resulted in the selection of 82 statements, of which 50 were also found in the inductive population.

The combined population of 50 statements was then reviewed using a structured approach adapted from authors such as Dryzek and Berejikian (1993) to ensure no facets of the discursive landscape were underrepresented. The framework used, and the distribution of statements is presented below:

	Risk	*Knowledge*	*Driver & barriers*
Conceptual	4	9	11
Operational	10	8	7

This Q-statement set was piloted with five individuals who were broadly familiar with the groups of actors likely to be involved in the final study. Feedback from these sorts resulted in the following 31 Q-statement set that was used in the initial phase of the study:

	Risk	*Knowledge*	*Drivers & barriers*
Conceptual	4	6	6
Actor-specific	5	6	4

Results

The 20 sorts were analysed using KenQ software, using centroid factor and principal component analysis (PCA) comparatively. Initial centroid factor analysis resulted in three factors that fulfil the Kaiser-Guttman criterion with Eigenvalues over 1.0 (8.328, 2.37457, and 1.49235 respectively); PCA resulted in four factors over 1.0 (8.8685, 2.8152, 1.8702, and 1.0744). This last factor is very close to the 'cut off' and accounted for 5% of the explained variability, but was included in the data analysis to understand if any further insight was

obtainable from this factor. Whilst this study recognises that the use of the Kaiser-Guttman criterion can be challenged on the fact that it may result in overly large numbers of factors, this is not the case here (with only three or four). Similarly, the remaining factors account for so little of the variation that it seems reasonable to excludes them at this juncture.

Factor rotation

Centroid Varimax

The factor loading threshold was set relatively high at 0.55, resulting in one confounded result (DN1) and the remaining 19 loading on one factor only. The factor score correlation matrix is as follows:

	Factor 1	Factor 2	Factor 3
Factor 1	1	0.4585	0.317
Factor 2	0.4585	1	0.031
Factor 3	0.317	0.031	1

Principal Component Analysis (PCA) Varimax

Both DN1 and GM1 were confounding factors at the 0.XX level, hence were excluded. GM1 loaded on both factor three (0.59558) and factor four (0.68656); by excluding GM1's sort this factor ceased to be included in the analysis. The remaining three factors' correlation matrix is given below:

	Factor 1	Factor 2	Factor 3
Factor 1	1	0.4589	0.2915
Factor 2	0.459	1	0.061
Factor 3	0.2914	0.061	1

Appendix 8: Dyad interview guide

A. I would like us to focus on your relationship with X. Could you tell me a little more about them please?
   a. How long have you known them?
   b. How did you get to know them?
   c. Has your relationship changed in that time?
B. What do you typically talk about?
   a. What do they know most about?
   b. What do you know that they don't?
C. Do you share knowledge?
   a. If so, about what?

D. Now imagine someone you would share a lot of knowledge with, both ways. Place them here (point). Now here (point) is someone that you would not share with, for many reasons. With X, where do you lay in this line?

Appendix 9: Dyad selection

The following charts display the counts of each degree and betweenness value for the actor population to inform dyad selection.

Count of degree values

Count of betweenness values
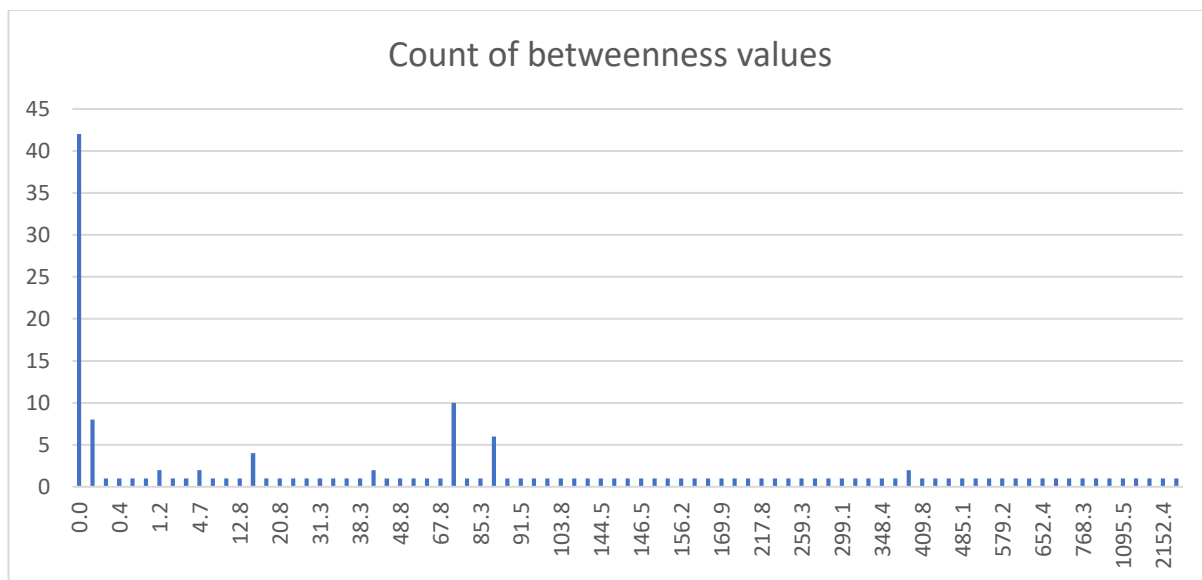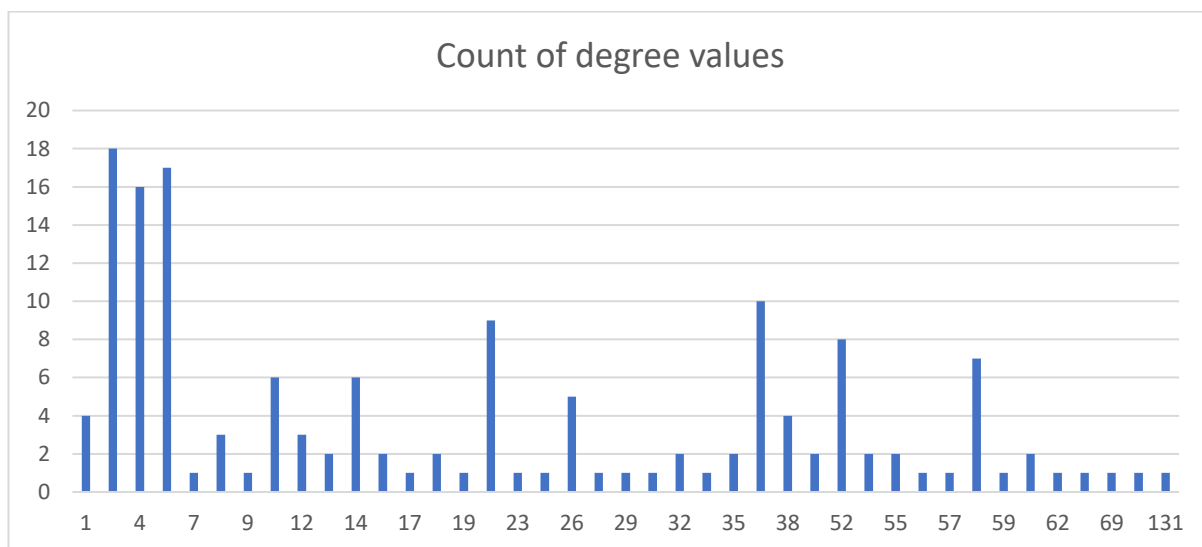
The actor shortlist of high-betweenness (B) and high degree (D) is given here:

Label	D	B	Label	D	B	Label	D	B
SIPS 1	131	9585.0	SIPS 3	38	15.3	Pastoralist 26	20	0.0
Pastoralist 35	75	1320.3	SIPS 4	38	15.3	Pastoralist 27	20	0.0
Pastoralist 97	69	1965.3	SIPS 5	38	15.3	Pastoralist 28	20	0.0
Pastoralist 82	64	768.3	Pastoralist 64	36	79.1	Pastoralist 29	20	0.0
Pastoralist 88	62	540.8	Pastoralist 65	36	79.1	Livestock Trader 3	19	169.6

Pastoralist 8	60	409.8	Pastoralist 66	36	79.1	CDR	18	227.9
Pastoralist 89	60	145.4	Pastoralist 67	36	79.1	Pastoralist 33	18	187.4
Pastoralist 87	59	141.4	Pastoralist 68	36	79.1	Pastoralist 36	17	169.9
Pastoralist 40	58	424.9	Pastoralist 69	36	79.1	Motorbike 1	16	348.4
Pastoralist 91	58	87.5	Pastoralist 70	36	79.1	Agrovet 2	16	58.1
Pastoralist 92	58	87.5	Pastoralist 71	36	79.1	Pastoralist 83	14	592.0
Pastoralist 93	58	87.5	Pastoralist 72	36	79.1	North Horr Chief	14	146.5
Pastoralist 94	58	87.5	Pastoralist 73	36	79.1	Pastoralist 5	14	91.7
Pastoralist 95	58	87.5	Livestock Tra 1	35	775.9	Pastoralist 4	14	91.5
Pastoralist 96	58	87.5	Thresher	35	35.3	Pastoralist 2	14	87.6
Pastoralist 90	57	85.3	Pastoralist 86	34	1095.5	Pastoralist 3	14	80.7
Pastoralist 44	56	164.8	Pastoralist 21	32	851.7	N. Livestock Tra 1	13	0.0
Pastoralist 76	55	350.9	Local Police	32	652.4	N. Livestock Tra 2	13	0.0
Pastoralist 43	55	144.5	Livestock Tra 2	31	259.3	N. SIO	12	145.3
N. SIPM	54	2152.4	NH. SIPM	29	485.1	Pastoralist 74	12	47.4
Pastoralist 78	54	67.8	VSF-G North H.	28	629.3	Pastoralist 75	12	47.4
Pastoralist 41	52	0.1	DVO	26	652.6	Pastoralist 10	10	579.2
Pastoralist 42	52	0.1	AHA	26	433.4	Pastoralist 16	10	542.6
Pastoralist 45	52	0.1	Pastoralist 22	26	385.1	Transparency Int.	10	141.4
Pastoralist 46	52	0.1	Pastoralist 24	26	385.1	Pastoralist 1	10	48.2
Pastoralist 47	52	0.1	CAHW	26	218.4	District Water Of.	10	38.3
Pastoralist 79	52	0.1	Pastoralist 37	25	338.0	Pastoralist 53	10	0.0
Pastoralist 80	52	0.1	NH. SIFSC	23	739.2	Pastoralist 38	9	7.6
Pastoralist 81	52	0.1	Pastoralist 34	20	156.2	SI. DCD	8	307.3
Livestock Tra	40	292.5	Agrovet 1	20	91.9	Pastoralist 85	8	217.8
NH. SIO	40	103.8	Pastoralist 20	20	0.0	Pastoralist 26	20	0.0
SIPS 2	38	15.3	Pastoralist 23	20	0.0	Pastoralist 27	20	0.0

Appendix 10: Dyad analysis calculations

Framing

The scores for each of the factors within the dyad were summed; a gap of more than 5 points was set as the threshold for consideration as a primary factor. This factor (or factors) was compared with qualitative data to cross reference the validity of the selection. The table below displays this data, with the primary dyad framing(s) highlighted in orange

Harmony

Harmony was calculated by evaluating the differences in each framing value between ego and alter framing spectra. The algorithm for h (harmony) is $h = \sum(f_n - a_n)^2$, where f the ego factor score, a the alter factor score, and n the factor number. This gave values from 2 to 26; in combination with a data review the thresholds were set as <4 – very similar, 4-8 – similar, 8-12 moderately similar, >12 dissimilar.

Empathy

As with harmony, empathy examines the differences between each factor in the ego factor spectrum, and the alter's projection. The algorithm used for actor empathy (E_a) is $E_a = \sum(f_{n(e)} - f_{n(p)})^2$. Dyadic empathy ($E_d$) is the sum of the two actors, $E_d = E_{a1} + E_{a2}$, where a_1 and a_2 are actors, e the ego score of factor n for actor a, p the alter score for actor a. The thresholds for dyadic empathy were set at <10 – high degree, 10-20 moderate, and >20 low degree of empathy.

Projection

The projection value for any one actor (P_a) can be calculated by using $P_a = \sum(f_{n(e)} - f_{n(ea)})^2$, where $f_{n(e)}$ is the ego factor score for factor n of actor a, and $f_{n(ea)}$ is the factor score given by actor a to their alter. The total dyadic projection value P_d can be calculated using $P_d = P_{a1} + P_{a2}$. Thresholds can be set at <20 - belief that actors have similar framings, 20-40 - moderately similar framings, >40 - belief that actors hold different framings to one another.

Appendix 11: Data collection summary

Network Data					
Stage	*Macro network construction*	*Key Actor interviews*	*Innovation exemplars*	*Sub network identification*	*Case Study mapping*
Number of informants	88	Total: 24 Calc: 1 Nbi & 12 NH Resp-led: 4 Nbi & 7 NH	29	11 Key Actors (3 Nbi & 8 NH)	78
Process of selection	6-person initial sample with subsequent respondent-led snowball	Network calculated measures of betweenness (n= 10) and degree (n= 9) with overlap of 5; total calculated = 14, omit one as institutional so =13	Review of qualitative data from Macro Network Construction	Review of qualitative data from Key Actors Interviews, Innovation Exemplars, and Macro Network Construction Data visualisation using a Force Atlas calculated in Gephi	Whole network mapping based on sub-network bounding CS1: aimed 39, achieved 32 CS2: aimed 45, achieved 26 CS3: aimed 31, achieved 20
Location/s	17 Nairobi, 71 North Horr	5 Nairobi, 19 North Horr	3 Nairobi, 26 North Horr	3 Nbi, 8 North Horr	78 North Horr
Timings	FS1	FS1	FS1	FS1	FS1
Data collection method/s	Semi-structured interviews	Semi-structured interviews	Innovation histories	Discursive interviewing, artefact description	Semi-structured interviews
Analysis Methods	Network data collation in Excel Qualitative data in NVivo Network calculations in Gephi Visualisation in Gephi	Qualitative data analysis using NVivo Network visualisations using Gephi	Qualitative analysis using NVivo	Researcher-led interpretation Modularity Class algorithm in Gephi	Network data collation in Excel Qualitative data in NVivo Network calculations in Gephi Visualisation in Gephi

	Framings			*Dyadic Analysis*	
Stage	Thematic Analysis	Q-Method	Participatory Frame Building	Communities of Shared Subjectivity	Dyadic Analysis
Number of informants	32	20	68 Six groups of 4-10 pastoralist respondents Three groups of 2-4 NGO participants (North Horr, Marsabit, Nairobi) Cross check with 3 x NGO actors and 5 non-elite pastoralists	36	20
Process of selection	Researcher-led targeted sampling using Key Actors	Following P-set selection methodology to be representative of the diversity of opinion, led by Key Actor interviews, innovation histories, and case study networks	2 x elite male 2 x non-elite male 2 x non-elite female		See dyadic selection
Location/s	6 Nairobi 26 North Horr	6 Nairobi 14 North Horr	Nairobi and North Horr	3 Nairobi 33 North Horr	North Horr
Timings	FS2	FS2	FS2	FS2	FS2
Data collection method/s	Semi-structured interviews	Q-sort and structured interviews	Group participatory exercises	Semi-structured interviews	Semi-structured interview, frame attribution method
Analysis Methods	NVivo-coded qualitative analysis	KenQ analysis in combination with qualitative cross-referencing	Participant-led frame building	Analysis and visualisations using Excel, cross-referencing with NVivo-coded interviews	Interviews coded in NVivo Frame attribution plotted on framework developed in chapter 5